CNS OCCASIONAL PAPER NO. 18

Stories of the Soviet Anti-Plague System

Edited by
Casey W. Mahoney,
James W. Toppin, and
Raymond A. Zilinskas

Monterey Institute
of International Studies
A Graduate School of Middlebury College

CNS
James Martin Center for
Nonproliferation Studies

James Martin Center for Nonproliferation Studies

cns.miis.edu

The James Martin Center for Nonproliferation Studies (CNS) strives to combat the spread of weapons of mass destruction by training the next generation of nonproliferation specialists and disseminating timely information and analysis. CNS at the Monterey Institute of International Studies is the largest nongovernmental organization in the United States devoted exclusively to research and training on nonproliferation issues.

The Monterey Institute of International Studies

www.miis.edu

The Monterey Institute of International Studies, a graduate school of Middlebury College, provides international professional education in areas of critical importance to a rapidly changing global community, including international policy and management, translation and interpretation, language teaching, sustainable development, and non-proliferation. We prepare students from all over the world to make a meaningful impact in their chosen fields through degree programs characterized by immersive and collaborative learning, and opportunities to acquire and apply practical professional skills. Our students are emerging leaders capable of bridging cultural, organizational, and language divides to produce sustainable, equitable solutions to a variety of global challenges.

James Martin Center for Nonproliferation Studies
Monterey Institute of International Studies
460 Pierce St., Monterey, CA 93940, USA
Tel: +1 (831) 647-4154
Fax: +1 (831) 647-3519

Partial funding support to realize this occasional paper has been provided by the Nuclear Threat Initiative.

ISBN #978-0-9892361-3-3

Cover image: Russian biohazard sign, "Caution! Toxic Agent"
Back cover image: Old fashioned, reusable Soviet-era syringe "Record"

STORIES OF THE SOVIET ANTI-PLAGUE SYSTEM

CASEY W. MAHONEY, JAMES W. TOPPIN, AND RAYMOND A. ZILINSKAS, EDITORS

JAMES MARTIN CENTER FOR NONPROLIFERATION STUDIES

Table of Contents

Translator's Notes

Writing Russian words and names in English

The Russian alphabet is much different from the alphabets used for English and many other European languages. In Russian, each written letter has a consistent or easily predictable sound. By contrast, in English the "f" sound, for example, also can be written as "ph" or "gh." Russian, however, does have some silent letters.

There are many different systems for converting Russian spellings of names, etc. into English. Some systems leave out the Russian silent letters, resulting in a simpler and more phonetic English version, which can be a very important advantage for non-Russian readers. Other systems (such as those used for library cataloguing) may include all silent letters so that names can be converted readily from Russian to English or vice versa by computers, but these longer versions can be more challenging for readers.

As a further complication, the different European languages that use the Roman alphabet spell Russian names differently according to the sound systems of those languages. For example, the names Chekhov and Tchaikovsky both start with the same Russian letter "Ч", but the "Tch" reflects how the sound would be written in French versus "Ch" in English.

For these and other reasons, there may be several different English spellings of the same Russian name. The composer Чайковский, for instance, could be spelled Tchaikovsky, Chaikovsky, Tchaykovskyy, Tschaikovskii, etc., although in most cases one spelling is predominant. Essentially, we follow the system used by the US Board on Geographic Names, but with a few simplifications for readability. For example, we use a single "y" in situations where strict adherence to the system would give "yy" (e.g., we use "Domaradsky" instead of "Domaradskyy"). Fortunately, search engines seem to do a good job of recognizing these variations, so the search results based on one version of a name will usually suggest common alternative spellings.

Structure of Russian names

Russian names have three parts: first name, patronymic, last name. The patronymic is derived from the father's name, so Ivan Petrovich Kuznetsov is the son of Petr Denisovich Kuznetsov (who is the son of Denis, and so on). All of Ivan's brothers would have the same patronymic and last name, for example Aleksandr Petrovich Kuznetsov, Yury Petrovich Kuznetsov, etc. (Note: these names are given as examples only and are not intended to refer to actual people). Ivan's sisters would have a slight variation of this patronymic and last name reflecting the gender construction used in Russian, so they would be Irina Petrovna Kuznetsova, Nataliya Petrovna Kuznetsova, etc.

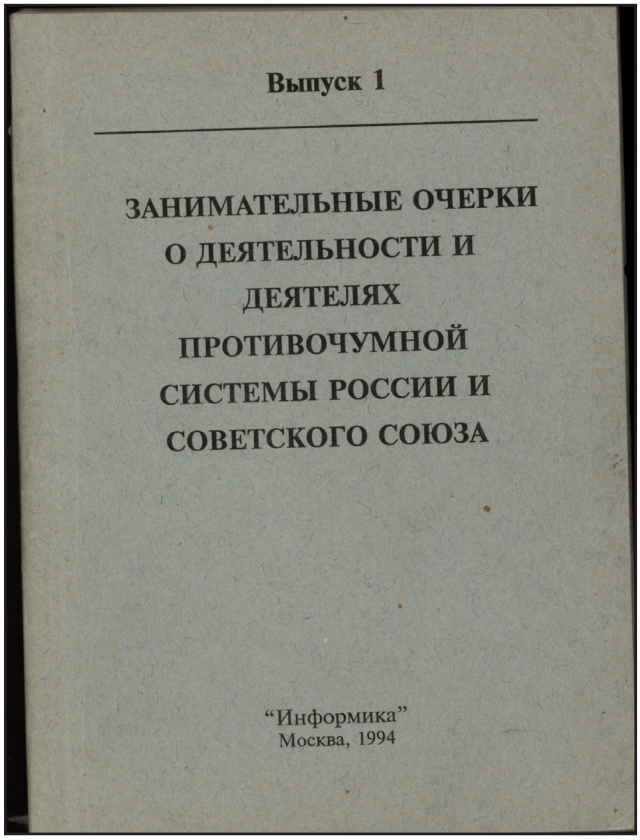
For a married Russian couple, if the woman takes the husband's last name, her last name will reflect this gender variation. For example, Mr. Popov's wife will have the last name Popova, Mr. Lensky's wife's name will be Mrs. Lenskaya. However their patronymics will be different (unless their fathers

happened have the same first name). Some last names, such as those ending in *-enko*, are invariable, so will be the same for male and female.

In formal situations, it is common to address or refer to a person using the first name and patronymic, rather than using the English equivalent of Ms. Lastname or Mr. Lastname.

Introduction

Throughout the twentieth century, the 2nd Directorate of the USSR Ministry of Health (MOH) directed a wide-ranging "anti-plague system" with the main objective of protecting the country from endemic and imported dread diseases such as plague, anthrax, tularemia, Crimean-Congo hemorrhagic fever, and others with either a natural or laboratory-based etiology. In addition, it had an important, three-phased role in the Soviet Union's offensive biological warfare (BW) program: to provide training to the BW program's scientific workers on biosafety practices; to submit cultures of especially virulent pathogens to that program's research and development institutions; and, in some instances, weaponize some bacterial species.



Cover of Volume 1, *Interesting Stories of the Events and People of the Anti-Plague System of Russia and the Soviet Union.*

Because the Soviet Union considered information about endemic infectious disease—as well as BW-related activity—to be state secrets, hardly any outsiders knew about the anti-plague (AP) system's work and accomplishments. For various reasons noted below, with the exception of a few states with their own plague experts, the Soviet AP system was unknown to Western nations. In fact, our research of the Western literature found just a single publication in 2002 about the AP system in a Western newspaper (by the *Washington Post*'s Joby Warrick; see Part II) and no academic publication prior to 2006, when investigators at the James Martin Center for Nonproliferation Studies (CNS) published five separate but connected articles in the journal *Critical Reviews in Microbiology*.[i]

After the USSR dissolved in December 1991, the AP system fragmented, and its institutes and stations located outside of Russia became part of the health systems of the newly independent states. Problematically, however, Russia stopped funding the AP scientists and auxiliary personnel in those states, which offered only insufficient funding for these programs. The results were predictable; to this day, AP scientists and technicians are trying to eke out a living on starvation wages, and the physical

[i] Sonia Ben Ouagrham-Gormley, Alexander Melikishvili, and Raymond A. Zilinskas, "An Introduction," *Critical Reviews of Microbiology* 32(1) (2006), <http://informahealthcare.com/toc/mby/32/1>, as well as on the CNS website at <http://cns.miis.edu/antiplague/index.htm>.

security that once protected facilities and culture collections has deteriorated to near uselessness. However, after 1991, some information about the AP system's history and work program has become known, as its scientists publish accounts of their research and findings and visitors to non-Russian AP facilities tell about their experiences.[ii] (The Russian AP system is an exception; it remains closed to outsiders and today is almost as secretive about its current activities as it was during the Soviet era.) As a result, international assistance to most national AP systems has been forthcoming from international sources such as the International Science and Technology Center and the US Cooperative Threat Reduction program.[iii]

In 2002, CNS was fortunate in receiving a generous grant from the Nuclear Threat Initiative (NTI) to conduct a thorough study of the Soviet AP system. This study concluded in 2006 with the publication of the five articles mentioned in the preceding paragraph. This first product of CNS's research into the AP system provides a historical overview of this system, including a review of its role in both the offensive and defensive aspects of the Soviet BW program, as well as its biological weapons proliferation potential after the dissolution of the Soviet Union in December 1991. However, while conducting this first project, CNS researchers had collected much information about the status of the AP systems in the then-10 newly independent states. This warranted a second publication released online in January 2008, which contained this new information as well as an assessment of each national system in terms of its proliferation potential.[iv] The occasional paper at hand is thus the third, and probably final, report that CNS will publish on the Soviet and Russian AP system. It is based on a compilation illustratively titled *Interesting Stories About the Activities and People of the AP System of Russia and the Soviet Union* (henceforth, *Interesting Stories*…) that was edited by Moisey Iosifovich Levi and other former members of the AP system, and released between 1994 and 2002.

The *Interesting Stories*… collection consists of 12 volumes (the twelfth volume has two issues), each of which contains between five and 15 chapters. The chapters vary widely as to their contents; some are essays that describe research and field investigations, others are biographies, and yet others are anecdotes that recount interesting and amusing experiences. Many are illustrated by photographs, maps, or sketches; all of which, unfortunately, are of poor quality, as is the binding of the paperback volumes. All in all, the compilation provides a unique portrayal of the work, lives, and experiences of AP scientists that took place mostly during the 1930s through the 1960s.

The compilation deals mostly with scientific matters, including field research in regions most Westerners have never heard of, the containment and elimination of epidemics of plague and other highly dangerous diseases, the eradication of animal hosts of pathogens, and laboratory research

[ii] Igor V. Domaradsky, a former director of two Soviet AP institutes, was the first Russian writer to publicly reveal details the AP system and the Soviet BW program in *Troublemaker, or The Story of an "Inconvenient" Man* (in Russian), privately published in Moscow, 1995.

[iii] See Chapter 23 in Milton Leitenberg and Raymond A. Zilinskas, *The Soviet Biological Weapons Program: A History* (Cambridge, MA: Harvard University Press, 2012), pp. 679-97.

[iv] Sonia Ben Ouagrham-Gormley, Alexander Melikishvili, and Raymond A. Zilinskas, "The Anti-plague System in the Newly Independent States, 1992 and Onwards: Assessing Proliferation Risks and Potential for Enhanced Public Health in Central Asia and the Caucasus," James Martin Center for Nonproliferation Studies, January 3, 2008, <http://cns.miis.edu/antiplague/>.

involving virulent pathogens under often primitive conditions. There are also snippets of other experiences involving the secret police, tribes with unique customs, and oddities brought about by Stalinist era xenophobia. This paper provides the first English-language access to the *Interesting Stories*... by presenting complete translations or abstracts of the chapters that constitute the volumes.

Striving to stay away from the "popular science" genre, editor Levi instead characterized the *Interesting Stories*... as "something between science literature and academic work." Levi aimed to "convey the vibrancy and complexity of scientific research, the clashes of opinion, and the whole of the inherited knowledge of plague as a natural phenomenon."[v] Indeed, this task was made urgent by the age and health of many of the long-time AP system members or, alternately, their colleagues and relatives who could tell their stories. In addition to providing a great deal of historical narrative, experimental data, and other technical details, the volumes convey the striking devotion of the scientists to their work, which entailed hard and sometimes dangerous conditions in the field and laboratory. I.V. Khudyakov's epigraph "The March of the Plagueologists" bears recounting:[vi]

No medals we received,
In rain and melting ice,
For treading 'cross the flow of rivers strong!
Far off from darling eyes,
from urban paradise,
Gray marmots there received us in their song. […][vii]

Doctors, zoologists, where are our
years of youth!?...
We lived among the mountain passageways!...
Go on, ye' ol' horse, take the path yet unexplored,
The path with no repose, - the path
of plague![viii]

Left to right: M.A. Aykimbaev, N.P. Mironov, M.V. Pryadkina, L.A. Timofeeva, M.I. Levi, T.I. Aisimova

[v] M.I. Levi, Foreword, *Interesting Stories*… 1 (1994), pp. 6-7.

[vi] In English, the term "plagueologist" does not exist. We translated the Russian term "chumolog (чумолог)" in this poem as "plagueologist," but recognize its closest meaning in English probably is "plague specialist."

[vii] Readers should note that we use brackets in the text for two purposes and in footnotes for one purpose. In the text, the first purpose is to note by writing […] that there is a section in the original that we decided was not needed and so was omitted here. The second purpose is to insert our words within brackets that serve to clarify the original text. For example, in the original text it is written "the station had…" so we clarify this text by writing "the [Nukus AP] station had…" The purpose in footnotes is to make sure that the reader is informed that the footnote denoted by [Author's note 1, in the original.] means that this particular footnote was in the original source. All footnotes that do not have this bracketed insert have been written by the editors.

[viii] *Interesting Stories*... 5 (1997), p. 245.

Though Levi meant to tailor the series to "biologists of a general sort, medical doctors, parasitologists, epidemiologists, microbiologists, and naturalists in the broad sense... and especially to young readers, preparing for scientific careers," the *Interesting Stories*... also have relevance for wider audiences. Given the use of the AP system in Soviet public health, scientific research, and national security, this source can also inform the current work of public health officials, biosafety practitioners, nonproliferation policy makers, experts on the research and development of technologies with dual civil-military applications, and scholars of Soviet and Russian history, politics, and society, among others.

Practical training seminar for auditors of S.M. Kirova VMOLA, RPChI, March-April 1966. Seated (left to right) are G.A. Balandin, L.N. Makarovskaya. M.S. Drozhevkina, V.S. Uraleva, I.V. Domaradsky, A.G. Somova, S.I. Zaplatina.

With the aim of providing Westerners with access to the portions of Levi's volumes that are most relevant to these audiences, we have arranged Part I of this publication in the following manner. Each of its 12 chapters corresponds to the 12 volumes of the *Interesting Stories*… We present the articles contained in each volume as bibliographic entries, providing the title of the work, the authors' names, page numbers, and so forth. Each entry contains a brief abstract, which identifies the content and main point or aim of the corresponding article. Where interesting portions merit additional attention, we have included summaries of what we consider important points, which follow the abstracts. In selected cases, complete translations of longer passages, or of the entire original texts are included, as well.[ix]

Most of the volumes begin with a foreword written by Levi, all of which have been fully translated. Volumes 4 through 12 also include extensive supplementary material, such as collections of "Forgotten Photographs," indices of names, and bibliographies of the AP scientists' scholarly works, which until publication in the *Interesting Stories*... had never been compiled. Our compendium includes a selection of the best quality photographs and a description of all photographs.

[ix] In choosing which points and passages to include in greater detail, we sought to highlight portions bearing relevance to proliferation and biosecurity threats, to the AP system's link to the Soviet BW program, to public health and biosafety, and to the personnel and organizational issues related to these aspects. However, in order to present as complete a catalogue as possible of the all Levi's *Interesting Stories*…, we include representative samples of anecdotal pieces, technical explanations of field and laboratory work, and the politics of the AP system as well.

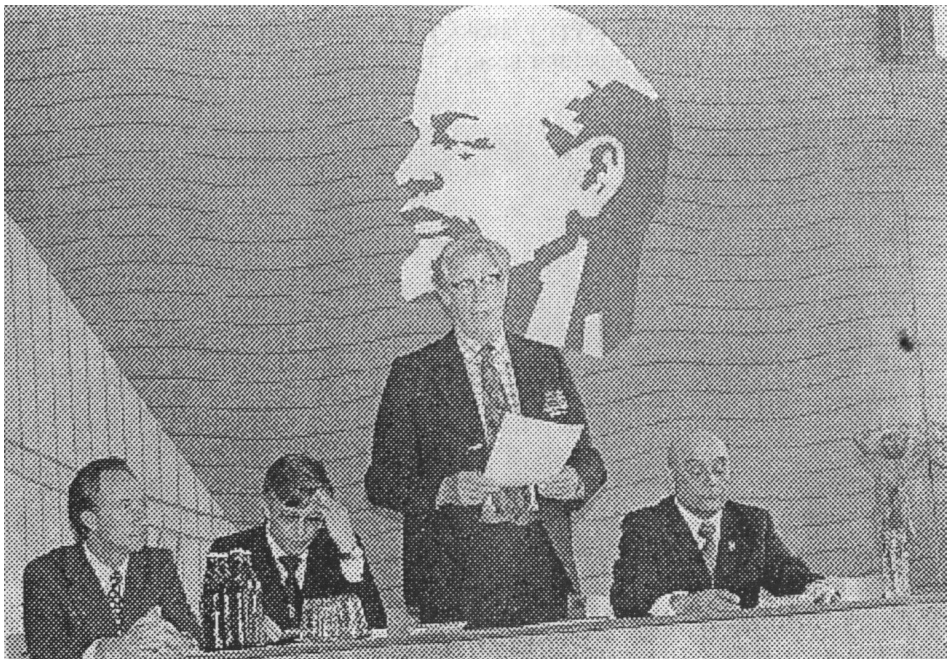
In Part II of this Occasional Paper, we present articles that supplement the material presented in Part I. Specifically, Part II is comprised of three articles about the AP system that were published in the Russian and American media. The first two articles were written by Taisiya Belousova and were published in 1998 and 1999 in *Sovershenno Sekretno* (*Top Secret*), an "international newspaper" founded in the USSR in 1989 as a liberal countervoice to the establishment press. Each article seeks to portray the scope of the intrigue in which the AP system was involved. Belousova quotes at length from the contributing authors of Levi's *Interesting Stories*…. The first article, titled "The Plague," contrasts the public's naïveté about epidemic disease in the Soviet Union with the secrecy in which the government purposefully shrouded the realities of much Soviet public health. Belousova brings the position of AP workers into stark distinction: dedicated both to resolving scientific puzzles and serving the public in epidemic emergencies, the AP specialists persevered with their labor of love despite the lack of recognition they received for the dangerous work they conducted and the often difficult lives they led.

Figure 9 (page 5). Seminar for managers and epidemiologists from high-risk infection divisions. Rostov-on-Don, 1926. Seated (left to right) are M.I. Levi,(?), G.A. Balandin, T.I. Puchkova, A.K. Shishkin, ?, ?, ?, I.A. Dukalov. Standing (behind M.I. Levi, left to right) are N.P. Mironov, R.M. Sayamov, I.S. Maloletkov, I.Kh. Ivanov.

In the second article, "Bioterror: Who will protect Russia?," Belousova explains how the changing threats of high-risk infection in Russia forced the AP system to respond by pursuing new innovations in enhanced prevention and detection capabilities. The title remains a question since conclusive studies into how well the AP system would respond to a deliberately caused biological event lack sufficient funding. Indeed, Belousova indicates the threat posed by pathogens stored in the poorly guarded culture collections of the AP system that could be diverted for criminal or terrorist purposes.

The third article is by Joby Warrick, a *Washington Post* national intelligence reporter, who was the first to publish an extensive article about the AP system in a major Western newspaper titled "Soviet Germ

Factories Pose New Threat: Once Mined for Pathogens in Bioweapons Program, Labs Lack Security."[x] In unembellished language, Warrick illustrates the results of previous CNS reports, depicting the frozen, nearly defunct facilities of the AP system in Ukraine as a dormant threat. The key challenge according to Warrick is managing the leftovers of the Soviet BW program—particularly its personnel. Recognizing the need for a next generation of AP specialists, Warrick reports, "…today, training is harder to come by, even for the few young scientists who are willing to accept starting salaries of less than $25 a week." Citing the limited resources from the governments that maintain AP facilities, and those from state donors abroad, these publications put forth an important question to their readers across the world: who will safeguard these public health assets from being used to do harm?



Ceremony installing new director of the Stavropol AP Institute, 1979. (Left to right: Yu.G. Suchkov, new director, Stavropol AP Institute; V.P. Sergiev, Director of GUKI, USSR Ministry of Health; P.N. Burgasov, deputy minister of health of the USSR, national sanitary doctor general; V.G. Pilipenko, outgoing director)

Part III contains short biographies of two of the most important persona in relation to the Soviet AP system: Petr N. Burgasov and Igor V. Domaradsky.[xi] During most of the period covered by *Interesting Stories...*, Burgasov was a deputy minister of health and, as such, was the head of the ministry's 2nd Directorate that governed the AP system. Domaradsky was a world famous plagueologist, the former

[x] Joby Warrick, "Soviet Germ Factories Pose New Threat: Once Mined for Pathogens in Bioweapons Program, Labs Lack Security," *Washington Post*, June 16, 2002, p. A1.

[xi] There are two variations of his last name—Domaradsky and Domaradskij. The second was used only in one instance, as an author of the only book he published in English with Wendy Orent (see note 13 below). Except when referencing this book, we use Domaradsky throughout.

director of two AP institutes (respectively located in Irkutsk and Rostov), the developer of the modern Soviet BW program, and a prolific contributor to *Interesting Stories*... Part IV consists of a conclusion written by this paper's editors providing thoughts on why Levi's volumes were written and their possible impacts on science in Russia.

The occasional paper ends with four annexes. Annex 1 explains the concept of natural plague focus and foci. The second spells out acronyms, while the third is a glossary of technical terms. Annex 4 contains the complete Table of Contents of Levi's 12 volumes.

It is probable that the CNS owns the only complete set of *Interesting Stories*... in the United States and, possibly, in the Western world. In order to make these volumes available to scholars and interested public, we have decided to donate the set, plus some associated material, to the Hoover Institution at the Stanford University where they are lodged in the Russian and Commonwealth Independent State Collection.[xii]

[xii] See <www.hoover.org/library-and-archives/acquisitions/154451>.

PART I: M.I. LEVI'S "*INTERESTING STORIES...*"

VOLUME 1 (1994)

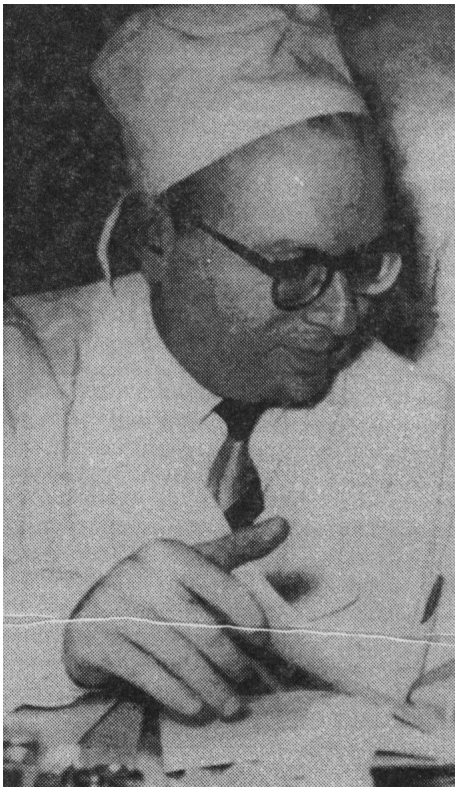
From the Editor

Moisey Iosifovich Levi (p. 5)

*Introduction to the "*Interesting Stories...*" series.*

Full translation:

> With this volume, we begin the publication of articles about the USSR AP service and its outstanding people.



Moisey Iosifovich Levi

Moving ahead, we intend to address the following topics: the conflict between fundamental viewpoints on the existence of a plague epizootic process in nature, the history of the development of current methods of diagnosing plague in humans and animals, live and killed plague vaccines, genetic properties and variability of plague microbes, the recent history of human illness, paradoxical problems in the study of plague, the dramatic history of the founding of AP establishments, the history of scientific and administrative conflicts within these establishments, episodes from the lives of prominent figures, and predictions concerning the epidemiology and epizootiology of plague with an eye toward the future of the AP service.

We will strive to publish interesting and attractive articles that get to the heart of the problem, so readers may find some text challenging. Our work is intended for general biologists, medical professionals, parasitologists, epidemiologists, microbiologists, and naturalists in the broad sense of the term. But most of all we are interested in young readers preparing for scientific careers.

From the Editor

Moisey Iosifovich Levi (pp. 6-7)

*Introduction to the first volume of the "*Interesting Stories...*" series.*

Full translation:

> Russia, like other European countries, had been stricken by many plague epidemics. In the late 1890s, [tsarist] Russia established its first specialized institutions to combat this terrible infection. Colossal resources were invested in studying plague as a natural phenomenon. [Over time,] the extensive network of specialized medical establishments for this purpose came to be called the USSR AP service. From the beginning, this branch of public health was largely isolated from other institutions and was relatively decently funded. The "founding fathers" worked to establish an effective base for its operations. The USSR AP service developed into a unique phenomenon with no counterpart in the history of this or any other country. It produced a huge legacy of knowledge about plague as a natural phenomenon, making this disease the most thoroughly studied of any naturally occurring infection. Scientists in other countries contributed far less to the body of knowledge about plague. This situation could have arisen in our country only because the most capable scientists were attracted to the study of plague, while the public health bureaucrats were able to bring specialists from different fields together into a unified scientific field. Of no small importance was the morality of the "founding fathers" in circumstances of relatively abundant material resources.
>
> Nowadays, plague is much less of a danger to humans. Many of the "founding fathers" and outstanding figures of the AP service are now dead. In addition, there are "new songs to sing," now that traditional science such as microbiology, epidemiology, and parasitology have handed the palm branch over to molecular biology. Therefore, in this series of publications, we would like to summarize different stages in the study of plague so that the lessons learned will not be erased from human memory.
>
> We aim to make this series interesting for a broad circle of readers. At least some of the articles will be accompanied by drawings, tables, and diagrams to convey the major research findings in an accessible way. Needless to say, this will not be the easiest material to read, and will require some effort to understand the text, similar in difficulty to the articles in *Scientific American*. Our articles will be somewhere between scientific literary works and articles from specialists' journals. Therefore, do not expect polished literary gems, on the one hand, or methodological details, historiography, or references, on the other hand. This form of presentation fulfills the desire of the reading public to know more about scientific issues than is reported in the so-called popular scientific literature and at the same time allowing scientists to present their subjects to a wider audience.

In addition to sections about important achievements in plague science, this volume also has articles about heroically self-sacrificing researchers. The main job of the editor is to bring to today's reader all the excitement and fascination of scientific research, the contradictions, conflicting viewpoints, and the sum total of knowledge about plague as a natural phenomenon. We also try to present a list of unresolved problems and a history of the science and the people drawn to it, while giving due respect to those founders of the USSR AP service who, although no longer alive, are worthy of our grateful remembrance.

The first volume of this series was published at the editor's expense. A donation fund will be established to help publish subsequent volumes and create a literary history of this unique phenomenon in human history known as the USSR AP service. The names of donors and the amounts donated will be published in each volume of the series, along with a report on the expenses paid by the fund. Donations can be made in person or sent to the following address: Nadezhda Nikolaevna Basova, 23 Amurskaya St., Building 3, Apt. 18, Moscow, 107241.

M.I. Levi, Editor

Gerbils, Plague, and the Volga (The Story of a Paradox)

Moisey Iosifovich Levi (pp. 8-44)

This scientific chapter describes research demonstrating the co-evolution of rodent carriers, flea vectors, and plague bacterium strains in the northwest Caspian region.

Studies of plague often take many years because observation periods occur during spring and autumn, which are also the busiest times for plague control and prevention work. In addition, animal holding facilities are full during these periods for other reasons, so there is scant room to hold experimental animals.

Researchers at Astrakhan AP Station and Elista AP Station (approximately 300 km due west of Astrakhan) collaborated in 1958-59 to study differences in plague susceptibility among three gerbil subspecies in the northwest Caspian area. Boris Georgievich Valkov, newly graduated from Leningrad Medical Institute and eventual director of Elista AP Station (c. 1958), started the program, with Abram Izrailevich Shtelman from Astrakhan APS as co-founder. The group contributed important findings to the field.

However, V.N. Ter-Vartanov, director of the Stavropol AP Institute, vehemently opposed the collaboration. As a result, Valkov was fired as director of Elista AP Station (c. 1959).[1] He went on to

[1] See biographical sketch in M.I. Levi, "Vartan Nikitich Ter-Vartanov—Director of the Stavropol AP Institute," *Interesting Stories...* 4 (1996), pp. 231-40.

pursue a fruitful career as a professor, receiving a Doctor of Medical Sciences degree. Other original researchers also left the project; Luiza Stefanovna Biryukova had to leave Stavropol, and M.I. Levi had to leave his post as deputy director of Stavropol AP Institute and went to Rostov AP Institute. Only Shtelman kept his job (he died a few years after defending his doctoral dissertation in 1965).

Yet, this line of research continued and eventually demonstrated the coevolution of rodent carriers, flea vectors, and plague bacterium strains.

Professor I. S. Tinker's Life of Discovery

A. I. Tinker (pp. 45-71)

This chapter is a biographical sketch of Josef Samsonovich Tinker (1898-1962), field worker, researcher, teacher, and administrator in the AP system from 1925 until his death.

After receiving a medical degree at Don State University in 1924, Tinker conducted several years of AP field work, leaving behind a large collection of photographs. He then held various senior administrative and scientific posts in the AP system, combined with teaching and epidemic control field work. He helped develop the AD plague vaccine and did important work on cell immunology, producing a doctoral dissertation on immunology of tularemia.[2] He did major work on insect extermination in plague foci and populated areas, including port facilities, where Soviet authorities particularly feared the origination of new outbreaks of disease from abroad, and the prevention and treatment of high-risk infections. His final work focused on chemical vaccines against plague.

Konstantin Vasilevich Durikhin (The Story of an Inspiration)

Moisey Iosifovich Levi (pp. 71-157)

This scientific chapter describes various models developed by Konstantin Vasilevich Durikhin (1936-1986), a plague and cholera researcher at Rostov-on-Don AP Institute and Volgograd AP Institute who was noted for his work on cellular immunity.

Durikhin investigated cellular immunity against plague. His insight that immune response is described by Poisson distribution was a remarkable intellectual breakthrough.[3] His candidate's dissertation was titled "Plasma-cell reaction in several species of animals immunized with plague capsule antigen,

[2] The term AD plague vaccine was used in the 1930s; it refers to a way of preparing killed vaccines while preserving the intact microbial antigens (Vladimir Motin, former scientist at the Gamaleya Institute of Epidemiology and Microbiology in Moscow, personal communication with the editors, July 8, 2013).

[3] The Poisson distribution is a discrete probability distribution used to predict rare events given very many opportunities to occur, such as mutations of DNA exposed to radiation.

and evaluation of this reaction by methods of mathematical statistics" (Rostov-on-Don, 1967). He developed an excellent culture medium for plague bacterium.

In the late 1960s, Durikhin moved to Volgograd AP Institute. Soon after, serious cholera problems in the country caused the institute to shift focus from plague to cholera.[4] Accordingly, he began working in this field until his death from liver cancer at age fifty.

Boris Nikolaevich Pastukhov: Bureaucrat and Person

Moisey Iosifovich Levi (pp. 158-64)

This chapter is a biographical sketch of Pastukhov (b. 1933), who was the long-time director of the High-Risk Infection Department, Anti-Epidemic Administration, USSR MOH during (at least) the 1950s-60s.

Pastukhov was an apt administrator of the AP system because he let knowledgeable underlings decide policy, and, in addition, was adept at acquiring funding, supplies, and facilities. As a result, the AP system was able to obtain high-quality facilities even in very remote areas—much better than other anti-epidemic organizations of the general public health system.

He is described as a typical Soviet bureaucrat, with prior experience in the Ministry of Agriculture, but with little knowledge of epidemiology. In the Soviet bureaucratic system, administrators (especially higher level) did not need knowledge of the subject area; rather administrative capability (i.e. fulfilling plans, keeping problems from reaching higher-ranking officials) was valued more.

Levi reports that he defended higher pay for AP personnel, yet also accepted bribes to keep corrupt, incompetent administrators in the Caucasus AP stations. He later held a position at the Central AP Station, Moscow.

Bird Detective

Nadezhda Nikolaevna Basova (pp. 166-68)

This chapter describes an ornithosis outbreak among pet pigeons kept at the AP Institute of Caucasus and Transcaucasus in Stavropol. [5]

[4] M.I. Narkevich et al., "The Seventh Pandemic of Cholera in the USSR, 1961-89," *Bulletin of the World Health Organization* 71, 1993, pp. 189-96. The work of the AP system on cholera epidemics is described in Yu.G. Suchkov, "Shuravi in Afghanistan, 1965," *Interesting Stories…* 4 (1996), pp. 82-104.

[5] At a date unknown to the editors, the Russian government renamed the Scientific AP Institute of the Caucasus and Transcaucasus to the Stavropol Anti-plague Scientific Research Institute (see <www.russmed.ru/eng/mzrf.htm>). Both names are found in the book since we chose not to change what was written by the original authors.

After an investigation of the ornithosis outbreak, an order was issued to destroy the pigeons. The pigeon club leader, who was away at the time of the outbreak, tried to have this order rescinded, even appealing to the KGB director. The decision was upheld on scientific grounds and the pigeons and loft were destroyed to prevent a human outbreak.[6]

[6] The disease in question probably was psittacosis, which is a bacterial disease transmittable to humans. Its causative pathogen, *Chlamydia psittaci*, probably was weaponized by the Soviet BW program.

VOLUME 2 (1994)

What Can We Learn from Human Cases of Plague?

*Grigory Dmitrievich Ostrovsky (*pp. 3-26). Four tables, seven photographs.

Plague epizootics, 1951-52 in Dagestan Autonomous Soviet Socialist Republic, indicated by black triangles

This chapter is an anecdotal essay that addresses the persistent enigmas surrounding plague theory that remain despite what was discovered about the disease through the author's experience in plague research, control, and eradication, particularly in the 1960s.

Grigory Dmitrievich Ostrovsky became director of the Department of High-Risk Infections, USSR MOH, in 1963. At the time, the department had only five central staff members, responsible for five research institutes and 21 AP stations with over 14,000 employees.

The scope of plague surveillance and control work in USSR is described, as well as the secrecy concerning infectious disease information before and after 1956 (see translated excerpt).

Four plague outbreaks in the USSR in 1965 and 1966 are described: Takhta District, Turkmen Soviet Socialist Republic (SSR), October-November 1965 (located in southern Turkmenistan along the border with Afghanistan on the Murgab River); Kazalinsk District, Kzyl-Orda Region, Kazakh SSR, August 1966 (located on the northeastern edge of the Aral Sea bed in Kyzl-Orda Region); Kulsary village, Guryev Region, Kazakh SSR, August 1966 (located 460 kilometers east of Astrakhan across the Caspian Sea); and Karakul village, Kzyl-Orda Region, Kazakh

SSR, August 1966 (located in the Kyzl-Orda Region, about 50 kilometers southwest of Kazalinsk). One table presents information about 38 plague outbreaks in camels, 1907-67.

Pulmonary plague outbreaks occurred in Vladivostok (1921) and Gadrut, Azerbaijan (1931).

Four photographs depicting monuments dedicated to medical personnel who died during Gadrut 1931 outbreak are included.

Excerpt:

> Before the 20th Party Congress in 1956, information about human infectious diseases either went unreported or appeared in the scientific press in such statistics terms that it was impossible to judge the true dimensions of incidence. The totalitarian government was concerned with keeping a respectable image. After 1956, there was permission to publish information about plague-infected rodents and fleas, but under the "For Official Use Only" classification. At the same time, the USSR MOH reported no human plague cases to the World Health Organization (WHO), even though this was not the true situation. This created the impression that plague had been eliminated and that it was only of historical interest to the country. Now, in the post-Soviet period, journalists readily report human and animal cases of plague, often with a noticeable gusto and without a good understanding of the problems, while in the 1960s-70s, any disclosure of "secrets" was severely punished. This posed a glaring contradiction: if there is no plague, why does the country need such a huge network of AP establishments? Moreover, in the 1950s-60s, high-risk infection departments were established as part of the sanitary-epidemic stations of regions and large cities, and new AP stations were established.[7]

Unexpected Puzzles About Enzootic Plague

*Innokenty Stepanovich Soldatkin and Yu. V. Rudenchik (*pp. 27-–59). Four tables, one photograph (of author Soldatkin), eight references.

This scientific chapter describes the formulation of alternate hypotheses challenging the classical theory that natural foci of plague are maintained by transmission through fleas.

The chapter describes developments in field study methodology. E.V. Rotshild proposed and carried out large-scale surveys of plague epizootics by collecting "snapshot" data at various stages of a given

[7] The USSR had a Sanitary Epidemiological System (SES) that functioned in parallel with the AP system. The main difference between the two was that SES performed classical public health functions such as vaccination campaigns, food hygiene, water hygiene, cancer prevention, etc. The AP system performed some public health functions related to highly dangerous infectious diseases, but its main function was to research plague and other dread diseases for the purpose of generating findings that could be applied to control or eliminate them.

epizootic (1960s). G.G. Sviridov reproduced epizootics under controlled conditions (1960s). N.S. Novokreshchenova and one of the article's authors developed a radioactive marker technique for studying flea activity in plague foci.

Gorny Altay, 1975. Second from the left: E.V. Rotshild, fourth: A.G. Derevshchikov, senior zoologist of the Gorny Altay AP Station.

By the 1980s, a large body of field data had emerged, clearly contradicting the classical flea-transmission theory. However, no consensus on a theory to replace it emerged. T.V. Bakanurskaya demonstrated the existence of an "atypical" *Yersinia pestis* strain (not detectable by ordinary testing) that converts to the typical form in the environment. V.S. Larina found the L-form of *Y. pestis* living in symbiosis with soil saprophytes, a form that also converts to the typical form. E.V. Rotshild proposed that a geochemical variable might trigger plague outbreaks, though this variable has yet to be identified.

History of Control Measures in Natural Plague Foci: Lessons from Soviet Experience

*Yury Vitalyevich Rudenchik and Innokenty Stepanovich Soldatkin (*pp. 60-85). Three tables, three figures, one photograph (presumably of author Rudenchik, but not labeled), 24 references.

This scientific chapter reviews the theory on the development of concepts and practices of epizootic plague control in the USSR, including basic research techniques and more advanced innovations of Soviet scientists. Author I.S. Soldatkin won the contest for writing the best articles of the first seven volumes of the series.[8]

The article describes many field experiments and campaigns involving rodent and flea extermination in various natural plague foci of the USSR. Many of these measures covered large areas and lasted many years. However, they did not provide a permanent eradication solution, as plague epizootics eventually returned. This called into question prior assumptions about how plague bacteria persist in natural foci, raising particular uncertainty about the role of fleas in epizootics. Successful eradication of natural plague foci will thus require new concepts and techniques to be developed.

[8] See *Interesting Stories...* 8 (1998), p. 271.

Passive Hemagglutination Reaction for Plague: 25 Years of Struggle, Triumph, and Limitations

Moisey Iosifovich Levi (pp. 86-150). 11 tables, one photograph (portrait of author), 14 references.

This scientific chapter reviews the theory on the development, principles, and field use of serologic tests (i.e. passive hemagglutination, passive hemagglutination inhibition, antibody neutralization, and antigen neutralization) for field surveillance of plague epizootics in the USSR.[9]

Professor Moisey Fishelevich Shmutter at Central Asia AP Institute in Alma-Ata developed improved diagnostic antigens for plague bacteria and other pathogens c. 1968.[10] Before that, diagnostic antigens used in the Soviet Union were produced by the Rostov AP Institute.

Field personnel were initially unhappy with the introduction of serologic testing because it threatened to lower their pay. Epidemiological field crews received bonus pay of 6 percent of monthly salary per day of field work, provided that they isolated a plague culture during that time. However, no bonus was paid when serologic test results were positive. When the new test was introduced into pathogen diagnostics, crews faced a loss of their bonus when they did not obtain bacterial cultures. Soon after the introduction of the new tests, however, the entire pay system was revised to eliminate the bonus.

Some resistance to serologic testing also came from the State Scientific Research Institute of Microbiology and Epidemiology of South-East Soviet Union, or, abbreviationally, Mikrob, in Saratov—traditionally the center for developing test methodologies, although most serologic methods were developed at other institutes. However, B.K. Fenyuk of Mikrob ordered Sergey Nikolaevich Marin and Yu.G. Suchkov to conduct a comparative study of test methodologies. This careful study convinced Fenyuk and others at Mikrob of the usefulness of serologic testing. Marin later developed field surveillance methodologies employing serologic testing.

In the 1970s, Suchkov and Yu.V. Kanatov proposed the first diagnostic erythrocyte antibody for plague detection.

Serologic testing was used in field work to detect plague by testing rodent bones in raptor pellets. Various serologic techniques have been used to study plague-infected fleas.

In Western countries, the immunoenzyme method is far more common than passive hemagglutination testing.

[9] Each of these serological tests detects the presence of antibodies to bacterial and viral pathogens in a person's blood but with different advantages and disadvantages.

[10] Though Alma-Ata is now called Almaty, the original publication employs the previous name for the capital of the Kazakh Soviet Socialist Republic.

Excerpt:

> In our country, research on plague and other high-risk infections (including major advances in diagnostic biologicals and serologic methods) was hidden behind a curtain of secrecy (incidences of plague and other infections in humans were not disclosed) for reasons of preparing for possible bacteriological warfare. None of this type of research was conducted in civilian institutions of the AP service, although planning agencies did not exclude this possibility.[11]

Teacher and Colleagues

*Yury Grigoryevich Suchkov (*pp. 151-81). One photograph (portrait of author), nine references.

This chapter tells about the author's collaborative work on plague with AP system colleagues. It includes an overview of the author's career from the 1950s onwards, and it describes the technical discussions that the author had on scientific and practical issues concerning plague.

The Virology Laboratory at the Stavropol AP Institute studied viruses and rickettsias in rodents, poultry, and migratory birds. The laboratory closed when M.I. Levi and N.N. Basova went to the Rostov-on-Don AP Institute.

Plague enzootics were found to occur among voles in Armenia. A new plague strain specific to voles was identified. This strain requires thiamin for growth, unlike other strains.

Levi started to develop serologic test methods at Stavropol AP Institute. Levi left Stavropol because of problems with the director and the scientific director of the institute. A brief biography of V.N. Ter-Vartanov, director of Stavropol AP Institute, is given, along with commentaries on laboratory directors and other personnel at Rostov-on-Don AP Institute.[12]

Motion pictures were produced that showed epidemiology field work at Shaken, a small village near the Aral Sea in Kazalinsk District, Kyzylorda Region, Kazakhstan.

The contentions over the acceptance of serologic testing for plague are described.

Changes occurred at Rostov AP Institute after the arrival of I.V. Domaradsky as director.[13]

[11] This statement is not correct; in fact, the AP system provided samples of pathogens to the Soviet offensive BW program and had an important role in its program to defend against BW. For a study of the AP system's role in the Soviet BW programs, see Leitenberg and Zilinskas, *The Soviet Biological Weapons Program*, Chapter 5.

[12] More extensive biographical sketch included in M.I. Levi, "Vartan Nikitich Ter-Vartanov—Director of the Stavropol AP Institute," *Interesting Stories...* 4 (1996), pp. 231-40.

[13] Domaradsky's arrival to Rostov is also discussed in M.I. Levi, "My Departure from the AP System," *Interesting Stories...* 2 (1994), pp. 201-08 (see note 17).

AP field personnel provided general medical assistance to local people.

Suchkov became director of Stavropol AP Institute in 1979 after 20 years at Rostov.

WHO Plague Collaborating Center (Director, A.K. Akiev) was based at Scientific AP Institute of the Caucasus and Transcaucasus.[14]

It was difficult to find reliable seasonal field assistants to set poison bait for rodents in the Caucasus. Other aspects of rodent extermination field work are described.

The scientific debates on the continuity of enzootic plague are examined.

Boris Konstantinovich Fenyuk, Chief Zoologist of the AP Service

Innokenty Stepanovich Soldatkin (pp. 182-87). One photograph (showing author with subject).

This chapter is a biographical sketch of B.K. Fenyuk (1902-69), director of the zoology laboratory at Mikrob. It includes descriptions of Fenyuk's research during the time the author worked for him from 1952 onward.

Viktor Mikhaylovich Zhdanov: Fate of a Scientist (Early Period)

Moisey Iosifovich Levi (pp. 188-200)

This chapter is a biographical sketch of V.M. Zhdanov (1914-87), AP researcher and administrator. It illustrates the contrast between his early work in the AP bureaucracy as an opportunistic, treacherous careerist, with the respectability of his later career as director of D.I. Ivanovsky Institute of Virology.

Zhdanov was a gifted scientist and attained his doctor of medical sciences degree at age 30. He studied hepatitis transmission among Interior Ministry troops in Turkmenistan during World War II. However, to further his administrative career, Zhdanov conformed to the culture and practices of the Soviet bureaucratic system and Communist Party. He "took actions" against Jewish colleagues in accordance with the desires of the party and the Soviet intelligence agency, the KGB.

[14] The relationship between the WHO and the AP system began in 1973 and survives to this day as the WHO Collaborating Centre for Reference and Research on Plague at the Scientific AP Institute of the Caucasus and Transcaucasus in Stavropol (listed by WHO as the Stavropol Research Antiplague Institute), one of 19 such collaborating centers in Russia. See WHO Collaborating Centres Global Database: <http://apps.who.int/whocc/List.aspx?cc_code=RUS>.

The author worked with Zhdanov at Kharkov Institute of Epidemiology and Microbiology, where Zhdanov was head of the epidemiology department.

Zhdanov was deputy minister for high-risk infections at the USSR MOH for several years. He then was appointed director of the D.I. Ivanovsky Institute of Virology, Academy of Medical Sciences, which Levi describes as a result of his forcing out of the incumbent director, P.N. Kosyakov. Still, at the Ivanovsky Institute, he did much to build and equip the institute and further its work. However, his bureaucratic responsibilities hampered his scientific work and detracted from the quality of his publications. In the Soviet system, a scientist's status depended on having as many official positions as possible—academic committees, journal editorships, commissions, presidiums, and so forth—which, as a result, left less time for his or her scientific work.

In exchange for permission to travel abroad, Zhdanov wrote a report stating that Western countries were preparing for BW using fleas infected with influenza. Author Levi viewed this as an attempt to mock the stupidity of KGB overseers. According to Domaradsky and other sources, Zhdanov was subsequently recruited into military research, code-named "Project Ferment," for developing antibiotic-resistant strains of pathogens used in biological weapons.[15]

Zhdanov fought bitterly with N.N. Zhukov-Verezhnikov, the most senior official in the AP system and a former deputy minister of health, who had insisted that the Japanese conducted bacteriological war using fleas infected with high-risk infectious agents. He had served as the prosecutor at the 1949 Khabarovsk War Crime Trials (Khabarovskii protsess) of 12 Japanese scientific workers complicit in the alleged development and testing of biological weapons on human subjects captured from the Soviet Union during World War II.[16] All of the Japanese workers were found guilty and sentenced to

[15] Igor Domaradskij and Wendy Orent, *Biowarrior: Inside the Soviet/Russian Biological War Machine*, (Amherst and New York: Prometheus Books, 2003), pp. 143-44, 149, 155-56. Zhdanov was truly two-faced in regard to public health in general and to BW specifically. On the one hand, he was a beloved figure at the World Health Assembly (WHA). In particular, while serving as the Soviet deputy minister of health in 1958, Zhdanov proposed to the WHA the establishment of a smallpox eradication program and, on the behalf of the Soviet Union, offered sufficient vaccines to give it a strong start. Further, he appears to have worked very hard in the late 1960s and early 1970s to realize the Biological and Toxin Weapons Convention (BWC), which forbids nations to develop, test, store, and transfer biological weapons. See F. Fenner et al., "Chapter 9: Development of the global smallpox eradication programme," *Smallpox and Its Eradication* (Geneva: World Health Organization, 1988), pp. 365-420. On the other hand, in 1972, he and Domaradsky developed the "Five Principal Directions," which guided the establishment and objectives of the Soviet offensive BW program called Ferment. As part of that program, its virologists were ordered to weaponize the variola virus, which causes smallpox. In effect, the weaponized variola virus conceivably would have been used against populations that were highly susceptible to being infected and killed by it. See Leitenberg and Zilinskas, *The Soviet Biological Weapons Program*, pp. 67-68.

[16] The record of the 1949 Khabarovsk War Crime Trials can be found in Union of Soviet Socialist Republics, *Materials on the Trial of Former Servicemen of the Japanese Army Charged With Manufacturing and Employing Bacteriological Weapons*, (Moscow: Foreign Languages Publishing House, 1950).

imprisonment that ranged from three to 25 years.[17] Author Levi cites Zhdanov's courage in undertaking this fight with Zhukov-Verezhnikov, given the Cold War political circumstances at the time.

Zhdanov obtained permission for Lev Aleksandrovich Zilber, the leading virologist in the Soviet Union, to travel abroad, a privilege previously denied by the authorities.

The degrading and demoralizing Soviet system made it impossible for Zhdanov, and many other very talented scientists, to realize their full potential for scientific achievement. Zhdanov remained director of the Virology Institute until his death at age 74 after having suffered a second stroke in 1987.

My Departure From the AP System

Moisey Iosifovich Levi (pp. 201-08)

This chapter has an autobiographical narrative about how Levi was forced from his position in 1964 as director of the Epidemiology Department, Rostov-on-Don AP Institute.

M.I. Levi attributes his expulsion from the AP system to the anti-Semitism of the Soviet bureaucracy.[18] Levi had supported I.V. Domaradsky's appointment as director of the Rostov-on-Don AP Institute without knowledge of the problems that had surrounded Domaradsky at Irkutsk. Surrounded by anti-Semitic sentiment in the Soviet cadres, Domaradsky decided that firing Levi would be necessary in order to be awarded membership in the prestigious Academy of Medical Sciences (Domaradsky became the first academician from the AP system).[19]

Levi, his wife, and others lost their positions at Rostov AP Institute around the same time. Domaradsky was elected corresponding academician in the academy, then, a year later, left Rostov for Moscow after having pledged to remain in Rostov for a longer period. Domaradsky later blocked Levi's appointment as deputy scientific director at the Central Epidemiology Laboratory, Moscow. Deputy Minister of Health P.N. Burgasov also worked to prevent Levi from getting jobs.[20]

[17] Boris G. Yudin, "Research on humans at the Khabarovsk War Crime Trial," in Arthur Kleinman, ed., *Japan's Wartime Medical Atrocities: Comparative Inquiries in Science, History, and Ethics* (Abingdon: Routledge, 2010), pp. 59-78.

[18] Indeed, the percentage of the scientific community that was comprised of Jews was on a downward trend, from 9.5 in 1960 to 6.1 percent in 1973. Aleksandr Solzhenitsyn, *Two Hundred Years Together* (in Russian), (Moscow: Russki Put', 2001), p. 423.

[19] Domaradsky discusses his arrival at Rostov and the dismissal of Levi, arguing that infighting at the Rostov AP Institute had begun to cripple institute operations: "A number of leading members of the institute, in particular Prof. M.I. Levi, a gifted scientist, bitterly resented the decision by the Soviet MOH to change the direction of the Rostov Institute's activities from the study of plague foci to 'Problem No. 5' issues of biological defense. . . . Naturally these scientists did not want to abandon their plague-control work." See Domaradskij and Orent, *Biowarrior* (2003), pp. 94-95.

[20] The name Petr N. Burgasov appears with some frequency in *Interesting Stories*... For his biography, see Part III of this report.

Levi eventually obtained a position at Moscow Disinfection Station and proceeded to spend years researching a variety of issues related to the AP system, helped by the encouragement and efforts of several directors of Department of High-Risk Infections, USSR MOH: I.I. Ladny, K.A. Kuznetsova, G.D. Ostrovsky, and Yu.M. Fedorov.

Volume 3 (1994)

Foreword

Moisey Iosifovich Levi (p. 3)

Introduction to the third volume of the "Interesting Stories..." *series.*

Full translation:

The first two volumes of "*Interesting Stories*…" received mostly positive comments, although several readers expressed objections. They said it was difficult to comprehend some articles that were overloaded with factual material and hypotheses. We can respond by saying that "*Interesting Stories*…" is a special form of elite literature intended for young people who are striving for scientific careers and who, the authors feel, should share in the solid traditions of the AP service. In a number of cases, the articles are thorough reviews on major topics for which a simplified treatment would not be desirable.

We have received some well-founded criticism that the articles did not address certain problems, such as plague pathogenesis and the genetics of microorganisms. We did not publish reminiscences about several of our country's outstanding scientists. In response to these comments we can promise to include these in the future.

However, this future is unclear, because the cost of publication is constantly increasing, and we have yet to find funding sources. If we are not able to find sponsors in the near future, this third volume of "*Interesting Stories*…" will be the last.

M.I. Levi, Editor

Nikolay Grigorevich Olsufyev: Scientist and Teacher

Irina Sergeevna Meshcheryakova (pp. 4-11). One photograph (portrait of Olsufyev).

This chapter is a biographical sketch of N.G. Olsufyev (1905-88), the Soviet Union's leading tularemia expert. It describes his work in microbiology, epidemiology, natural focality, prevention, diagnosis, and tularemia treatment.

Olsufyev's work on tabanids included a doctoral dissertation, two monographs, and the description of new species.[21] He worked for many years at Gamaleya Research Institute of Epidemiology and Microbiology and there was director of tularemia laboratory during 1949-88. Topics of his work included: classification of tularemia foci by landscapes; natural tularemia sources; modeling infection in wild animals; roles of ixodid ticks and tabanids; epizootic process; mapping tularemia foci; and research of an anthropogenic mechanism of tularemia transmission.

[21] Tabanids are flies of the family *Tabanidae.*

Olsufyev studied biology, taxonomy, biochemistry, antigens, subspecies, and laboratory identification of tularemia pathogen. Much of his work focused on human morbidity. He found that tularemia foci cannot be completely eliminated. Olsufyev studied phases of the tularemia infection process and tested anti-tularemia drugs and a live tularemia vaccine. The findings from this research resulted in applications that brought tularemia morbidity down from tens or hundreds of thousand cases per year to 200-300 per year. He authored six large monographs and over 300 articles.

Nikolay Akimovich Gaysky

My Encounters with Nikolay Grigorevich Olsufyev

Yury A. Myasnikov (pp. 12-31)

This chapter recounts the author's work and personal relationship with NG Olsufyev (1905-88). It includes an account of the dismissal of IO Boshyan, a "pseudoscientist" and an adherent of Lysenkoism at the Gamaleya Institute, Moscow, who claimed to possess the ability to convert viruses into bacteria. It also describes the dispute among those credited with the development of the live tularemia vaccine.

In 1950s, the Russian Soviet Federated Socialist Republic MOH, Administration of Sanitation and Epidemiology, began forming committees on various infections. Olsufyev was named to head the Tularemia Committee.

Excerpt:

> I remember that one of the professors on the committee had found an old manuscript by Boris Yakovlevich Elbert and Nikolay Akimovich Gaysky. The professor had discovered it when doing research at the "closed" Zagorsk Institute.[22] The manuscript had apparently originated in a "sharashka," where Elbert and Gaysky had worked and where they developed the first live tularemia vaccine.[23] The authors were freed before World War II and sent into exile, but all their manuscripts were kept at the Zagorsk Institute, although

[22] In Soviet times, the official name of the "closed" Zagorsk Institute was the Scientific Research Institute of Medicine of the USSR Ministry of Defense. Its main purpose was to research and develop viruses to arm biological weapons.

[23] The NKVD (the predecessor of the KGB) created a secret system of scientific research institutes and development laboratories, colloquially called "*sharashka*," which employed scientists sentenced to serve time in prisons for political crimes (Order 1020, USSR, Nov. 9, 1949). As a result of the repressive campaigns against bourgeois sabotage in the 1930s, the Soviet regime imprisoned large numbers of scientists and engineers, among other elements of the educated classes. Instead of sentencing such specialists to GULAG labor camps, the *sharashki* enabled the government to continue to benefit from the skills of such specialists (see Minister of Internal Affairs of the USSR, "Order of the Ministry of Internal Affairs of the USSR to Organize '*Sharashkas*,' 1949," http://memorial.krsk.ru/DOKUMENT/USSR/491109.htm. Anthony Rimmington provides extensive detail on the subject in, "The Soviet Union's Offensive Program: The Implications for Contemporary Arms Control," in *Biological Warfare and Disarmament: New Problems/New Perspectives*, ed. Susan Wright (Lanham: Rowman and Littlefield Publishers, 2002), fn. 69, pp. 139-140.

no one, not even the authors, knew about this. Gaysky ended up working at the Irkutsk AP Institute and from memory immediately resumed the vaccine experiments. Then the war started and tularemia began taking a heavy toll on the civilian population and on soldiers as well.[24]

Boris Yakovlevich Elbert

Elbert was exiled to Frunze where he found employment at the Microbiology Department of the Medical Institute, which was not certified to work with high-risk infectious microbes. It was only after the war, when he went to the Rostov AP Institute, that he was able to resume work on the vaccine (he developed a liquid live vaccine). However, the leadership of the Irkutsk AP Institute took advantage of Elbert's delay in resuming work and claimed the vaccine to be "Gaysky's vaccine." Back when both were released from prison, they had signed pledges not to reveal what they had done while working at the *sharashka*, so it was impossible to prove that Elbert and Gaysky were co-developers. In 1946, Elbert and Gaysky received a State Prize for the live tularemia vaccine, but at the 1946 national tularemia conference, Irkutsk scientists falsely accused Elbert of tagging his name onto the discovery. Elbert declared from the podium that he and Gaysky had jointly developed the vaccine, but Gaysky remained silent.

By the time the manuscript was discovered in the 1960s, Gaysky had died and passions had quieted. Professor Olsulfyev made a copy of it and presented it to Elbert at the Tularemia Committee meeting. Overcome with emotion, Elbert declared that he never thought he would live to see this manuscript again.[25] Olsulfyev sent the copy to the director of the Irkutsk AP Institute with a cover letter from the Minister of Health.

[24] In some areas surrounding the Don delta, more than three quarters of local populations suffered from tularemia. The Elbert and Gaysky vaccine was reportedly tested on soldiers at Stalingrad. See R.C. Cochrane, "Biological Warfare Research in the United States," US Chemical Corps, *History of the Chemical Warfare Service in World War II. Vol. II* (Fort Detrick, MD: Historical Section, Plans, Training and Intelligence Division, Office of Chief, Chemical Corps, November 1947), p. 150, cited in Eric Croddy and Sarka Krcalova, "Tularemia, Biological Warfare, and the Battle for Stalingrad (1942-1943)," *Military Medicine* 166 (October 2001), p. 837.

[25] The contents of this manuscript are also described in I.M. Gabrilovich, "Concerning the History of the Development of the Tularemia Vaccine," *Interesting Stories…* 5 (1997), pp. 176-81.

Affinity of Antibodies to Capsule Antigen of the Plague Pathogen

Moisey Iosifovich Levi (pp. 32–86). Four tables, 12 figures, one photograph (portrait of author), 115 references.

This is a scientific essay describing the results of 10 years of the author's research on antibody-antigen reactions related to plague pathogens, which was conducted during his term as director of the Central Control Research Laboratory at Moscow Municipal Disinfection Station.

Levi concludes the article by explaining the rationale of including a long bibliography of 115 sources in the Interesting Stories… *collection, which was meant to be less technical, and more literary.*

Excerpt:

> Breaking with the tradition established in the *Interesting Stories*.., where articles have practically never been accompanied by lists of literature relevant to the theme at hand, excepting those of the same author, we have decided to add a list of key scholarly articles to this sketch. The complexity of this issue justifies this choice, as does the relatively small number of articles necessary to fully understand the problem in general. Perhaps it will be the case that there will be young researchers who will take an interest in this crucial issue and find this list of use.

Experimental Mother-Daughter Games at Work

Nadezhda Nikolaevna Basova (pp. 88–122). Nine figures, one photograph (portrait of author).

This chapter recounts the work of N.N. Basova at the Rostov AP Institute between 1959 and 1965 and describes her colleagues.

Basova, a virologist, arrived at the Rostov AP Institute in 1959, when the institute was expanding with the construction of new facilities. She began working on a chemical vaccine against plague. She describes the laboratory routine, institutional politics, disputes, etc. Animal experiments were conducted to study plague innate immunity transfer to offspring.

The Rostov AP Institute conducted wide-ranging research between 1960 and 1963, but its program of work shifted "catastrophically" in 1963 and 1964, changing from a focus on regional plague control, to work on "special" purposes. This was a political decision to better align the institute's projects with the specialties of N.N. Zhukov-Verezhnikov, an expert in microbiology and genetics, rather than epidemiology.[26] After I.V. Domaradsky became director of the institute, Basova had difficult relations with him and left Rostov for Moscow in March 1965.

[26] Her tone suggests that she viewed the directive as a political favor for his personal benefit: "The idea just came about to transfer [the work of the division] to the interest area of N.N. Zhukov-Verezhnikov, altering (the) institute's profile into a microbiological division with an accent on genetics" (pp. 111-12). However, in Soviet times, the designation "special purposes" (*osobykh tseley*) was a euphemism for secret work, which in this case was biological weapons-related. A

Chronic Plague and, More Generally, the Organization of Scientific Research

Moisey Iosifovich Levi (p. 123–136). One table, one figure.

This scientific chapter describes original research and testing related to chronic plague in animals as an explanation for the survival of plague pathogens between epizootics.

In the 1960s, L. Adamov investigated plague abscesses as a mechanism for *Y. pestis* survival in marmot populations. However, this line of inquiry did not produce conclusive results.

Levi notes that a general shortcoming in Russian science was scientists' failure to follow up carefully on unexpected results, such as the long-term recurrence of antigenuria in plague-infected rodents. He mentored junior coworkers at the Turkmen AP Station, Ashgabat, Turkmenistan, in the investigation of chronic plague, including an antigenuria study. Eventually the coworkers moved to Mikrob, where they finished dissertations under L.V. Samoylova, but without crediting Levi's previous contribution to their work.

Tracking Down the Answer to the Riddle of Plague Enzoosis

Aleksey Ilich Dyatlov (pp. 137-225). Six figures, one photograph (portrait of author), 14 references.

This lengthy essay reviews the scientific literature on plague enzoosis, which demonstrates that plague resistance among rodents is population-dependent, not species-dependent. It includes an account of the author's career as a zoologist in the AP system in Central Asia and southern Russia from 1952 onward. It also describes the activities and personnel of the Nukus and Uzbek AP stations and the Stavropol AP Institute, as well as general trends in the AP system during 1950s-90s. Parts two and three of this article are published in volumes 4 and 5 of the series.

The Nukus AP Station was a typical AP station of the 1950s and later employed approximately 150 staff, and between 60 and 80 seasonal workers for fieldwork, as well as 500-700 rodent exterminators as temporary employees during fieldwork seasons. The first staff members at Nukus came from the Stalingrad AP Station, which had closed around 1949.

Station workers were instructed not to mention the AP station when asked by others about their work. Instead, they were ordered to say that their work concerned influenza in order to avoid questions

former scientist with Biopreparat, the main civilian Soviet BW agency, reported that the Rostov AP Institute, along with the Volgograd AP Institute and Mikrob, were extensively involved in biological weapons research. See Leitenberg and Zilinskas, *The Soviet Biological Weapons Program*, p. 146.

about plague, which AP workers were not allowed to answer since information about plague and cholera was secret in the 1950s.

In the 1950s, the AP system had grown to the extent that it employed 10,000 permanent employees, including 2,000 specialists. Massive rodent exterminations for plague prevention were carried out mainly in the 1950s and 1960s. These exterminations were gradually reduced over time, and by the 1990s, they had been completely cut from the work of the AP system.

Based on his experience, Dyatlov describes the inept medical treatment provided in the field for suspected plague.

The Central Asia AP Institute in Alma-Ata blossomed in mid-1950s, eclipsing Mikrob as the center of *Y. pestis* microbiological research.

In the 1940s through 1960s, research by the USSR AP service focused on geography and mechanisms of natural foci, so zoologists headed many AP stations. The article provides a history of research and theories on how plague is transmitted between epizootics. The article lists research topics and activities of the AP system in 1950s. It also describes the logistics and challenges of organizing temporary field crews (see excerpt below). Many of the temporary personnel hired to exterminate rodents had drug dependencies or similar problems.

Dyatlov reports that, in the 1960s, the AP system changed its focus from plague biology to medical studies concerning, for example, cholera and brucellosis prevention. Immunological and molecular biological research also figured into the new program. He attributes this development to two reasons. First, field studies were unsuccessful in yielding new information. Second, cholera outbreaks were ongoing. Physicians replaced the many biologists who left their management positions in the AP system during this period.

In 1963, the author became senior zoologist at the Uzbek AP Station in Tashkent and was promoted to deputy director in 1966. The Uzbek Republic MOH attempted to take advantage of Dyatlov's Uzbek nationality by preventing him from informing Moscow about cases of cholera. Uzbek MOH officials believed that the capital interpreted the presence of cholera in a given republic as a measure of bad performance by the local or republic health ministries.[27] By the late 1960s, many AP stations had come under the leadership of employees with local ethnic descent, which improved relations with the Uzbek MOH, but as a result, the USSR MOH was able to exercise less control over these stations. The author transferred to a new post as senior scientist at the Stavropol AP Institute in August 1969.

Beginning in the early 1960s, serologic testing became a widespread practice in the AP system. Yet, incorrect application of serologics resulted in both over-reporting and under-reporting of plague

[27] See also K.A. Kuznetsova, "Features of the Organization of the AP Service" *Interesting Stories...* 3 (1995), pp. 226-32, which also describes attempts of the Uzbek MOH to prevent Dyatlov from informing Moscow about cholera cases in the Uzbek Republic.

occurrences in the 1970s and 1980s. As a result, younger specialists came to focus more on genetics and microbiology, rather than on field investigations of natural plague foci. Serologic diagnostics improved in the 1980s as the AP system refocused on cholera prevention and medical issues. Notably, serologics practice was developed in the Main Administration of Quarantine Infections, which the USSR MOH organized during the 1980s to coordinate effective plague prevention.

Excerpt:

Dyatlov explains how he came to participate on his first field trip with an AP epidemic brigade and describes experiences of travel and life in the Central Asian desert. This excerpt also includes a description of the burrows where great gerbils (plague vectors) lived and where AP workers harvested samples.

The field research season was nearing. In September, the [Nukus AP] station had to get the Chaban-Kazgan epidemic brigade out into the field. Chaban-Kazgan is 350 kilometers east of Nukus in the middle of the desert. I think that this was my most difficult assignment. S.K. Shchukarev, who was assigned to go to Chaban-Kazgan as zoologist, was preparing to go on this over two-month trip very reluctantly. I noticed this, and when I had the opportunity, I asked P.A. Grekov whether I could go there. He answered in the negative, primarily because I still had not taken the specialization courses for zoologists. Only after I had done so would I be allowed to work at a natural focus. However, within several days, my participation was no longer out of the question. Grekov tried to frighten me about the difficulties that I would face, Shchukarev's mood brightened considerably, and, obviously, I started preparing for the trip.

The chief of the epidemic brigade was A.G. Fisher, a physician who was my age. He had one laboratory technician and two nursing assistants. The zoology group consisted of two instructors/rodent-exterminators, four rodent-trappers/workers, and me. The brigade also included two drivers for the GAZ-51 trucks. Thus, the brigade consisted of 13 people total.

We left in mid-September. I lay on top of the heavily loaded truck, holding a rifle. We quickly drove through the so-called "crop zone," and right after Takhta-Kupyr, we entered the desert. On our left, to the north, was the Beltau upland with a low, weathered point jutting south. Near Beltau is a series of broad *takyrs* [salt flats][28] in places covered with low narrow sand belts with woody plants (saxaul and calligonum). Mirages appeared on the *takyrs*. Sometimes, it seemed that water's edge was a few tens of meters ahead of the truck. I even knocked on the top of the cab and had them stop the truck because I was worried about driving into the water, which truly delighted our driver, Koldybay. There were almost always small flocks of gazelles somewhere in view. They enjoyed racing the trucks and always tried to cut across in front of us. At the insistence of Koldybay and Sasha Fisher, I finally shot one of the gazelles, which was not very difficult.

[28] A *takyr*, similar to a salt flat in North America, is a flat clayey tract found in the deserts of Central Asia, covered with water during rainy seasons, but which dries into a fissured landscape during summer.

During the harsh winter of 1954-55, glare ice covered the area for a long time, killing most of the gazelles, probably hundreds of thousands of them. This animal population never recovered to its previous level of the 1950s.

Putting poison in each rodent burrow

About 25 kilometers before Chaban-Kazgan, we passed Chagyr Well, which is located in a depression between high *barkhan* dunes with sparse patches of three-awn grass.[29] Here, the *takyrs* alternate with loose salt soils. The truck dove headlong into a puddle of airy dust. Waves of dust whipped over me on top of the truck, rapidly turning my multicolored city clothes, and the rest of me except for my teeth and eyes, to a uniform gray color. We arrived at Chaban-Kazgan late in the evening. We set up at the weather station, where the expedition had rented one large room. The zoological group lived in tents. The laboratory was set up in a ten-person tent, and also in a yurt rented from Bibigul, a Kazakh woman who was a single mother with a newborn daughter named Uruncha. Bibigul was an attractive woman about 25 years old whose face was not at all the typical broad and flat Kazakh face, but was rather more like that of an Arab or Egyptian. She was associated with the Chaban-Kazgan epidemic brigade for nearly 40 years after this. She, and eventually her daughter from age 15, worked for the brigade as nursing assistants and also guarded the equipment and supplies when the brigade was not there.

The next day I went out in the field to work with the zoological group. The first field site was Kaska-Tau (Bald Mountain), which was 10 kilometers from Chaban-Kazgan. For this field season, we had three, small, two-person tents with two or three people in each. There were no cots or mattresses; sometimes they issued us mattress covers, but not always. For bedding we gathered armloads of artemisia ("dzhusan" in Kazakh), which is a common, small, very

[29] *Barkhan*: An arc-shaped sand ridge. The three-awn grass is of the genus *Aristida*.

aromatic plant in thickets that usually occupy the lower slopes of sand hills and ridges, as well as the valleys between these ridges. It also made wonderful tinder. It contains volatile oils, and one match sets it off like Bengal fire. The aroma of dzhusan is unforgettable. This plant certainly makes me nostalgic for the desert.

Three or four years later, our living conditions on expeditions improved. We had ten-person tents (this is a real home, not a doghouse), cots and mattresses, GAZ-63 trucks, and an ATV that made it much easier to get around the desert along tracks or in the valleys between ridges. In 1953, we dug out and built a 20-room underground shelter at Chaban-Kazgan that provided space for the laboratory, a dormitory, and storage.

In 1952, we rented PO-2 airplanes. Chaban-Kazgan was more than 100 kilometers from the main airport, and as the airplanes did not have radios, they operated in pairs. If an airplane had to fly somewhere that was 30-50 kilometers from Chaban-Kazgan, then both airplanes went. The pilots were experienced; they flew us to distant places that would have been difficult to reach by truck, and chose their landing sites from the air. If there were *takyrs* nearby, then it was easy to find a landing area, but in other places it was difficult. If the pilots didn't land in a good spot, there was no choice but sit tight for the landing, and then the entire brigade had to spend the whole day cutting saxaul, leveling mounds, filling low spots, etc. so we could take off for home. And even after all this, it was necessary to put the tail of the airplane on a rise. We put saxaul logs in front of the wheels because these airplanes didn't have any brakes. The pilot revved up the engine to the maximum, the airplane broke away from the saxaul brakes, and within 60-80 meters, we made it into the air with the wheels and wings skimming the tops of the saxaul bushes below us. About five years later, we got bigger and better AN-2 airplanes, but these were subject to all kinds of specific safety regulations. Although these planes were more maneuverable, due to their larger size there were fewer possible landing sites.

The airplanes, like the trucks, took us to the field sites with our tents, cooking gear, animal traps, and everything else we needed. Every day we sent our collected materials (lidded buckets with trapped or dead rodents and test tubes containing live fleas) back to the laboratory for investigation. The zoological work at the field sites consisted of determining the numbers of great gerbils and several other types of rodents (midday, tamarisk, and Libyan gerbils, and jerboas).[30] We used special, sometimes laborious, methods to determine the relative populations of these animals. For example, in order to obtain population data for great gerbils you had to walk a 12 kilometer route carrying a 2 meter pole. During the hot season, when a person walking at a leisurely pace of 4.5 kilometers per hour is figured to lose 1 liter of water per hour, it is not easy to cover this distance, on sand, in rugged terrain. In addition, we had to determine the number of fleas (or, "abundance" [the mean number of parasites in all hosts]) in the burrows of great gerbils and middays; 30–50 for the great gerbils and 200 for the middays.

[30] Midday is a species of rodent in the family *muridae*; tamarisk (*Meriones tamariscinus*) is also a species of rodent in the family *muridae*; jerboa is a species of rodent in the *dipodidae* family.

The mandatory "duty" elements of our work clothes were kersey boots and coveralls. The rest depended on the season. When we returned to the tents after work, we had to change out of this duty clothing. We treated our hands with 3 percent Lysol and then washed them.

Technicians and workers performed most of the work at a field site, which consisted of trapping rodents and fleas for investigation. It is necessary to say a few things about rodents and fleas.

The great gerbil is a rodent about as big as a medium-sized rat (of which it is a distant relative), but has thicker, straw-colored fur and a brush of forward-curving black hairs on its long tail. It often sits on its hind feet, nimbly using both "arms" to fill its mouth with a gnawed saxaul branch. It can easily climb into bushes up to 2 meters high. In places where branches are gnawed off, the plant grows a witch's broom of new shoots that are the gerbil's favorite food. Therefore the saxaul bushes near the burrow have a particular look, with tufts of young shoots. At the least indication of danger, the animals make a whistling call.

The great gerbil burrow is particularly interesting. It is called a colony because of its large size and perhaps also because several families may live there. The burrow often covers an area of 50-200 square meters and has numerous entrances spaced 0.5-2 meters apart. These entrances are usually in the center and rarely at the perimeter. Sand gets in and the animals are constantly cleaning out the passages. These burrows are surrounded by a general rise in the ground level, which is a typical feature of the great gerbil's complex burrow.

Gerbils dig a string of holes, not necessarily interconnected by underground passages, from the main burrow to the saxaul that is the food source, which may be up to 50 meters away. Around the bush itself, they dig one to three groups of outlier burrows. There are often several hundred entrances to the burrow. In a sandy desert with light soil, the burrow will cover a larger area and have more entrances than in an area with dense soil.

Different parts of the burrow have different functions. The central residential part of the burrow is usually at the base of a hill or ridge and has a deep nesting passage that may be as far as 2.5 meters down. One to three feeding rooms also are in the center of the burrow, but in passages near the surface. The animals spend most of their time in these rooms, eating the food they gathered, because it's not always possible to be outdoors; it is cold in winter, and in summer the sun will kill one of these animals in 10 minutes if it does not keep moving. The gerbils bring in edible branches (saxaul, asafetida, chamomile, senecio, etc.) and tear them to pieces, thus keeping the passage open. After this, they eat the slender edible branches of the plant and gnaw around the outside of the larger branches. In October and November, they especially love saxaul seeds. Plant remains and gerbil scat accumulate in the feed rooms. Because the animals spend more time in the feed rooms than anywhere else, this is where the fleas usually are found, feeding on the blood of the animals. They vomit some of this blood out and also leave excrement with partially digested blood. The flea larvae feed on these blood-based remains.

…

The technology for collecting fleas from great gerbil burrows is interesting. The following tools are used: a white napkin, a rubber hose or flexible rod with a flannel bag (4-5 x 100 cm) fastened to the end, an aspirator (a device resembling a rubber pear with a valve that pulls a stream of air and fleas into a test tube or flask), tweezers with soft grip ends, and test tubes plus holders for them.

The person who is collecting fleas usually inserts the flannel hose into the burrow and then pulls it out and inspects it. If there are fleas in the burrow, they will be tangled in the fibers of the hose cloth, from which they can be picked off using the tweezers and put into a test tube. However, it is often possible to get fleas from a burrow without using the hose; the collector stands so as to cast a boot shadow over the burrow entrance, and if there are a lot of insects they will be seen jumping around. When there are really large numbers of fleas (hundreds or thousands), there will be a dark cloud above the burrow entrance. The napkin is used to collect fleas from these burrows. Most of the fleas will go back into the burrow or bury themselves in the sand to try to avoid the deadly effect of the sun's rays, but the most active ones will jump onto the napkin. The insects are readily visible there and can be quickly collected with the aspirator. When these fleas have been collected, the collector moves a hand at the burrow entrance or taps the napkin, causing a new wave of flea activity. After these have been collected, a shadow is again cast over the burrow entrance and again a new batch of fleas will appear. If you start with the most efficient method, which is to blow into the burrow, then all the fleas will immediately come jumping out and you won't have time to collect them all because most will escape by burying themselves in the sand.

Features of the Organization of the AP Service

Klavdiya Aleksandrovna Kuznetsova (pp. 226-32)

This chapter presents information about the people and events of the author's career. It discusses the possibility that some plague researchers developed cancer due to radiation exposure during their fieldwork.

Kuznetsova mentions the names of colleagues in the Main Administration for Quarantine Infections, USSR MOH, during the early years of that agency. She lists six names of AP researchers from the Volga-Urals region who died of cancer. The cause of these cancers is ascribed to radioactive contamination of soils in this region as a result of uses of devices "for special purposes."[31] It is noted that I.D. Ladny, Director of the All-Union Research Institute of Medical and Medical-Technical Information, died in car accident.

[31] Indeed, the Soviet Union conducted "as many as" 124 peaceful nuclear explosions, in addition to nuclear weapons tests, between 1965 and 1988, according to the Comprehensive Nuclear Test-Ban-Treaty Organization. See <www.ctbto.org/nuclear-testing/history-of-nuclear-testing/peaceful-nuclear-explosions/>. Some twenty-eight tests and explosions took

The author describes a 1981 plague outbreak in the Uzbek SSR and the response measures taken by the Main Administration for Quarantine Infections to reported cases of plague. Kuznetsova discusses the reluctance of Uzbek MOH officials to report plague cases to Moscow, fearing that it would create a negative image of the Uzbek SSR compared with other republics reporting no cases of epidemic disease.[32]

The Window Opened a Little

Moisey Iosifovich Levi and Nadezhda Nikolaevna Basova (pp. 233-38)

This chapter describes a visit by a delegation from the National Institutes of Health, Bethesda, Maryland, to the Rostov-on-Don AP Institute in 1964. Secrecy concerns prevented any possibility of collaboration between the Soviet and American scientists.

The Americans visited to explore possibilities for scientific cooperation. Yet the Soviet government would not allow the foreigners to enter the Institute and forbade its staff from divulging any "secrets." The Americans were disappointed with the reception, and apparently did not pursue any further attempts at cooperation.

One of the American delegates, a Dr. Volk, originally came from Rostov. He wanted to see his former residence, but found that it had been destroyed during World War II.[33] However, he did locate a "sister" [sometimes used to mean cousin] who had been imprisoned and exiled to the gulag during the 1930s. But, by the time of the Americans' visit in 1964, she had been rehabilitated and was living in an apartment in Rostov with her daughter and granddaughter.

Excerpt:

> Word that the Americans (!) would be visiting the AP institute (!!) threw the administration into panic. They were advised (...) to greet the visitors warmly, but not disclose any scientific secrets.

place in the region immediately upstream of the Astrakhan, Uralsk, and the Guryev AP stations on the Ural and Volga rivers. Fallout from these tests is believed to have been one of several sources of radioactive contamination found in the aquatic ecosystems of the Caspian Sea basin. See Philip R. Pryde and Don J. Bradley, "The Geography of Radioactive Contamination in the Former USSR," *Post-Soviet Geography* 35 (1995), pp. 557-93. S.M. Vakulovsky and V.B. Chumichev, "Radioactive Contamination of the Caspian Sea," *Radiation Protection Dosimetry* 75 (1998), pp. 61-64. Pavel Szerbin, "Identifying Sources of Radioactive and Heavy Metal Contamination in the Caspian Sea: Future Research Opportunities," in Michael H. Glant and I.S. Zonn, eds., *Scientific, Environmental, and Political Issues in the Circum-Caspian Region*, ed. Michael H. Glant and I.S. Zonn (Dordrecht: Kluwer Academic Publishers, 1997), pp. 246-249.

[32] Details of this outbreak are provided in K.A. Kuznetsova, "Bukhara, 1981..." *Interesting Stories...* 4 (1996), pp. 43-46.

[33] This person probably was Vladimir K. Volk (1897-1975), a Center for Disease Control expert on communicable diseases.

The institute administrators "understood" this as follows: they were not to let the guests into the institute proper, but were to limit the visit to a discussion in the library. The Americans immediately understood this "reception" as a refusal to cooperate. They lost interest in Rostov and its tourist attractions. Even an extremely lavish reception in a fashionable restaurant did not erase the negative impression from this aborted contact.

'Incorrect' Plague

Moisey Iosifovich Levi (p. 239-45)

This chapter describes the author's tour of AP stations in Dagestan, Azerbaijan, Georgia, and Armenia after he had been appointed deputy director of the Stavropol AP Institute in spring 1957. He describes the natural environment, cultures, and architecture of the Caucasus region.

In Armenia, the author identified a previously unknown strain of *Y. pestis*, which particularly affected voles.

Plague Prank

Nadezhda Nikolaevna Basova (pp. 246-54)

This chapter describes the living and working conditions of several AP field stations. He also describes the recreation and humor of AP personnel.

After watching a movie on Saturday night, members of the expedition laboratory staff of Dagestan AP Station decided to stage a prank on the supervisor by pretending to be sick with ornithosis. The supervisor, an ornithologist, had some anxious moments but eventually figured out the ruse.

Proscriptions

Igor Valerianovich Domaradsky (pp. 256-60)

This chapter contains a list of 21 AP system staff members who were arrested on political charges, with information including each individual's date and place of birth, position, and dates of service in AP system, and information about her or his fate.

Domaradsky notes that many within the AP system have forgotten those who suffered as a result of the Stalin repressions, and sets forth the table as a record. He notes sardonically that only select (A.V. Naumov, I.F. Zhovty, L.N. Klassovsky, L.A. Avanyan) individuals responded to his requests for

information about the repressed AP members, and that Rostov, Alma-Ata, and Stavropol failed to submit official responses. Domaradsky noted the fear these individuals still had for revealing such secrets, reporting they attributed a lack of detail to "poor memory." He asks that the families and friends of those not listed forgive the incompleteness of the list.

Excerpt:

We hope that the present publication will act as an impetus for further inquiries. The times have changed, gentlemen, and there is nothing more to fear! We are counting on your aid (p. 257).

Table 1

Information on AP system workers subjected to the repressions of the Stalin era[34]

Given name, patronymic	Last name	Information
Vladimir Alekseevich	Berdnikov	Senior scientist, Mikrob Institute 1934-37; arrested 1931 and 1937
Anna Artemevna	Bezsonova	Doctor of medical sciences, secretary of AP Center, chief of pedagogical section, Mikrob Institute 1934-37; investigated 1934 and 1937
Vladimir Arkhipovich	Bychkov-Oreshnikov	Director, Mikrob Institute 1934-37; fate unknown
Alevtina Aleksandrovna	Volferts	Senior scientist, epidemiology department, chief of tularemia section, Mikrob Institute 1932-38; arrested 1938; conviction rescinded 1943
Nikolay Akimovich	Gaysky	1922-30, 1937-47 last position, deputy director, Irkutsk AP Institute; arrested 1930; during four years of imprisonment worked in Soviet Army (RKKA) test laboratory no. 3
Dmitri Alekseevich	Golov	Chief, epidemiology department, vaccination division, assistant director, Mikrob Institute 1920-35; arrested 1930, exiled to Alma-Ata 5 years, and re-arrested and reportedly shot
Konstantin Ivanovich	Danilin	Epidemiologist, 1930

[34] Information is provided as was made available.

Dmitri Nikolaevich	Zasukhin	Chief, parasitology department, Mikrob Institute 1929-37
Natalya Stepanovna	Idovayskaya	Chief, publishing and library, Mikrob Institute 1924-41
Ilya Grigorevich	Ioff	Worked at Stavropol AP Institute; sanctioned for 10 months
Aleksandr Grigorevich	Kratinov	Director, pathology laboratory, Stavropol AP Institute; arrested 1934 and sentenced to 5 years
Nikolay Ivanovich	Makarov	Director, Irkutsk AP Institute 1941-45; in late 1930s was punished in Stavropol
Sergey Mikhaylovich	Nikanorov	Director, Mikrob Institute 1921-30; later at Alma-Ata AP Station; reported shot
	Niyazov	Physician at Alma-Ata AP Station 1930s; arrested with Nikanorov and disappeared
Vladimir Fedorovich	Sivolobov	Chief, Alma-Ata AP Station, 1953-61, previously at Mikrob Institute; detained for one year 1941-42; case dismissed
	Skavronsky	Staff member, Alma-Ata AP Station, 1930s
Aleksandr Mikhaylovich	Skorodumov	Professor, founder of AP service in Siberia and of Irkutsk AP Institute; arrested 1937 and died in "NKVD torture chamber"
Ariadna Nikolaevna	Sosunova	Wife of D. A. Golov; worked at Central Asia AP Institute in Alma-Ata prior to 1960s, sanctioned (no details available)
Vartan Nikitich	Ter-Vartanov	Chief, Stavropol AP Station beginning 1937; Director, Irkutsk AP Institute 1940-41; Director, Stavropol AP Institute in 1952-63; sanctioned for 17 months in 1935

Veniamin Vasilevich	Shunaev	Worked at Central Asia Institute many years; arrested in Trans-Baykal 1938 and sentenced to firing squad, but sentence rescinded and was freed two years later
Iosiv Solomonovich	Erlikh	Director, Chemical-Bacteriological Institute and also chief, Stavropol AP Station; arrested 1937 and shot

VOLUME 4 (1996)

Foreword

Moisey Iosifovich Levi (p. 3)

Introduction to the fourth volume of the "Interesting Stories..." series.

Full translation:

> The volumes of *Interesting Stories*… have already become a sort of tradition, and each volume is larger than the previous one. The present, fourth, volume is noteworthy for the many photographs of people in the former Soviet Union's AP system. The first volumes received a favorable review and we expect that more reviews will follow.
>
> On the eve of the 100th anniversary of the AP system, the number of authors contributing to each volume of *Interesting Stories*… has expanded. The first volume had only three authors, which increased to five in the second volume, seven in the third, and nine in the fourth.
>
> Regrettably, the selection of articles has been one-sided; they primarily describe the activity of AP establishments in the European part of the country, while there is scant attention to the very rich history of the eastern regions. However, we are not losing hope.
>
> M.I. Levi, Editor

AP System of the USSR

Vyacheslav Petrovich Popov (pp. 4-9). One table, one photograph (of author).

This chapter outlines the history of the AP system between 1901 and 1991.

Complete translation:

> The breakup of the Soviet Union in late 1991 coincided with the ninetieth anniversary of the country's AP system. This system was a basic element of the Soviet public health sector. It comprised six AP research institutes (Mikrob All-Union AP Research Institute, Volgograd AP Research Institute, Irkutsk AP Research Institute of Siberia and the Far East, Rostov-on-Don AP Research Institute, Central Asia AP Research Institute, and AP Research Institute of the Caucasus and Transcaucasus), 29 AP stations, and 55 AP divisions (see map).

Continual outbreaks of plague epidemics in the Astrakhan steppes prompted the tsarist government to decide on July 17, 1901, to open an AP bacteriology laboratory in Astrakhan. This was the first specialized AP institution.

After plague epidemics in Transbaykal and Manchuria in 1910-11, the Chita Bacteriology Laboratory opened on September 17, 1913, as the first such facility in Siberia.[35] By the end of 1917, Russia had an AP network consisting of administrative agencies and 10 AP stations, primarily in the European part of the country.

The AP system was expanded in Soviet times. Russia's first AP institute, Mikrob in Saratov, opened on October 18, 1918. The last AP station to open was the Kabardino-Balkaria station in Nalchik in 1976, providing epidemiological surveillance of the Central Caucasus. The station had been an AP division of the Dagestan AP Station.

In 1971, the USSR MOH formed the Main Administration of Quarantine Infections, later renamed the Main Epidemiological Administration, which administered the country's AP system.

In the Soviet Union, there are 43 known natural plague foci covering a total area of about 220 million hectares.

The epidemiological surveillance work in these foci was done by 21 AP stations: Armenia, Azerbaijan, and Georgia stations in the Transcaucasus; Turkmenistan station; Karakalpak and Uzbekistan stations in Uzbekistan; Kyrgyzstan station; Aral Sea, Guryev, Mangyshlak, Chimkent, Taldy-Kurgan, and Uralsk stations in Kazakhstan; and Astrakhan, Altay, Dagestan, Kabardino-Balkaria, Tuva, Chita, and Elista stations in Russia. Every year these stations monitored 75 percent of the focal area of the Soviet Union. Crimea, Moldavia, Novorossiysk, Leningrad, Odessa, Maritime, Khabarovsk, and Central AP stations carried out border controls to prevent the importation of quarantine and other diseases into the Soviet Union.

At the end of 1991, the AP institutions of the USSR had about 10,000 employees. The AP service has been well-equipped and well-funded in recent years. It is a strong organization that has minimized the risk of human plague in the natural foci. The last case of human plague on Russian soil was recorded in 1979 in the town of Artezian.[36]

[35] Chita is located near the Russian border with Mongolia and China, approximately 630 miles west of Irkutsk. Artezian is located near the northwestern coast of the Caspian Sea.

[36] Location of station/division is given in parentheses if different from the station's name.

REFERENCES

1. E.P. Golubinsky, I.F. Zhovty, and L.V. Lemesheva, *Plague in Siberia* (in Russian), Irkutsk, 1987, p. 241.

2. G.G. Onishchenko, "History of the development of the AP organization in Russia" (in Russian), *Zdorovye naseleniya i sreda obitaniya*, 9 (1994), pp. 1-6.

3. A. K. Rogatkin, *History of the Founding and Activity of Astrakhan AP Station* (in Russian), Astrakhan, 1991, p.20.

Table 2: USSR Anti-plague Institutes

1. Central Asia Scientific Research AP Institute in Alma-Ata.
2. Scientific AP Institute of the Caucasus and Trans-Caucasus in Stavropol.
3. Scientific Research AP Institute of Siberia and the Far East in Irkutsk.
4. Scientific Research AP Institute in Rostov-on-Don.
5. Scientific Research AP Institute in Volgograd.
6. State Scientific Research Institute of Microbiology and Epidemiology of South-East Soviet Union (Mikrob) in Saratov.

Table 3: USSR AP Stations and Divisions[37]

No.	AP Station	AP Division
1.	Azerbaijan (Baku)	Dzulfa Khachmas Shamkhor Gadrut Lenkoran Ishimli
2.	Aral Sea (Aralsk)	Dzhusaly Kzyl-Orda Chelkar
3.	Armenia (Yerevan)	Kafan Leninakan Martuni
4.	Altay (Gorno-Altaysk)	

[37] Location of station/division is given in parentheses if different from the station's name.

No.	AP Station	AP Division
5.	Astrakhan	Dosang Yenotaevka Kharabali Yandyki
6.	Georgia (Tbilisi)	Batumi Tstiteli-Tskaro
7.	Guryev	Ganyushkino Makhambet Emba (Kulsary)
8.	Dagestan (Makhachkala)	Budennovsk Kizlyar
9.	Kabardino-Balkaria (Nalchik)	
10.	Karakalpak (Nukus)	Takhtakupyr Turtkul
11.	Kyrgyzstan (Frunze)	At-Bashi Osh Przhevalsk
12	Crimea (Simferopol)	
13	Leningrad	
14	Mangyshlyak (Shevchenko)	Novy Uzen
15	Moldavia (Kishinev)	
16	Novorossiysk	Sochi
17	Odessa	
18.	Maritime (Ussuriysk)	Nakhodka Pogranichny
19	Tajikistan (Dushanbe)	
20.	Taldy-Kurgan	Bakanas Panfilov
21	Tuva (Kyzyl)	
22.	Turkmenistan (Ashkhabad)	Kyzyl-Arvat Krasnovodsk Mary Nebit-Dag Tashauz Chardzhou
23.	Uzbekistan (Tashkent)	Bukhara Zaravshan

No.	AP Station	AP Division
24.	Uralsk	Dzhangali (Novaya Kazanka) Dzhambeyty Kalmykovo Chapaev Furmanovo
25	Khabarovsk	South Sakhalin (Korasakov)
26	Chimkent	Dzhambul
27.	Chita	Borzya Zabaykalsk Kyakhta
28	Central (Moscow)	
29	Elista	

Tracking Down the Answer to the Riddle of Plague Enzoosis, Part II

Aleksey Ilich Dyatlov (pp. 11-20)

This chapter recounts trends in the AP system from the 1950s through the 1990s, focusing on relations between the staff of the AP system and the USSR MOH bureaucracy. Parts one and three of this chapter are published in volumes 3 and 5 of the series.

Dyatlov describes the changes to the organization of the USSR MOH and AP system from the 1950s through the 1990s. Tensions and conflicts over administrative and scientific issues frequently arose between AP personnel, who were specialists in fieldwork with plague, and the central staff of the USSR MOH, comprised primarily of Moscow-based academics and administrators who were not part of the AP system. Administrators of this second category eventually took control of the previously more autonomous AP system, serving to marginalize the influence of career AP staff. As a result of the rise of the authority of the Moscow bureaucracy, from the 1970s onward, the autonomy of AP institutes and stations waned. In the 1980s, a military laboratory was established at the Volgograd AP Institute.[38]

[38] By 1971, the official focus of the Volgograd AP Institute, previously dedicated exclusively to civilian research, had turned toward offensively-directed BW research to weaponize *Burkholderia* species. "The culture collection at the Volgograd AP Institute was of particular interest to the [biological weapons] program because these pathogens [*Burkholderia*] are infectious in aerosol form and, at that time, there were no vaccines to protect populations against them." See Raymond A. Zilinskas, "The AP System and the Soviet Biological Warfare Program," *Critical Reviews in Microbiology* 32 (2006), pp. 48-50.

The author provides biographical sketches of several specialists from Moscow and Leningrad who dealt with the AP system. Yevgeny Nikanorovich Pavlovsky, an eminent non-AP academic medical researcher and cult figure, bolstered the authority of non-AP academics over the AP system. Polina Andreevna Petrishcheva, the director of the Natural Focal Disease Department of the Gamaleya Institute, Moscow, was a fanatically devoted disciple of Pavlovsky, but never directly attempted to exert influence over the AP system. Valent Viktorinovich Kucheruk succeeded Petrishcheva at the Gamaleya Institute and set out to continue the trend that Pavlovsky had begun, seeking to exert greater influence over the AP system from Moscow.

Kyzyl-Arvat Plague

L.A. Melnikov (pp. 21-42). One photograph (portrait of author).

This chapter describes a previously undisclosed plague outbreak in 1949 in Kyzyl-Arvat city, Turkmen SSR.

Melnikov participated in an operation to control a plague outbreak in Kyzyl-Arvat (now Serdar) in the Turkmen SSR. He estimates that several hundred people were infected with plague during the outbreak; however, no official statistics were ever released. Melnikov describes fieldwork, the logistics of control operations, and natural features of the area, and he includes anecdotes about the members of the AP field team.

Bukhara, 1981, …

Klavdiya Aleksandrovna Kuznetsova (pp. 43-46)

This chapter describes a plague outbreak in the Uzbek SSR in 1981 and the tensions within the bureaucracy that followed.

Kuznetsova was one of the USSR MOH officials who were dispatched to the Bukhara region in response to reported cases of plague.

One of the three plague cases in the outbreak was a girl who had not received the vaccine against plague. The author reports that Uzbek SSR MOH employees subsequently attempted to falsify the vaccination so that it would appear that the girl had been vaccinated prior to the outbreak. Additionally, the Uzbek SSR MOH officials wanted to punish public health personnel who, following official procedures, reported the case to the central authorities in Moscow. Kuznetsova notes that, more generally, Uzbek officials were upset that the central authorities were characterizing their republic's efforts as deficient as demonstrated by the outbreak having occurred.

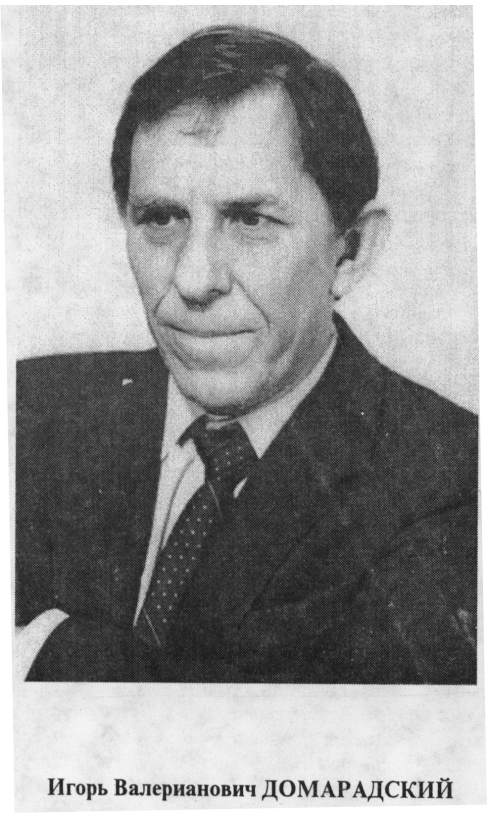
From Plague Epizootiology to Pathogen Genetics

Igor Valerianovich Domaradsky, Yury Grigorevich Suchkov (pp. 47-81). Four tables, one photograph (portrait of author Domaradsky), 12 references.

This chapter describes the key people and scientific discoveries that increased knowledge about the genetics of Yersinia pestis in the 1960s and 1970s.

E.G. Koltsova (initially employed by the Rostov AP Institute and later by the Microorganism Extrachromosomal Heredity Laboratory, All-Union Research Institute for Protein Biosynthesis), Moscow), studied the "pesticinogenecity" [sic] factor.

In the early 1960s, the AP system and institutes changed their priority work to a focus on BW defense. In the late 1960s, many Soviet scientists began discussing the progress other countries were making in molecular biology and molecular genetics, areas in which the Soviet Union lagged behind, and they speculated about the potential military applications of these latest achievements. After numerous closed meetings, a secret organization under the Main Administration of the Microbiological Industry, *Glavmikrobioprom*, was established, which included three AP institutes. In the following years, the AP institutes had neither the staff nor resources to work on fundamental problems, such as plague research and epidemiology, because efforts were directed at solving entirely different "special" problems. After 1965, many scientific workers at the Rostov AP Institute were transferred from plague work to cholera work. Even more personnel were reassigned to cholera in 1971 after the Rostov AP institute was designated as the lead institute for all matters related to cholera.


Игорь Валерианович ДОМАРАДСКИЙ

Igor Valierianovich Domaradsky

In 1973, Domaradsky was transferred to *Glavmikrobioprom* in Moscow and was forbidden to have any further contact with AP institute personnel.[39] Subsequently, V.N. Milyutin, a specialist in electron microscopy, was appointed director of the Rostov AP Institute. At his previous post at the military institute in Zagorsk, he had worked with rickettsias and viruses.

In the mid-1970s, Mikrob became a focal point for research on genetics and biochemistry of plague and cholera pathogens. From the late 1970s onward, the Microorganism Extrachromosomal Heredity Laboratory at VNIIsintezbelka, Moscow, conducted intensive genetic research on *Yersinia pestis* and other *Yersinia* species. Projects included research on the relationship of plasmids to pathogenicity and on the transfer of foreign genetic information into *Yersinia* species. This work and results were

[39] The reason for Domaradsky's inability to communicate with former colleagues was that he became part of the offensive Soviet BW program and thus was forbidden to even hint at what he was doing and where he was stationed.

kept under strict secrecy. E.Ya. Amirov prepared a doctoral dissertation on transduction (the transfer of genes) between strains of *Yersinia pestis*, but he never defended his dissertation due to secrecy requirements. Similarly, Domaradsky's book, *Biochemistry and Genetics of the Plague Pathogen* (1974), left out a number of very interesting research findings due to government secrecy restrictions. But, the author did succeed in including a previously unpublished table demonstrating the differences in growth factor requirements of 350 strains of *Y. pestis* stored in various laboratory cell culture collections.

Shuravi in Afghanistan, 1965

Yury Grigorevich Suchkov (pp. 82-104). One photograph (portrait of author), 11 references.

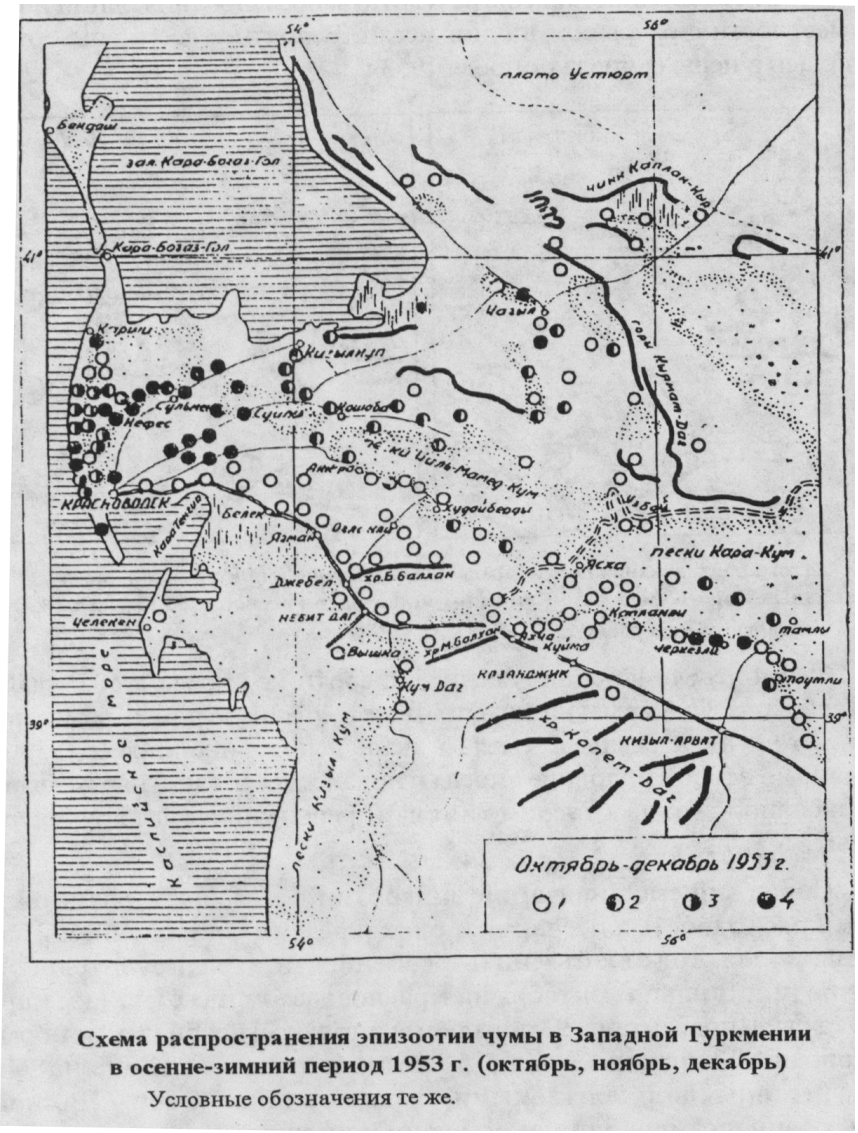
*This chapter describes a cholera outbreak in the south of the Uzbek SSR and northern Afghanistan in 1965 and the response of Soviet officials (*shuravi*) to it.*[40]

The author was a member of a Soviet field crew sent to Afghanistan to investigate a possible cholera outbreak. In general, higher-level Soviet and Afghan authorities tended to suppress information about cholera outbreaks. Public health workers were threatened with penalties for revealing evidence that pointed to cholera. Despite evidence to the contrary, the notion persisted that all cholera outbreaks that occurred in the former Soviet Union were imported and could not be endemic.

Excerpt:

> It should be recalled that, before 1965, according to the official data there was no cholera in the Soviet Union. Therefore, physicians and public health administrators were not psychologically prepared to confront this infection. The dominant viewpoint was that cholera was imported by sick people from other countries or vibrio carriers spread the causative pathogen as acts of sabotage. Even the never disclosed cholera outbreak in Stalingrad in 1942-43, during World War II, was designated to have been an imported infection. But who could have brought it in? German soldiers, none of whom had cholera?
>
> I think it's necessary to describe the following episode, which characterizes those times. It was written by R.S. Zotova and she asked that it be included in my article.
>
> "In 1965, when cholera epidemics were being reported in Afghanistan and the Uzbek SSR, the Turkmen SSR MOH, together with the Turkmen AP Station, would place anti-cholera epidemic brigades in Kushka city at the border with Afghanistan and in the Kizyl-Atrek village at the border with Iran. In the beginning, a physician (whose name, unfortunately, I do not recall) from the high-risk infection division of the republic sanitary-epidemiology station worked at the sanitary-epidemiology station in Kushka. He took water samples from the Kushka River, which flows out of Afghanistan, and tested them for the cholera vibrio, but did not find any.

[40] "Shuravi" is an Afghan term for "Soviet," and was adopted by Soviets who were sent to Afghanistan as advisers and soldiers during the 1979-88 war.



Distribution of plague epizootics in West Turkmenia, fall-winter, 1953 (October, November, December). 1—cultures of plague microbe not isolated; 2—cultures isolated from rodents; 3—cultures isolated from ectoparasites; 4—cultures isolated from both rodents and ectoparasites.

Later, this investigation was continued by Dora Vasilyevna Zheglova, a physician from the Turkmen AP Station. Within a short time, she recovered and identified over 20 strains of the El Tor cholera vibrio from the river. At this point, a physician from the republic sanitary-epidemiology station wrote a declaration to the Lenin District Communist Party Committee in Ashkhabad, stating his hypothesis concerning the isolation of cholera vibrios from the Kushka River. In his opinion, Zheglova had taken cholera vibrio cultures from the live culture collection at the Turkmen AP Station and used them to 'infect' the Kushka River water. As a result, Zheglova was accused of sabotage, and criminal charges were lodged against her.

"This matter was investigated by a special commission established by the Lenin District Communist Party Committee. The commission members included N.V. Uryupina, a senior scientist at Mikrob, who was an excellent microbiologist and also a big-hearted person. I also helped the commission with the laboratory work for the investigation. Being a physician at the Turkmen AP Station, I worked in Kizyl-Atrek during that period and, like Zheglova, isolated tens of cholera vibrio strains.

"Uryupina used the differential diagnosis methods that had just recently been recommended by WHO for use to distinguish classical and El Tor cholera vibrios, which was based on

hemagglutination of large erythrocytes, Greig hemolysis, phagotyping using a set of Mukherjee phages, and other tests. After a month of intense work, the strains isolated from water sources in Kushka city and Kizyl-Atrek village were identified as El Tor cholera vibrios. The culture collection at the Turkmen AP Station contained only strains of classical cholera vibrio. Naturally, the latter were much different from the newly isolated cultures.

"Therefore, thanks to the competence and integrity of N.V. Uryupina, the commission concluded that there was no sabotage. Similar strains of El Tor vibrios were isolated in subsequent years. The results of the commission's work were reflected in my candidate's dissertation.

"The district party committee summoned Zheglova and informed her that the terrible sabotage accusation was retracted. As she told the story later, they forgot to apologize to her for the colossal mental toll that it took of her. However, before long she was awarded the title of 'Honored Physician of the Turkmen SSR.'"

I'm sincerely grateful to Raisa Zotova for recounting this episode, which was extremely typical of our life at that time, and now I'll continue my story.

Unfortunately, the predominant viewpoint even today is that cholera epidemics are imported, such as the one in Dagestan in 1994 and the isolated cases that have occurred in other southern regions of the Russian Federation and the former Soviet republics of Central Asia and the Caucasus. As in the past, it gets copied from one review paper to another that pandemic cholera spreads from an endemic focus in the Ganges-Brahmaputra Delta. It is acknowledged as a fact that the El Tor cholera pathogen was exported from Sulawesi Island in 1961 and had caused at least ten persistent endemic foci to be established *only* in tropical climates with equatorial monsoons. However, an analysis of publications on cholera in the Russian-language and foreign literature provides an ever-stronger basis for Professor V.Yu. Litvin and others, who classify cholera as a sapronosis.[41] When analyzing the cholera outbreak that occurred in Dagestan in the summer of 1993, the local specialists identified nine cholera cases and three vibrio carriers. This outbreak was interpreted by [B.A. Batyrova, K.O, Abakarova, and A.Z. Faradzheva,] the authors of ["On the cholera outbreak in Dagestan in the summer of 1993,"] as imported from Pakistan by a group of tourists. However, four of the disease cases could not be linked to the tourists. Moreover, on September 8 [of that year], two weakly virulent strains of the El Tor cholera Ogawa serotype were isolated from water flowing in the main irrigation canal, and similar findings have occurred nearly every year for many years. The authors write that one man from Kaspiysk [a town on the Caspian Sea in Dagestan] died of cholera on July 30 [of that year]. The physicians linked his illness to a fishing trip the man took to the main canal, without having had any contact with the tourists. The El Tor biotype Ogawa serotype cholera vibrio was isolated from both the victim and his wife. These facts show that there was no single interpretation of the cholera outbreak in Dagestan in 1993 and especially in

[41] Sapronoses refers to microorganisms that normally live in soil or water, but also are able to infect humans.

1994. The impression is that, as in the past, the dogma of imported cholera prevails among specialists, including those in regions where it is entirely probable that the pathogen has been established.

"Giving our ignorance its due," as Boris K. Fenyuk loved to say, it would hardly be possible today to interpret the many cholera epidemics, including [those in] Afghanistan and Uzbekistan in 1965 and Dagestan in 1994, as only imported or only local" (pp. 101-03).

An Important Tradition

Raisa Semenovna Zotova (pp. 105-10). One photograph (portrait of V.F. Kiyko).

This chapter consists of a biographical sketch of Vladimir Fedorovich Kiyko (1940-89), the author's husband, including a description of his work at the Turkmen AP Station and the All-Union Research Institute of Microbiology.

Zotova describes the medical treatment that her husband received after his retirement from the AP system due to illness. By publishing her story, she wishes to demonstrate that the AP system made it a priority to find the best medical care for current and former staff members.

Full translation:

Very soon after it was founded, the [AP] system established several distinctive traditions. One of these carried on unfailingly for many years until just recently, and I would like to write about it here.

Under this tradition, officials of the High-Risk Infection Department of the MOH helped AP workers and their family members obtain medical care. The assistance was mainly in the form of making space available in prestigious Moscow clinics, scheduling consultations with leading specialists, obtaining scarce medicines, and arranging travel to health resorts. The moral justification for these efforts was the fact that the vast majority of AP system workers, as well as their relatives, lived in very isolated areas where qualified medical assistance and medicines were unavailable. The main feature of this tradition was that these officials saw their role of providing assistance not as a courtesy, but as a duty. As an illustration, I would like to describe one exception that highlights a deviation from the usual practice.

After many years of service in the High-Risk Infection Department, Grigory Dmitrievich Ostrovsky left to work at the sanitary-epidemiological administration of the Ministry of Railways. It was well known that the best hospitals in Moscow were the four hospitals that belonged to this ministry. Several employees of the AP system asked Ostrovsky to have themselves or relatives admitted to Ministry of Railways hospitals in Moscow. Following the old tradition, Ostrovsky overcame considerable obstacles and got them admitted. Although medical workers in the healthcare field generally also had privileges in obtaining medical

help, this paled in comparison with the tradition in the AP system, where it extended even to people who, for various reasons, no longer worked in the system. In a general atmosphere of bureaucratic indifference and reticence in taking responsibility, a respectful attitude toward ordinary employees from the hinterland could not help but make you feel touched and proud to belong to the AP clan.

Here it would be appropriate to recount a situation in which I was directly involved and which characterizes how differently the general healthcare network and the AP system deal with someone who gets sick. This case is interesting because the very same person sought help from the general network and from the AP system. The person is my husband, Vladimir Fedorovich Kiyko, who, after finishing medical school, worked for many years at the Turkmen AP Station. Vladimir usually worked as a leader of epidemic field teams investigating natural plague foci and also cholera outbreaks. He was very successful in promoting new methods of research, especially the use of serologic reactions in natural plague foci. His efforts laid the basis for establishing the bacteriological-serologic method of investigating biological material for plague. He was able to show that in a number of cases, when cultures of great gerbil organs do not contain the plague microbe, the bacteriological-serologic method is able to detect it. The reason for these different results was clearly shown to be that the plague microbe is retained in local granulomas that cannot be analyzed by ordinary methods of investigation. Vladimir was a good manager of temporary epidemic field teams. He took an active interest in people's lives, established good relations with the local residents, and provided medical assistance to the Turkmen and Kazakh people. He was masterful at giving injections and performing therapeutic massage. He was a serious student of books on Eastern medicine. In other words, Vladimir led a fairly busy and active life filled with scientific research and practical activity, as did many others in the AP system.

In 1982, after many years of working in the AP system, Vladimir left and transferred to the Moscow area to work at the State Research Center for Applied Microbiology (SRCAM). This institute was part of the Main Administration for Microbiological Industry (*Glavmikrobioprom*), but the USSR MOH's 3rd Directorate operated the institute and handled medical care for the staff. Vladimir worked as junior scientist in the aerosol laboratory, which was headed by N.G. Simonov. Vladimir was particularly valuable to the center, because he had solid practical experience working with high-risk infection pathogens, and the aerosol laboratory focused on these types of infections.

Anyone working with aerosols of pathogenic microbial cultures had to wear a special suit equipped with an inlet air filter. These suits had talc applied to the inside surfaces at the factory in order to prevent sticking. Naturally, the talc had to be removed from a new suit before use. Only then can the suit be worn.

In 1985, the laboratory was using the aerosol method to infect animals. Vladimir was assigned to observe how the animals behaved and what happened to the microbial culture. At that

time, the laboratory did not have any previously used special suits, so, among other things, Vladimir was given a new suit, but the talc had not been removed. In other situations, this mistake could have been corrected easily. However, Vladimir did not discover the mistake until after he was in the experiment area. He could not take off the suit because in that case, he would have breathed in the virulent cultures, just like the experimental monkeys. He took off the suit as soon as it was safe to do so. At first, Vladimir did not notice any signs of illness, but later he developed a cough with asthma attacks. He was hospitalized in the local hospital with a diagnosis of pneumonia, but he could not get over it completely. The doctors treating him could not come up with a correct diagnosis, and Vladimir's health deteriorated. He was no longer able to work in the aerosol laboratory and was transferred to a different laboratory. After Vladimir's health declined further, he sought help from the High-Risk Infections Department of the MOH. As a result, he was hospitalized in the hospital therapy clinic of the Moscow Medical Academy. After a month and half, he was discharged in satisfactory condition. But just one month later, his condition worsened. The local officials sent him to the therapeutic department of Medical-Sanitary Unit No. 66, which is in Protvino. Here, X-rays showed for the first time a cavity in his lung. The department director, Ms. Shoshinova, tried to discharge the inconvenient patient quickly, and when asked to transfer him to Moscow clinics, she replied that the medical establishments associated with the 3rd Directorate did not have any specialists capable of helping him.

Again he had to turn to the High-Risk Infections Department for help. Despite the fact that Vladimir had not worked in the AP system for several years, he had received help several times in the past. Once again, they came to his assistance and hospitalized him at the Academician Chuchalin Clinic, which was noted for having the country's best pulmonologist. Here, Vladimir finally received the correct diagnosis of talcosis. This is a relatively rare disease which has a much more severe course than the related disease, silicosis (miner's disease).[42] He was put on disability. When one of the highly skilled specialists taking care of Vladimir saw the X-rays, he was astounded to find that connective tissue had replaced lung tissue nearly everywhere, and predicted that Vladimir had only a few months to live. Cysts had formed in his lungs and filled with liquid, fostering the development of infections in his body. Vladimir carried on nearly three more years, was admitted to several clinics, and had the most cyst-ridden part of one lung removed, but cavities remained in other parts of the lung tissue. From what I have heard, there is only one physician in the world that specializes in treating talcosis patients, but he lives in England. There was no chance that someone who worked at a special institute would be allowed to travel there, and even a simple request for Vladimir to travel to one of the Crimean sanatoriums, as his attending physicians advised, was denied. The grounds for the refusal were that he had caused the problem himself because he had violated instructions by putting on a suit with talc still in it (special people were responsible for preparing the work suits). This was pure, blatant cynicism because it would be hard to believe a physician would willingly don a new suit and breathe air laden with talc.

[42] In fact, to this day, there is no effective treatment for advanced talcosis.

Vladimir Kiyko died suddenly in February 1989 at the age of 49. He had entered a Moscow clinic, this time a surgical clinic, for an operation to remove one lung entirely. On the day of a routine bronchoscopy, he died while they were taking him from his room to the operating room.

Despite the indifference of Vladimir's immediate superiors, he was treated in the best hospitals in Moscow thanks to his status as a former AP worker. This help was provided by officials of the MOH and by former AP workers living in Moscow: K.A. Kuznetsova, Yu.M. Fedorov, M.I. Narkevich, M.I. Levi, N.N. Basova, and A.P. Vazhevy.

The case of Vladimir Kiyko is not the only instance when help was given to former AP workers. This was the rule, and although people did not always take advantage of it, they knew that help was available. People who worked in the AP system and their relatives were practically never refused this help, regardless of the position they held. Even now, when most of USSR's AP facilities are located outside of Russia, an effort is made to honor requests for medical assistance from AP workers in the former Soviet republics. This tradition is still alive and reinforces the notion of Russia as a friendly country.

Ilya Grigorevich Ioff (100th Anniversary of His Birth)

Nataliya Federovna Darskaya (pp. 111-205). 11 photographs, ten references, list of Ioff's 136 published works and prepared manuscripts.

This chapter consists of a biographical sketch of Ilya G. Ioff, director of the parasitology departments of the Rostov Microbiological Institute and the Stavropol AP station. Darskaya comments on the most important aspects of his work and also incorporates information that was excluded from previous biographies, including previously unpublished correspondences with colleagues and family.

Ioff was a leading expert in the systematics of Aphaniptera (fleas) and made major contributions in the epidemiology of plague, malaria, and tularemia. He was director of the Parasitology Department at Rostov Microbiological Institute from 1928 to 1934, and then director of the Parasitology Department at Stavropol AP Station. One of Ioff's proposals elicited significant controversy, but led to further research into the matter. He posited that there was a correlation between the sunspot cycle (climate fluctuations) and the cycles of epizootic activity, such that researchers could predict epizootic outbreaks and take effective preventive measures. Darskaya considers him an outstanding naturalist, field worker, adviser, administrator, and researcher.

Olga Ivanovna Skalon

Nataliya Federovna Darskaya (pp. 206-12). 1 photograph (portrait of O. I. Skalon).

This chapter is a biographical sketch profiling the career of Olga I. Skalon, an entomologist in the AP system and expert in the systematics of Aphaniptera (fleas).

Skalon worked at the Irkutsk AP Institute and at the Yakutsk Zonal Commercial Hunting-Biological Station of the Sevmorput Arctic Institute. In 1949, she transferred to the Stavropol AP Institute, where she collaborated with Ilya Grigorevich Ioff in writing reference works, identification keys, and other scientific works on the flea fauna of the Soviet Union. She remained at Stavropol until her death in 1980.

Studies on the Life of Olga Ivanovna Skalon (1905-80)

Nadezhda Federovna Labunets and Astra Gershonovna Reitblat (pp. 213-19)

This chapter is a second biographical sketch of O.I. Skalon, an entomologist in the AP system and expert in the systematics of Aphaniptera (fleas). The authors, who were junior co-workers of Skalon at the Stavropol AP Institute, describe Skalon as a person and scientist.

Lev Ivanovich Leshkovich: His Destiny and Life

Moisey Iosifovich Levi (pp. 220-30)

This chapter is a biographical sketch of L.I. Leshkovich, a plague researcher at the Central Asia AP Institute in Alma-Ata.

Leshkovich believed that the AP system was spending far too much effort and money on zoological field studies, and that plague control was purely a public health and medical issue that should be the concern of doctors and public health educators. Still, he focused his major research on developing a live plague vaccine based on strains of *Yersinia pestis* mutated by radiation exposure. Unfortunately, his efforts ended in failure when a patient in his human trial developed clinical plague.

Vartan Nikitich Ter-Vartanov: Director of the Stavropol AP Institute

Moisey Iosifovich Levi (pp. 231-40). One photograph (portrait of Ter-Vartanov).

This chapter is a biographical sketch of V.N. Ter-Vartanov, director of the Stavropol AP Institute.

Ter-Vartanov was appointed director of the Stavropol AP Institute in the mid-1930s, replacing I.S. Erlikh who was arrested and executed during the great terror under Stalin. Ter-Vartanov received graduate medical training only later in life, when already serving as director. He is described as an able administrator, but also a despotic bureaucrat in the spirit of the times; he demanded extreme personal loyalty and effectively drove away otherwise competent scientists who refused to comply. He was fired from the directorship in 1963, about which Levi notes, "I.V. Domaradsky played a marked role in this process." Ter-Vartanov was subsequently assigned to teach courses on high-risk infections and retired from the AP system in 1979 at the age of 75.

Yury Mikhaylovich Rall: Encyclopedist of Plague Epizootiology

Moisey Iosifovich Levi (pp. 241-48)

This chapter is a biographical sketch of Y.M. Rall, a leading biologist and expert on plague epizootiology at the Stavropol AP Institute. It describes interactions between Rall and the author during the time they worked together at Stavropol in the 1950s. It also identifies correlations between Rall's personality, health, and productivity at work.

Forgotten Photographs

Moisey Iosifovich Levi and Yury Grigorevich Suchkov (pp. 249-320). 34 photographs.

This section contains photographs (individual portraits and group photographs), some accompanied with brief biographical sketches, of 54 prominent AP system persona.

Various individuals submitted photographs from their personal collections in response to a request by the authors. Biographies are given for the following people:

Guseyn Abdurakhmanovich Abdurakhmanov	Aleksey Konstantinovich Adamov
Mamed Neymatovich Aliev	Masgut Aykimbaevich Aykimbaev
Abram Lvovich Berlin	Rudolf Arkadevich Brudny
Yevgeny Vasilevich Buntin	Nataliya Federovna Darskaya
Vladimir Petrovich Dobronravov	Igor Valerianovich Domaradsky
Mark Andreevich Dubyansky	Vladimir Nikolaevich Federov
Boris Konstantinovich Fenyuk	Nikolay Ivanovich Kalabukhov
Anatoly Mashevich Karmov	Lev Nikolaevich Klassovsky
Ivan Zakharovich Klimchenko	Yevgeniya Ilinichna Korobkova
Vladimir Matveevich Kostyukovsky	Voldemar Pavlovich Kozakevich
Mikhail Prokopevich Kozlov	Klavdiya Aleksandrovna Kuznetsova

Larisa Georgievna Kuznetsova	Ivan Danilovich Ladny
Galina Nikolaevna Lenskaya	Moisey Iosifovich Levi
Sala Dzhamilovich Mamedov	Lev Maksimovich Marchuk
Grigory Moiseevich Medinsky	Nikolay Prokofevich Mironov
Senakh Arsenovich Mkrtchan	Ummed Akhmedovich Mamed-Zade
Nikolay Pavlovich Naumov	Petr Yevgenyevich Nayden
Boris Nikolaevich Pastukhov	Aleksandr Varlamovich Pavlov
Vlas Grigorevich Pilipenko	Magdalina Petrovna Pokrovskaya
Aleksandr Vasilevich Popov	Sergey Mikhaylovich Rassudov
Yevgeny Vladimirovich Rotshild	Dmitri Georgievich Savostin
Nikolay Mikhaylovich Semenov	Aleksandr Kondratevich Shishkin
Vladimir Fedorovich Sivolobov	Innokenty Stepanovich Soldatkin
Yury Grigorevich Suchkov	Ivan Fedorovich Taran
Vartan Nikitich Ter-Vartanov	Vladimir Yevgenyevich Tiflov
Mikhail Trofimovich Titenko	Viktor Mikhaylovich Tumansky
Sergey Nikolaevich Varshavsky	Nikolay Nikolaevich Zhukov-Verezhnikov

VOLUME 5 (1997)

Foreword

Moisey Iosifovich Levi (p. 3)

Introduction to the fifth volume of the "Interesting Stories..." series.

Full translation:

> The present volume was supposed to be devoted to plague enzoosis, but we did not carry through as intended because of the need to devote space to our customary sections on the history of the AP system. We had to pay due tribute to the current problems that life unfailingly puts before us. With the very existence of the AP system in question, the present volume opens an appropriate dialogue with the people in power. On the other hand, the issue also contains articles reporting previously unpublished materials relating to problems of plague enzoosis. Several articles report on the history of the AP system. The idea is to shine light on the activity and people of the AP system so that it does not suffer the same fate as legendary Atlantis, which is now known only from the tales of ancient Greek historians.
>
> Because of the difficulty of publishing in our country's few, small-circulation, scientific journals, subsequent volumes in this series might publish original fundamental works if they hold to the style of the previously published articles.
>
> Our publication continues to develop the theme of the "openness" of the AP system as a problem of utmost importance. It seems to us that someone had set out to hamper scientific research, disrupt established practices, diminish the importance of scientists in society, subjugate them to the will of others, and, in the final analysis, harm the country. The easiest way of accomplishing these things is to classify everything as secret. Our recent leaders had the right to make decisions as they saw fit, but without asking the "superpatriotic" secrecy advocates to show any proof of need, these leaders, instead of establishing a reasonable balance of interests, imposed secrecy on almost all aspects of the activity of the AP system with staggering ease. In those times, the AP institutes and stations had a cohort of brilliant scientists and practitioners who could have been the pride of our country and undoubtedly would have had a leading role in the international community of health professionals, but the harsh times prevented this. The secrecy system, which was a strong force for inertia, is still having its effects today, and therefore we continue to fight against it.
>
> M.I. Levi, Editor

Tracking Down the Answer to the Riddle of Plague Enzoosis, Part III: Caucasus

Aleksey Ilich Dyatlov (p. 4-50). One figure.

This scientific essay contains excerpt of a scholarly article that describes research on plague enzoosis performed by AP system staff members. It discusses leading theories on the persistence of the plague microbe and overviews contemporary work on the subject across the former Soviet Union. The first two parts of this essay are published in volumes 3 and 4 of this series.

The author had collegial relations with the other researchers at the Scientific AP Institute of the Caucasus and Transcaucasus in Stavropol. He provides character sketches of three of the directors of the Stavropol Institute, V. Ter-Vartanov, V. Pilipenko, and Azis Akiev.

Dyatlov recalls evidence that the plague microbe persists in soil between epizootics, especially in humid conditions. Evolutionary aspects of the plague microbe, including its close relationship to the pseudotuberculosis microbe, might account for its persistence in soil and explain the long periods between epizootics in some natural foci. Dyatlov also notes that plague foci in the Caucasus and Transcaucasus regions exemplify the differences between lowland and high mountain plague foci. The chapter discusses research on these issues, comparing work in the field of epizootiology during the Soviet Union to the current state of research in Russia, where the number of field investigations is greatly reduced.

Logical Model of Plague Enzoosis

Moisey Iosifovich Levi (pp. 51-129). One photograph (portrait of author), 11 figures, 12 tables, references.

This chapter is a scientific essay about the "synthetic hypothesis" of plague enzoosis, which combines concepts of the classical and telluric (relating to the earth) hypotheses.

Levi reviews theories on the evolution and taxonomy of *Yersinia pestis* in conjunction with evolution of warm-blooded hosts. He notes the possibility of external natural influences on the evolution of the microbe, such as the sunspot cycle.[43] Research conducted by Valentina Semenovna Larina explored the possible symbiosis of the plague microbe and soil microbes. In the article's conclusion, Levi discusses the origin and nature of natural plague foci and considers the susceptibility of various host species to infection by *Y. pestis*.

[43] Related research has been conducted on solar radiation cycles since the time of the work described in this chapter. For example, see V.V. Noronov et al., "The multiyear changes in the epidemic activity of the foci of zoonotic cutaneous leishmaniasis at the Murgab oasis. I. An analysis of the relations of morbidity to heliogeophysical factors" (in Russian), Meditsinskaya parazitologiia i parazitarnye bolezni 3 (1996).

So Close and Yet So Far (Unculturable Forms of the Plague Pathogen)

Yury Grigorevich Suchkov and Moisey Iosifovich Levi (pp. 130-40). One photograph (portrait of author), three tables, 19 references.

This largely scientific chapter describes research and its conclusions about the possibility of detecting "unculturable" forms of Yersinia pestis. *It includes description of laboratory materials and methodology, and experiment results.*

The results of the experiments demonstrate that the plague bacterium can be converted to an unculturable form and later reactivated into the initial vital form. The authors note the insufficiency of bacteriological and serological testing and suggest the utility of polymerase chain reaction (PCR) to future investigations.

Investigation of the Soil and Substrate from a Colony of Great Gerbils in an Epizootic Territory of a Natural Focus of Plague

Moisey Iosifovich Levi, Yury Grigorevich Suchkov, Igor Vasilevich Khudyakov, Boris Nikolaevich Mishankin, Raisa Semenovna Zotova, I.Yuryevich Suchkov, Ye.N. Yemelyanenko, V.Yu. Litvin, A.L. Gintsburg, D.I. Pushkareva, D.B. Kulesh, S.U. Kreyngold, and K.A. Shestakov (pp. 141-62). One figure, five tables, 30 references.

This chapter is a scientific article that describes original research that aimed to isolate the plague microbe in the soil of burrows located in natural plague foci and to develop a standard method of doing so. It includes descriptions of materials and methodology, experimental tests, and results.[44]

The authors explain, "In order to determine the role of burrows infected with the plague microbe between epizootics, it is essential not only to detect the pathogen in this medium, but to prove that this phenomenon is fairly frequent, otherwise it would be difficult to link the occurrence of new epizootics in several places at once after a long quiescence. The present research addresses this possibility. Another goal is to develop a suitable method for investigating the soil and substrate of burrows."

The authors describe their materials and methods and discuss the results of research using bacterial culture, polymerase chain reaction, and serologic testing to determine whether methods other than bacterial culture are needed to identify plague pathogens in the soil of burrows populated by great gerbils. Their study yielded four major results. First, serologic testing used to detect Fraction 1 in extracts from soils and substrates of great gerbil burrows can also be used to detect areas affected by prior plague epizootics.[45] Second, PCR performed on soil samples collected from great gerbil burrows

[44] This study is the subject of the narrative included in M.I. Levi, I.V. Khudyakov, and Yu.G. Suchkov, "Citizens' Initiative in Scientific Research," *Interesting Stories...* 6 (1997), pp. 235-50.

[45] Fraction 1 (F1) is an antigen that is produced by *Y. pestis* when it lives in an environment that is at the normal human body temperature. Its main purpose is to protect the bacterium from being engulfed by phagocytes (white blood cells). Strains of *Y. pestis* that produce F1 are highly pathogenic.

can detect plasmid genes, which code, first, for the producers of Fraction 1 and of murine toxin and, second, for Fraction 1 itself by the bacteriologic-serologic method in cultured material. Third, the concentration of Fraction 1 producers can be determined by titration of the cultured material. Last, positive results of PCR and the bacteriologic-serologic method were obtained with samples from both inhabited and uninhabited great gerbil burrows in a plague epizootic area (one in five inhabited burrows and one in four uninhabited burrows were investigated).

Plague in Moscow

Igor Valerianovich Domaradsky (pp. 163-75)

This chapter is an anecdotal essay about the "plague" of secrecy that covered scientific research on high-risk infections in the Soviet Union. It describes procedures applied by the Soviet Union to ensure that sensitive information was not released.

Full translation:

> Fear not! I resorted to this scary title only to attract readers' attention. There has not been any plague in Moscow since 1939, when it was brought there by A.L. Berlin, deputy director of Mikrob.[46] He had been infected in Saratov while testing the newly developed live EV plague vaccine and, without knowing he was sick, came to Moscow on a business trip. He infected two medical personnel, and all three died. Fortunately, because the proper epidemic control measures were taken, the outbreak did not spread.[47] However, what I want to talk about does relate to plague, although not in the literal sense, but as a metaphor. There is one more caveat. There is little that is interesting in my story, other than the circumstances under which I, and many people like me, had to live, but the times are so far in the past that memories have become faded and fragmentary. For this, I apologize in advance.
>
> As I have said several times before, after working for twenty-plus years in the AP system, that is, on the periphery [i.e. in provincial areas of the Soviet Union], I landed in the capital. In the role of a mid-level bureaucrat, initially without even clearly defined duties, I suffered from

[46] The circumstances of this epidemic are described in T. Belousova, "The Plague," included in Part II of this paper (see below).

[47] [Author's note 1, in the original.] A.L. Berlin's obituary in *Vestnik Mikrobiologii* (Saratov) 19 (1941) did not mention the cause of death "while on duty" (see my note "Proscriptions" in *Interesting Stories*… 3, 1995). It seems to me that Ye.I. Smirnov (*Voyna i voennaya meditsina* [*War and Military Medicine*], Moscow, 1979) recounts the episode extremely subjectively, in the spirit of stagnation times. Smirnov attempted to show that Berlin's death was due simply to his own negligence and violation of his professional duties. On the other hand, Smirnov indicates that there was an entirely justifiable reason for Berlin's urgent trip to Moscow: to report to the Science Committee of the USSR People's Commissariat of Health on the testing of the new vaccine. Incidentally, on the day after this, December 7, 1939, Pravda published an article entitled "Courage," which mentioned, among other heroes, A.L. Berlin. *Pravda* would not have published this article without permission from above!

boredom and began trying to obtain permission to set up a laboratory. After several months, at last, we came to an agreement, but because of various considerations, my superiors decided that the most suitable place for the laboratory would be at the All-Union Research Institute of Protein Biosynthesis, which was the main technological institute of the Main Administration of the Microbiological Industry [*Glavmikrobioprom*] under the USSR Council of Ministers. Among other reasons, someone apparently thought that the best place for me as a professor of biochemistry would be there, where they do "protein synthesis" (in fact, protein "synthesis" at the institute amounted to culturing yeasts on hydrocarbons and manufacturing protein-vitamin concentrates out of them). Whatever the reasons [for my placement], I was satisfied. Moreover, I was given complete administrative independence and the ability to decide for myself what line of research to pursue. However, one line of research was firmly stipulated for me: to understand molecular genetics of microorganisms. So immediately the question arose, where to start?

Since I would be working with pathogenic microbes for the foreseeable future, but because the Protein Biosynthesis Institute did not have the facilities for this kind of work, I decided to investigate pseudomonads as opportunistic bacteria.[48] But for that, we would need strains, especially of *Pseudomonas aeruginosa*, and these would have to be the type of strains that had been extensively characterized. So, I contacted the director of the Microbiology Institute of the USSR Academy of Sciences, A.A. Imshenetsky.[49] Very quickly he sent me a large number of a very wide variety of cultures of fluorescent and non-fluorescent pseudomonads, but none of them had been characterized. However, to my surprise I found a vial (or several vials, I do not remember now) with a culture of *Ps. pseudomallei*, that is, the melioidosis pathogen! When I began looking into things, I found out that the Microbiology Institute stored all the cultures it received in an unsealed refrigerator that was practically in the hallway. According to Professor D.G. Kudlay, who had gone there herself to obtain strains, the refrigerator was just crammed with them.

I was shocked to find vials containing *Ps. pseudomallei*; I imagined what could happen if someone in my laboratory or at the Microbiology Institute who was not familiar with the procedures for handling high-risk infections decided to work with this culture! I remember that in those years, melioidosis infection was considered difficult to treat, and at the AP institutes, the procedures for handling it were even stricter than for the plague microbe. I had to do something, but what? It would have been useless to call Imshenetsky; because of his academic snobbism, it is doubtful that he would have taken the necessary measures. For a number of reasons, I did not want to tell my superiors about it. There was only one thing left to do, which was to use the "Kremlin line" to call G.K. Skryabin, who was the Chief Scientific Secretary of the USSR Academy of Sciences (I knew him well from working on the Interdepartmental Council of

[48] Opportunistic pathogens are bacteria that are usually benign but can become pathogenic when the immune system of a host is impaired.

[49] [Author's note 2, in the original.] I met Imshenetsky back in the 1960s at one of the meetings about the "fifth problem." Note by editors: Problem 5 was the codename for the Soviet defensive BW program.

Glavmikrobioprom). As I expected, Skryabin understood everything immediately and took all the necessary steps, and it seemed to me that the problem was solved. However, word of this "emergency" eventually came out and a scandal erupted, in which, not surprisingly, I was the scapegoat! For a very long time after that, I was accused of "unethical" and "uncomradely" behavior toward my Academy of Sciences colleagues (why had I not solved this problem directly with Imshenetsky?). The only thing I could say in my own defense was to mention what happened with A.L. Berlin, and I was afraid something like that might happen.[50] Maybe I did not really need to get Skryabin involved, but the idea of a mishap involving strains at the Microbiology Institute was simply frightening!

Professor [Bruce] Holloway, a well-known Australian specialist on pseudomonad genetics and biochemistry, helped me establish a basic collection of the necessary strains, and for this I will always be grateful to him. Here, I would also like to say that, from that time on, I had to turn to foreign colleagues for help, and I was refused only one time, in the early 1980s, when the US Congress imposed restrictions on sending genetically altered strains to the Soviet Union.[51]

In addition to pseudomonads, I gathered a large number of various strains of *E. coli* and other bacteria, which I will discuss later. The collection grew constantly with altered strains produced in my laboratory, and by the early 1980s, there were nearly 2,000 strains in all.

The basic subject of research in the laboratory was extrachromosomal heredity of microorganisms (hence the laboratory's name, Extrachromosomal Heredity Laboratory). This was the first such laboratory in our country, not counting the Episome Laboratory headed by Professor D.G. Kudlay at the N.F. Gamaleya Institute. I say, "not counting," because due to some sort of dispute, V.D. Timakov very soon disbanded that laboratory and talked me into bringing Kudlay to my laboratory. It was only later that I understood the reason for this unusual "generosity" on the part of the president of the USSR Academy of Medical Sciences, and why he was willing to part with the author of two books on extrachromosomal heredity! I do not want to go into this any further, other than to say that Kudlay was not really a match for the subject matter of my laboratory. Although hardly anyone knew me in Moscow, and since, as a geneticist, I had no standing, at any rate I was able to bring together the colleagues I needed rather quickly, and I was never refused funding for acquiring imported equipment and reagents. So the work began.

The first order of business in the Extrachromosomal Heredity Laboratory was to have the workers master the methods of molecular biology, in particular the extraction of plasmids. I recall that at that time, imported radionuclides and high-speed centrifuges were needed in order to extract plasmids. At the same time, we started looking for ways of transferring heterologous

[50] See footnote 44 above.

[51] [Author's note 3, in the original.] This was at the time of the Korean airplane tragedy. [Note by editors: The US Congress retaliated against the Soviet Union after a Soviet interceptor aircraft shot down Korean Air Lines Flight 007 on September 1, 1983.]

genetic information using various conjugal plasmids and phages. Here it would be appropriate to say a few words about the background on which the events unfolded.

In the first half of the 1960s, we began talking about the successes in molecular biology that were being achieved in the West, and about how we were behind or, more accurately, stagnating. It is easy to understand the reason for our stagnation, if you think about the long dictatorship of the "people's academician" T.D. Lysenko, as a result of which a whole generation of biologists were forced to fit their research results into the Procrustean bed of the "world's leading scientist." They could not even imagine that any other science existed. By the way, this [Lysenkoism] affected more than just biology!

But, everything comes to an end sooner or later. In the early 1970s, the [Central Committee of the Communist] party and the USSR government issued a number of decrees on measures to develop molecular biology and genetics, and a real boom developed in these subjects.[52] The interest in these problems is shown just from the proceedings of two conferences at Pushchino-on-Oka that I initiated and organized (in particular, I decided on the program topics to be discussed). The Pushchino conferences in 1973 and 1974 brought together the entire world of contemporary science. Naturally, results were not long in coming. I remember how thrilled A.A. Baev and G.K. Skryabin were when they told *Glavmikrobioprom* Director V.D. Belyaev about the first successes in constructing hybrid DNA molecules. Doing so required them to set up suitable facilities and to master genetic engineering methods in a very short time! Although the first results were not original, they made a very strong impression and brought in a stream of funding from Belyaev, who dreamed of a "turnaround" in the [Soviet] microbiology industry.

But let us return to our story…

By the end of 1975, the preparatory work in the Extrachromosomal Heredity Laboratory was completed, and the first original results started to come. Among these, I would particularly note the transfer of one of the plasmids of gram-negative bacteria with a wide range of hosts to a gram-positive microbe, the hay bacillus [*Bacillus subtilis*]. This work showed not only that several of the genes of this plasmid were expressed in the bacillus, but even proved that the plasmid could be retained in its spores. Our results were published in the *Doklady* (*Reports of the USSR Academy of Sciences*) and *Zhurnal Mikrobiologii, Epidemiologii i Immunologii* (*Journal of Microbiology, Epidemiology, and Immunology*), which attracted the attention of Professor Ehrlich at the Pasteur Institute in Paris, who was working on similar tasks. However, he contended that the genetic information of gram-negative bacteria could not be recognized by the DNA-dependent RNA-polymerases of aerobic bacilli. Therefore, Professor Ehrlich asked us to send him our "hybrid" strains. Unfortunately, I was not able to do that, because the KGB representatives would not allow me to send strains out of the country (I did not have the right to bypass them and make

[52] See Leitenberg and Zilinskas, *The Soviet Biological Weapons Program*, pp. 65-66, 154-55.

contact with foreign scientists). The worst thing was that I could not even explain to Professor Ehrlich the reason for the refusal. As a result, he published an article that cast doubt on our findings! All this was made rather widely known and served as the basis for attacks on me from the adherents of S.I. Alikhanyan because they saw me as a competitor. In the end, everything fell into place and our findings were confirmed, but by then, no one remembered them.

While working in Moscow and gradually learning the intricacies of molecular biology, I could not help but think about the plague microbe, to which I had devoted over 20 years of study.[53] But after the A.L. Berlin incident, all work with plague in Moscow was categorically forbidden. On top of that, in the opinion of the above-mentioned KGB representatives who were monitoring me, such work might betray the true nature of the new organization that I had come to work for in Moscow.[54]

After thinking about it for a long time, I approached my direct superior, V.D. Belyaev, and tried to convince him that it would be in his interest to help me set up for work using vaccine strains of the plague microbe and other *Yersinia* species at the Extrachromosomal Heredity Laboratory. At that time, when they were finishing construction of new *Glavmikrobioprom* institutes outside the Moscow city limits for work with high-risk infection pathogens, we would have had a good theoretical base and relatively well-trained personnel. After listening to me intently and demanding assurances that there would not be any complications, Belyaev asked me to put it all in writing. Of course, by himself he could not authorize the laboratory to conduct research even with the EV strain, and therefore had to send my document "upstairs."[55] I was prepared for a long wait, but to my surprise, not long after that, I was invited to Lubyanka and was shown a resolution of approval from KGB chairman Yu.A. Andropov.[56] After that, everything was easy. True, the laboratory was placed under special observation and the workers I needed were given special clearances.[57] These included Ye.G. Koltsova (married name Yudina), a former colleague at the Rostov AP Institute who married a man from Moscow. She became my "right-hand" person.

[53] [Author's note, 4 in the original.] In particular, for the history of genetic studies of this microbe, see the article co-authored with Yu.G. Suchkov (*Interesting Stories*… 4, 1995).

[54] [Author's note 5, in the original.] See my book *Troublemaker, or The Story of an "Inconvenient" Man* (in Russian), privately published in Moscow, 1995, and the article *Istoriya odnoy avantyury* [*History of an Adventure*] (*Znanie-sila*, No. 11, 1996).

[55] The *Y. pestis* EV strain is non-pathogenic and thus used for vaccine purposes.

[56] Lubyanka square in the center of Moscow is host to the large, yellow Lubyanka building, referenced here, which doubled as the KGB headquarters and an infamous prison during the Soviet Union era. As such, Domaradsky's description of his summons to Lubyanka as an "invitation" in this context is understood to be somewhat ironic. The FSB, the successor to the Soviet secret police, still occupies the building in today's Russia.

[57] [Author's note 6, in the original.] It should be noted that many workers in the Extrachromosomal Heredity Laboratory did not agree to obtain clearances. Fortunately, I had enough personnel with clearances, because the laboratory staff included graduates of Moscow educational institutions who had been selected for work at Biopreparat's All-Union Research Institute of Applied Microbiology in Obolensk [which conducted classified R&D].

I directed the Extrachromosomal Heredity Laboratory on a volunteer basis. At my main workplace, organization Post Office Box A-1063, we were very interested in how the virulence of one or another microbe would be affected if we transferred to it the ability to make foreign toxins.[58] Therefore, the Extrachromosomal Heredity Laboratory attempted to transfer the *E. coli* hemolysis plasmid into the EV *Y. pestis* strain. This plasmid is considered one of the pathogenicity factors of *E. coli*. The "virulence" of the EV strain would be evaluated indirectly based on the production of F1, murine toxin, and pesticin 1. No one had attempted this previously. These experiments were successful; the EV strain acquired the ability to cause hemolysis, but we were not able to establish any other phenotypic changes. Several years later, S.A. Lebedeva at the Rostov AP Institute conducted similar experiments, but used virulent strains of the plague microbe and the hemolysis gene (pNR) cloned by us in plasmid pBR325, which Lebedeva inserted not by conjugation, the technique we used, but instead by transformation. These experiments deepened and broadened our knowledge of the EV strain. In particular, it was established that the virulence of the plague microbe decreases substantially when pNR is inserted. Later, I encountered a similar situation using other techniques on other microbes. However, sometimes the decrease in virulence was masked by new properties. For example, at organization PO Box V-8724, we introduced a gene from the diphtheria microbe into the cell of the pseudotuberculosis pathogen and produced an essentially new microbe; in the first few days after infecting animals, it produced symptoms similar to diphtheria, and then about two weeks later, caused changes typical of pseudotuberculosis.[59] From this you might say that all my "games" in Moscow, even those with the EV strain, could have caused big problems! However, I consciously took the risk, believing in my soul that I would succeed, and thinking that they would not prosecute a winner!

The next step in the work at the Extrachromosomal Heredity Laboratory was to search *Y. pestis* for plasmids. Ye.G. Koltsova found indirect evidence of these several years earlier when she was able to show that it was possible to transfer pesticinogenicity from the plague microbe to *E. coli*. On the other hand, doubts about the success of this were sown by Little and Brubaker (1972), who did not find plasmids in the EV *Y. pestis* strain. Still, as they say, there was no harm in trying, and we began similar research. In the summer of 1977, we found plasmids in the EV strain! You can imagine my surprise when I found out that similar data also had been obtained at the Kirov Institute![60] However they [i.e. its military scientists] used a large number of strains and a different method (after cesium chloride gradient centrifugation, we used electron microscopy, while the military researchers used electrophoresis in agarose gel). Incidentally, I would not have known about this for a long time, were it not for chance. When the Extrachromosomal Heredity Laboratory applied to have the discovery recognized, it was necessary to present a report to *Glavmikrobioprom*'s Interdepartmental Council, of

[58] So-called "post office institutes" were secret facilities where military R&D were undertaken. P.O. Box 1063 was the codename for the Biopreparat production associate.

[59] P.O. Box V-8724 was the codename for SRCAM.

[60] The official name of the Kirov Institute was Scientific-Research Institute of Microbiology of the Russian Federation Ministry of Defense.

which [Colonel General] Ye.I. Smirnov was one of the members.[61] That is how we found out about this. After long arguments about the priority of our discoveries, the Council decided to combine our data with the results of the military experiments and prepare a new application. In all fairness, it must be said that the whole matter only benefited from this, because in the end there was a more convincing basis for the viewpoint that the virulence of *Y. pestis* depended on plasmids. Unfortunately, the application was classified as secret and therefore even now, it is very difficult to prove the priority of our experiments.

Based on these events, V.D. Belyaev offered to strengthen the Extrachromosomal Heredity Laboratory by bringing in people from the AP system. He promised to provide apartments in Moscow for them. I gladly agreed to this, and got tentative commitments from my students Ye.P. Golubinsky, I.M. Alutin, and V.V. Korol in Rostov and from the Ryapises (husband and wife) in Volgograd. However, fate dictated that only the Ryapises were able to come to Moscow; V.D. Belyaev suddenly took sick and died, and his successor, R.S. Rychkov, as often happens in our country, categorically refused to pay the bill of his predecessor.

Another success of the Extrachromosomal Heredity Laboratory was an agreement between V.D. Belyaev and Ye.I. Smirnov to appoint me to lead one of the plague genetics subject areas at Kirov Institute. I have already written elsewhere about the results of this. I can only add that for many years, the military people shamelessly used my altered strains of *E. coli* and other bacteria (I still have the patent documentation), but they never informed me of the results of their work. As you can see, the game was entirely one-sided!

The EV strain was not the only object of intense focus at the Extrachromosomal Heredity Laboratory. At the same time, we studied the genetics of other *Yersinia*s, primarily the *Y. pseudotuberculosis* pathogen, for which we also were the first to discover plasmids. The evidence for this is our paper (1980) that appeared in one of the classified collected works of organization PO Box A-1063.

After hearing about our work on *Yersinia* genetics, Academician G.P. Somov of the Russian Academy of Medical Sciences asked me in 1982 to provide a place in the Extrachromosomal Heredity Laboratory for his colleague F.N. Shubin, who was very interested in the cause of the particular virulence of the *Y. pseudotuberculosis* strains that cause Far East scarlet-like fever. Perhaps because of the secrecy regime at the Extrachromosomal Heredity Laboratory, Shubin rather hastily moved on to the N.F. Gamaleya Institute, where he somewhat recently defended his doctoral dissertation on the "molecular epidemiology" of *Y. pseudotuberculosis*. He also began studying the genetics of this pathogen. The "riddle" of the far-eastern strains still has not been completely solved. There is probably not much hope that foreign colleagues will take this up, because they're not familiar with scarlet-like fever.

[61] Smirnov at that time was the head of the Ministry of Defense's 15th Directorate, which directed the Soviet BW program.

Our ideas on the concepts of the biochemistry and genetics of *Yersinia* species in the early 1970s are contained in the monograph *Biokhimiya i genetika vozbuditelya chumy* (*Biochemistry and Genetics of the Plague Pathogen*) (Domaradsky et al., Moscow, 1974). A major obstacle toward a better understanding of *Yersinia*s was their lack of inherent systems for transferring genetic information, even traits like multiple drug resistance (these are found, very rarely, only in strains of the Y. pseudotuberculosis pathogen). The plasmids we found in *Yersinia*s all turned out to be non-transmissible, that is, they are not transmitted directly between strains. Therefore by early 1978, one of the main problems, in my opinion, was to find methods of solving this quandary. It is true that one method was being widely used, but it had its limitations. This is the method of transferring conjugative plasmids from *E. coli* to *Yersinia*s and having them "mobilize" several genes, in particular those of the plague microbe. I recall it was namely this way that Ye.G. Koltsova was able to transmit the pesticinogenicity trait of the plague microbe to *E. coli*. Fortunately, one of the people working in the Extrachromosomal Heredity Laboratory was E.Ya. Amirov, a prominent specialist on bacteriophages. After careful study of the literature, we got the idea to use the P1 phage, to which the EV strain was sensitive. Due to the Amirov's efforts, we were soon able to determine the conditions for lysogenization of this strain by the P1 phage and prove that it can transfer genes of the EV strain to *E. coli*; i.e., that it was capable of transduction. It must be noted that Lawton and Molnar carried out lysogenization of *Y. pestis* by the P1 phage in 1972, but we found out about their work only after the corresponding research was completed at the Extrachromosomal Heredity Laboratory.[62] In addition, as far as I know, no one abroad followed up on Lawton and Molnar's findings.

The second step in expanding the capabilities of heterologous transduction was the lysogenization of the plague microbe by the lambda phage.

Another approach to transferring foreign genetic information was to reproduce on the plague microbe an "induced" transformation (and transfection) developed on *E. coli*. Since then, this method has been widely used in practice.

All our data on transduction and transformation of *Yersinia*s was documented in the form of inventor's certificate applications (we received about 10 inventor's certificates) and some data were published in the above-mentioned classified works of organization PO Box A-1063. E.Ya. Amirov's findings were documented in a classified doctoral dissertation, which, however, he was unable to defend for reasons beyond his control.

As I said before, *Glavmikrobioprom* built special institutes for high-risk pathogen work. One of these was the SRCAM, near Obolensk in the vicinity of Moscow. Because of a shortage of trained personnel, even before the construction of the SRCAM was completed, V.D. Belyaev

[62] [Author's note 6, in the original.] W.D. Lawton and D.M. Molnar, "Lysogenic conversion of *Pasteurella* by *Escherichia coli* bacteriophage P1 CM," *Journal of Virology* 9 (April 1972), pp. 708-09.

assigned me to lead the scientific work that was starting there. For a number of reasons, the tularemia pathogen [*Francisella tularensis*] ended up being the main subject of research at this institute. At the time, very little was known about the genetics and biochemistry of this pathogen.

For nearly four years from 1978, I commuted the 120 kilometers from Moscow to the SRCAM every week. Working with the colleagues assigned to help me there, I tried to impart to them all my knowledge and experience accumulated during years of work in the AP system, and particularly at the Extrachromosomal Heredity Laboratory. Everything had to be started from scratch, including organizing special laboratories and establishing a collection of live cultures of altered microorganisms, the main source of which was the Extrachromosomal Heredity Laboratory. In 1982, on orders from Rychkov, the new head of *Glavmikrobioprom*, I transferred nearly the entire collection of lyophilized cultures of *E. coli*, pseudomonads, pseudotuberculosis pathogens, and intestinal yersiniosis pathogens to SRCAM. The true value of all these cultures is hard to imagine![63] In addition to this, I laid the foundations of the "special literature" collection at the SRCAM, donating tens of books and collected works on problems of high-risk infections, including my publications as director of the Irkutsk and Rostov AP institutes.

The tularemia microbe turned out to be a "tough nut to crack." Everything that was easy to reproduce on *Yersinia*s and other microbes took a long time to accomplish with the tularemia microbe. It did not even help to bring my best colleagues, L.Ya. Ryapis and E.Ya. Amirov, to work at the SRCAM. The key to solving many of the problems was found only after several years. It turned out that the reason for the initial failures had to do with the distinguishing features of the DNA-dependent-RNA-polymerases of the tularemia microbe (as was in the case of the hay bacillus, see above).

I cannot keep from bragging; to this day, no one has surpassed our work on the molecular genetics of the tularemia microbe!

However, do not think that the Extrachromosomal Heredity Laboratory was involved only in secret research. In the 13 years of its existence, that is, until I left in 1987, we published a large number of articles, both in our country and abroad, on various topics concerning the molecular genetics of nonpathogenic bacteria. In addition, researchers at the Extrachromosomal Heredity Laboratory always participated in the annual conferences on the "Plasmid" program, which was established at my initiative under the sponsorship of the Interdepartmental Council on Problems of Molecular Biology and Genetics of the USSR Academy of Sciences and funded by *Glavmikrobioprom*. However, all this was only a cover for the main work of the Extrachromosomal Heredity Laboratory, of which I have recounted only a small part. (The Extrachromosomal Heredity Laboratory closed in 1987.)

[63] [Author's note 7, in the original.] In 1989, when I [Domaradsky] was asked for several strains from this collection, they offered to purchase them. This means that the people at the SRCAM were well aware of the value of the strains!

In 1982, I was transferred to the SRCAM because the director there, Major General [Nikolay N.] Urakov, felt that the Extrachromosomal Heredity Laboratory was "taking me away from the main" work, and he convinced the leadership of Organization PO Box A-1063 of this. Urakov's insistence was stronger than my arguments, and as a result, the status of the Extrachromosomal Heredity Laboratory was rescinded. Because the Extrachromosomal Heredity Laboratory was well equipped and had a large staff, the leadership of the Research Institute of Protein Synthesis, for which the Extrachromosomal Heredity Laboratory was always a thorn in the side, took advantage of this and decided to change its subject area. There was a gradual decrease in the size of the staff and increasing pressure on the remaining personnel. I was not able to defend it as I had been in the past, and I did not want to work on the production of protein-vitamin concentrates. In addition, it became more difficult to travel to the Extrachromosomal Heredity Laboratory from Obolensk, where the SRCAM was located. In the end, I was forced to let go of the Extrachromosomal Heredity Laboratory, but as a result, I lost a great deal. In general, the demise of the Extrachromosomal Heredity Laboratory was preordained, because after the death of V.D. Belyaev, my disagreements with Organization PO Box A-1063 on a number of fundamental issues sharpened, and Organization PO Box A-1063 viewed shutting down the laboratory as a sort of punishment for "insubordination." Urakov was the driving force behind this; he took undisguised pleasure in bossing around "some civilian."

Looking back, I often ask myself, to what extent was all this justified? My main work, what I consider my legacy, is kept behind the seven seals of the "special problem" for which Organization PO Box A-1063 was created [i.e. biological weapons development]. Now my legacy is buried under the fragments of this organization, which disintegrated along with the rotten-to-the-core state of "universal brotherhood and equality."[64] Recently, I obtained access to the Medline information system and in the enormous amount of literature on *Yersinia*s from 1969 through 1991, I could not find any mention of my name! It turns out that I wasted nearly half of my adult life. Is this not a lesson for the future generation of scientists who might be tempted by the "privileged conditions" of working in closed systems? I cannot speak for others, but the system of Organization PO Box A-1063 stimulated practically no scientific inquiry, stifled initiative, prevented people from interacting, attempted to isolate them from one another, suppressed freedom of movement, and established all the conditions for "helping oneself" to other peoples' data and ideas, or to put it plainly, plagiarism. In general, everything that occurred there could actually be called a violation of human rights guaranteed by the Constitution. Of course, every government has its secrets; there is no getting around this. However, scientific work should be led by intelligent, literate people who will not turn creative work into forced labor.

[64] Marxist communism, as espoused by the Soviet state, held these principles of universal brotherhood and equality as central tenets of its declared moral code.

I touched on only one aspect concerning the activity of Organization PO Box A-1063, which I recently called "a phantom organization."[65] But it was enough to provide a general idea of what it was.

Now I return to my title. Why "Plague in Moscow"? Was what I described not a plague that kills all living things?

Concerning the History of the Development of the Tularemia Vaccine

I. M. Gabrilovich (pp. 176-81)

This essay describes the history of the research and development of the tularemia vaccine, including the dispute between B. Elbert and N. Gaysky.

Secrecy shrouded many aspects of the development of the live tularemia vaccine. Relatively little was known about the tularemia bacterium until the 1960s. Gabrilovich attributes these conditions as the cause of the dispute between professors Boris Elbert and Nikolay Gaysky, and the proponents of each, over which of them should be credited with the development of the vaccine.[66]

According to Gabrilovich, "Tularemia vaccine was developed by Boris Elbert and Nikolay Gaysky in a closed establishment, the Biotechnical Institute of the People's Commissariat of Defense, circa 1932-36. All materials relating to its development were classified" (177). In 1961, professor N.M. Faybich obtained from the Main Medical Administration, USSR Ministry of Defense, a photocopy of Elbert's typewritten manuscript "Specific Prophylaxis of Tularemia," written in late 1936 and early 1937. Various contents of Elbert's manuscript are described. The manuscript includes detailed descriptions of experiments with the Moscow vaccine strain of the tularemia pathogen, demonstrating Elbert's key involvement in the vaccine's development.

Gaysky published "Tularemia Bacteria-Vaccine, Its Production and Application" in Irkutsk in 1944 under the classification "For Official Use Only." This book was the first to claim that the Moscow strain had been lost and that another, attenuated strain was later obtained. Given the restrictions of laboratory access, Gabrilovich expresses serious doubts that the strain was ever lost, but assumes that Gaysky felt that the statement was necessary at the time.

[65] [Author's note 8, in the original.] "*Na pozhiznenny srok?* [*Life sentence?*]" (*Pravozashchitnik*, No. 4, 1995).

[66] The object of this dispute is detailed in Y.A. Myasnikov, "My Encounters with Nikolay Grigorevich Olsufyev," *Interesting Stories…* 3 (1994), pp. 12-31.

Nikolay Tarasovich Bykov

Z.A. Bykova (pp. 182-88). One photograph (portrait of Nikolay Bykov).

This chapter is a biographical sketch of N. T. Bykov, researcher and director of Irkutsk AP Institute.

Bykov received a medical degree from North Caucasus State University in 1931. After his service in the army, he began his participation in plague control in various medical positions in the North Caucasus. After studying high-risk infections at Rostov AP Institute, he became director of the Stavropol AP Station in 1937. In 1940, he was appointed director of the Guryev Regional AP Station. Though Bykov had begun scientific research in 1935, few, if any, records of his early work remain. Due to secrecy restrictions, records of his work and accomplishments were stored at the Stavropol AP Station, but they were lost during the wartime evacuation of 1942.

During World War II, he participated in epidemic control work on the Stalingrad front and other areas. In 1944, he received his appointment as director of the Irkutsk AP Institute, and in 1946, he received his candidate of sciences degree. Between 1946 and 1948, he participated in fieldwork in Mongolia and China. He was killed in 1948 while riding in a car that was struck by a drunk driver. Through his life, he wrote a total of eighteen articles and manuscripts, some of which were left unpublished.

Up the Steep Slope

Igor Valerianovich Domaradsky (pp. 189-200)

This chapter is an autobiographical essay based on an excerpt from the author's 1995 book.[67] *It describes the history of the Irkutsk AP Institute and the author's experience as director of the institute from 1957 through 1964.*

As a former director, Domaradsky describes the fate of his predecessors at the Irkutsk AP Institute. N.A. Gaysky was arrested for political reasons in 1930 when he was director of the AP laboratory in Furmanovo village in the Urals. While serving a five-year sentence, Gaysky worked as a bacteriologist in a military laboratory.[68] The first director of the Irkutsk AP Institute, A.M. Skorodumov, was arrested in 1937 and died in an NKVD prison.

The Irkutsk AP Institute was traditionally strong in research on natural foci and, compared to other AP institutes, weaker in the area of microbiology. Domaradsky and his colleague, G.A. Yaromyuk, showed that fibrinolysin is an activator of blood plasminogen. He recalls that the institute hired a

[67] Igor V. Domaradsky, *Terevertisch* [Troublemaker, or the Story of An "Inconvenient" Man], Moscow: self-published, 1995). An expanded and updated version of Domaradsky's 1995 autobiography was later published in English; see Igor V. Domaradskij and Wendy Orent, *Biowarrior: Inside the Soviet/Russian Biological War Machine*, (Amherst, NY: Prometheus Books, 2003). The 1995 book caused Domaradsky several problems with Russian authorities since it described openly, for the first time, important and previously classified aspects of the Soviet offensive and defensive BW programs, as well as the AP system.

[68] See Yu.A. Myasnikov, "My Encounters with Nikolay Grigorevich Olsufyev," *Interesting Stories…* 3 (1995), pp. 12-31.

virologist and did virology research, noting that the only other AP institution with this capability was the Stavropol AP Institute. Irkutsk AP Institute also pioneered the production of cholera endotoxin. Domaradsky lists other achievements and innovations of the Irkutsk AP Institute during his term as director, and is especially proud of the many publications it generated.

Excerpt:

> In recent decades, much has changed at the Irkutsk AP Institute, and not for the better. In contrast with other AP institutes, it did not get attention from the powerful system of *Glavmikrobioprom*, which was established in the early 1970s in connection with the molecular biology boom. Therefore, the institute greatly lagged in acquiring new equipment and technology, which could not but affect the development of the institute. What a shame (p. 200)!

Aleksandr Kondratevich Shishkin, Director of the Rostov-on-Don AP Institute

Svetlanova Aleksandrovna Shishkina (pp. 201-09). Two photographs.

This chapter is a biographical sketch of A.K. Shishkin (1902-76), epidemiologist and director of the Rostov AP Institute, written by his daughter.

Aleksandr Shishkin, born in 1902, was orphaned at an early age. He first worked as a shepherd, then worked in the Kronstadt shipyard at age eleven, and eventually gained an education and graduated from the Rostov Medical Institute. In 1934, Shishkin became director of the Remontnoe AP post in the Rostov Region. Around the height of the Stalin repressions in January 1937, he was arrested as an "enemy of the people" and interrogated in prison for six months before the charges were dropped. In 1939, he was appointed director of the Rostov AP Institute. In October 1941, he organized the evacuation of the institute to Guryev. He conducted extensive epidemic control work on the southern front during World War II, then reestablished the institute in Rostov after the end of the German occupation. Under his leadership, the institute had a staff of leading scientists and made major advancements. He was forced to retire in 1963 as a result of internal politics, and died in 1976.

Excerpt:

> It was 1963. Aleksandr Shishkin was 61 years old. He would have been able to accomplish much more, but envy knows no bounds. Not all of the new administrative staff under him was unselfish and well-intentioned. At the time, the central government was applying pressure to reorient the institute's work. This produced changes in the organizational structure, and it became very difficult to resist this trend. A vicious internal battle began. Many of the most active people in the institute were forced out, as was the entire staff of the Communist Party

unit. In the new situation and without these people, Shishkin was left without any substantial support, and the opponents did not contribute very much to the Institute. In the late 1950s and early 1960s, the Rostov AP Institute had brought together many scientists to work on the Enzootic Areas Cleansing Program and the Chemical Vaccine Development Program.

Intrigues continued, and Shishkin retired, or, rather, they "retired" him. Then he had a severe heart attack, and, while delirious, kept repeating, "Why did they…?" But time heals, and he was surrounded by his beloved and loving wife, children, and grandson. Aleksandr Shishkin forgave everything, or almost everything, and in the last years of his life, told his eldest daughter that people are mostly good, and that there are more good people than evil ones.

Subsequently [after 1963], the institute became more involved in solving particular topics that had a less pronounced public significance.[69] New specialists arrived, bringing with them their own established interests in one or another area of science. Previously studied topics were dropped, along with the people who worked on them, and people switched to different areas, and this is always a time of low efficiency for long-range prospects (pp. 208-209).

Contribution of I.G. Ioff to the Epizootiology of Plague

Nadezhda Federovna Labunets (pp. 210-24)

This chapter is a review of fieldwork, laboratory research, and publications by I.G. Ioff on plague epizootiology, primarily in the areas of flea taxonomy and on climate and geographical factors in epizootiology.

Vladimir Nikolaevich Lobanov (biographical sketch)

V.V. Lobanov (pp. 225-31). Two photographs.

This chapter is a biographical sketch of V.N. Lobanov written by his son. It describes the father's background, scientific research, war experiences, and life in the AP system. Special note is made of the difficulties many AP personnel had in later years after the major objectives of the AP system had been achieved and the system lost the special status and esteem it previously held.

Excerpt:

Already separated from the AP system, Vladimir Nikolaevich [Lobanov] pondered its future: "The wide use of antibiotics has fundamentally changed the epidemiological situation regarding

[69] The word used in the Russian text for "particular" (*chastnye*), could be translated several other ways, including "private" or "special." This paragraph is worded circumspectly, but in context suggests that the institute began working on issues unrelated to public health.

plague. Previous preventive measures were excessive. The danger of bacteriological war is greatly diminished. Consequently, there must be a restructuring in the organization of research work, and a change in research priorities" (p. 230).

Notes on Epidemiologist Grigory Moiseevich Medinsky

Boris Nikolaevich Mishankin (pp. 232-44). Two photographs.

This chapter is a biographical sketch of G.M. Medinsky, a noted epidemiologist of tularemia, cholera, and leptospirosis, and also a specialist in defense against bacteriological warfare. It describes his personality, life, military service, and professional achievements.

At the Rostov AP Institute, Medinsky developed and implemented the concept of the specialized anti-epidemic brigade (SPEB). He served as a reserve lieutenant colonel of the medical service, worked as an AP researcher, and eventually acted as chief of the epidemiology department at the Rostov-on-Don AP Institute from 1967 to 1986. Remaining active in the field until the end of his life in 1995 or 1996 (the text is ambiguous on the precise date), Medinsky never found time to write the memoir that he had hoped to title "Notes of an Epidemiologist."

Excerpt:

In 1959, [Medinsky] defended his candidate's dissertation "Epidemiological Materials on Leptospirosis in the Estonian SSR," in which he summarized a broad scope of material on the natural foci of leptospirosis infection in this Baltic republic, information which he gathered during his service as chief of the Baltic Fleet high-risk infection laboratory in Tallinn.[70] By that time, Grigory Moiseevich [Medinsky] had acquired very valuable experience conducting studies, in a general sense and, in particular, on the topics of "bacteriological" attack cleanup procedures on shore units and ships of the fleet; of resolving issues arising from the interface between fleet services and the civil defense medical service; of conversions of general hospitals to include capabilities to handle high-risk infection; and of quarantine creation in a garrison in large cities.

He was the first to describe the previously unknown "island focus" of tularemia (on Saaremaa Island) in Estonia, and not long before his demobilization, he and coworkers A.A. Shaposhnikov, B.K. Dushenko, and others prepared the excellent *Manual on Bacteriological Defense of Naval Bases*. Of course, this manual was based on personal experience and observations made during his service. For example, in order to determine the possibility of decontaminating a submarine while under water, he, along with B.L. Shura-Bura, B.K. Dushenko, and I.F. Scherbakov, personally applied simulants to the vessel's hull, and after descending underwater with the crew, took samples for later analysis.[71] The need to

[70] In 1934, the Soviet Union established the "candidate of sciences degree," which was later classified as the equivalent to the PhD in the West.

[71] Simulants resemble BW agents but are non-pathogenic.

recommend the organization of rodent exterminations on warships prompted him, along with A.B. Dayter and A.A. Kruzhilny, to study the biology of black rats, which inhabited all the fleet's major bases.

He was interested in gray rats as carriers of leptospirosis (including the Monyakov type) in Estonia, as well as in studying various aspects of their behavior, particularly the speed of their movement in unfamiliar territories under experimental conditions. The state of world events occurring at the time gave rise to the latter interest; the Cold War had already begun, and the echoes had not yet died down from the trial of the Japanese military bacteriologist-physicians of the Kwantung Army who experimented on prisoners of war and civilians. Also, the war in Korea was underway, and there were loud accusations that the Americans were using bacteriological weapons against the peaceful citizens and army of North Korea. He was also acquainted with the Russian published version of the report by T. Roseberry and E.A. Kabat, with M.H. Boldt, entitled "Bacteriological War" (*J. Immunology*, 1947, vol. 56, no. 1), which, despite the incomplete and outdated information that it contains, undoubtedly had an influence in shaping the moral and political views of the young military physician (p. 238).

...in 1967, Medinsky was selected as chief of the department of epidemiology and organizational affairs, a post which he occupied until 1986, when health forced him to become a consultant. At the same time, he was chief of the laboratory for development of organizational questions of anti-bacteriological defense (p. 241).

...he participated in writing Chapter 5 of the monograph by I.V. Domaradsky, *Pathogens of Pasteurellosis and Closely Related Diseases* (1971), and wrote in detail as co-author with R.B. Goldin, A.M. Myasnenko, V.S. Grikurov, and V.N. Sagatovsky on the tasks of bacteriological surveillance and its organization in the book *Bacteriological Surveillance and Detection of Bacteriological Agents* (Moscow, 1971). He returned to the subject of anti-bacteriological civil defense in *Manual for Medical Service of Civil Defense* (A.I. Burnazhan, editor, Moscow, Meditsina, 1983), in which he, along with A.M. Myasnenko and M.I. Krasulin, laid out the principles of anti-bacteriological defense and medical aid to victims of bacteriological (biological) weapons. This theme was reflected also in his doctoral dissertation (1981) (p. 242).

The March of the Plagueologists

I.V. Khudyakov (p. 245)

This is a short chapter that contains lyrics to a song in four verses about members of the AP service, written in 1970. The name of the tune is not given.

Excerpt:

No medals we received,
In rain and melting ice,
For treading 'cross the flow of rivers strong!
Far off from darling eyes,

from urban paradise,
Gray marmots there received us in their song. […]

Doctors, zoologists, where are our
years of youth!?...
We lived among the mountain passageways!...
Go on, ye' ol' horse, take the path yet unexplored,
The path with no repose, - the path
of plague!

Epistolary Support for Saving the AP System

Boris Nikolaevich Mishankin (pp. 246-58)

This chapter contains reproductions of the letters exchanged between AP scientists and government bureaucrats discussing the requests of the former for financial support and assistance in reorganizing the AP system structure.

Full translation:

In 1996, the situation in the anti-plague (AP) system deteriorated: deferred paychecks, forced unpaid leave, and lack of funding to pay for operations, including surveillance of natural plague foci. Massive layoffs began, and many employees decided to leave. In our view, the situation began to threaten not only the further operation of the AP system, but also the epidemic safety of the country. This prompted us in May 1996 to send a letter to Aleksandr Yakovlevich Livshits, Russian Federation Presidential Aide for Economic Issues. The text of this letter follows.

Dear Aleksandr Yakovlevich,

Following on the article "Dislodged," published in Moskovsky Komsomolets newspaper on May 14, 1995, we would like to inform you that Rostov-on-Don Anti-Plague Research Institute is the name of the establishment where, by the start of the May holidays, the staff had only been paid through the first half of February. Beginning May 1, all the scientists at this institution, at their own "request," were put on unpaid leave for two months, and some were terminated. A similar situation occurred at other anti-plague institutes in Irkutsk, Saratov, Volgograd, and Stavropol.

For many decades, employees of the anti-plague institutes and stations have protected the country against epidemics of many high-risk infections: plague, cholera, tularemia, brucellosis, and leptospirosis. It was they who eradicated the cholera epidemic in 1965 in Uzbekistan, where over 500 cases were recorded, and the epidemics of 1970-73 in Odessa, Astrakhan, Kerch, Dagestan, Donetsk, Rostov-on-Don, Azov, and other cities of the Soviet Union.

Today in the Russian Federation, no one is better trained in high-risk infections than the specialists

of the anti-plague system, which is part of the Russian Federation State Committee for Sanitary-Epidemiological Surveillance (Goskomsanepidnadzor). Therefore, it is entirely natural that here at the Stavropol Anti-Plague Research Institute we have the world's only WHO Information Center for plague.[72] Please give these specialists a minimum opportunity to engage in scientific and practical work by paying them regularly in full and providing minimum funding to maintain the facilities.

Presently in the Russian Federation, there are active natural plague foci in Astrakhan Region, Kalmykia, Dagestan, Kabardino-Balkaria, Stavropol Region, the Pamir and Altay mountains, and the Transbaykal area. In addition, active natural foci of plague are spread along nearly the entire border with Kazakhstan, Azerbaijan, Mongolia, and China. But plague recognizes no borders!

Let's recall some figures. From 1920 through 1989, there were 3,699 cases of plague in the Soviet Union, resulting in 2,660 deaths. A few cases have occurred until the present time. However, these cases have been few because they were quickly identified, the infection foci were contained, and the people were treated. Cholera in Dagestan in 1993-94, where over 1,000 cases and vibrio carriers were identified (the real numbers were several times higher than this), was the first serious warning that the sanitary-epidemiological service and its anti-plague system are disintegrating.

Brief Overview

In 1840, Russia spent about 300,000 rubles (remember what a ruble was worth at that time!) to maintain its quarantine service (the predecessor of the present anti-plague system). In 1979-82, about 30 million rubles was spent on the anti-plague system. There is no information on the funding for the last few years, but judging by the state of affairs in the anti-plague institutes and stations, at best only enough money is allocated to pay salaries.

The quarantine service of our country and its successor, the anti-plague service, were built over a period of nearly 150 years. The 100th anniversary of the founding of the first anti-plague establishments in Russia is coming up. Who is going to preserve this system in our times without financial support? We haven't even mentioned fundamental scientific research at the anti-plague institutes.

Thus we are speaking of the anti-plague institutes and stations of the Russian Federation State Committee for Sanitary-Epidemiological Surveillance. We specifically mentioned the Rostov-on-Don Anti-Plague Research Institute (Director, Yury Mikhaylovich Lomov, professor, doctor of medical sciences) because we have somewhat more information concerning the financial situation there.

[72] Since 2009, there has been a WHO Collaborating Center for Plague at the Aikimbayev's Kazakh Scientific Centre for Quarantine and Zoonotic Diseases in Almaty, Kazakhstan.

We are writing to you, Aleksandr Yakovlevich, because we are concerned about the fate of the anti-plague system. Before transferring to Moscow, we worked in the system for many years as it blossomed and gained world renown.

I.V. Domaradsky worked in the system for 25 years, 16 of which as director of the Irkutsk and Rostov-on-Don AP Institutes.

Yu.G. Suchkov was director of the Stavropol AP Institute for four years, and also has a total of 25 years of service in the system.

M.I. Levi was deputy scientific director at the Stavropol AP Institute for three years and headed the epidemiology department at the Rostov-on-Don AP Institute for six years.

I.V. Domaradsky, Academician, Russian Academy of Medical Sciences, honored scientist, professor
18-46 Kutuzovsky Prospekt, Moscow, 121151

Yu.G. Suchkov, Doctor of Medical Sciences, professor
36a-21 Kosmodemyanskikh St., Moscow, 125130

M.I. Levi, Doctor of Medical Sciences, professor
23-3-18 Amurskaya St., Moscow, 107207

Our letter to the Russian Federation Presidential Administration was answered two months later. The reply was signed by A.A. Monisov, Deputy Chairman of the Russian Federation State Committee for Sanitary-Epidemiological Surveillance.

RUSSIAN FEDERATION
STATE COMMITTEE FOR SANITARY-EPIDEMIOLOGICAL SURVEILLANCE
(Russia *Goskomsanepidnadzor*)

TO: SCIENTISTS-EPIDEMIOLOGISTS
I. Domaradsky
Yu.G. Suchkov
M.I. Levi

8/13/96 No. 329-K-14
Ref.: No. A1-5401L of 7/29/96

Regarding your letter to Aleksandr Yakovlevich Livshits, Russian Federation Presidential Aide, and the Russian Federation State Committee for Sanitary-Epidemiological Surveillance would like to inform you of the following.

Funding for the Russian Federation State Committee for Sanitary-Epidemiological Surveillance in the current year is provided according to the indicators established by the Russian Federation Federal Law "On the federal budget for 1996" and the priorities specified by article 67 of this law.

In connection with a substantial shortfall in federal budget income and the priority of directing the available funds toward implementation of Russian Federation Presidential Edict No. 66 of January 19, 1996, "On measures to ensure the timely payment of wages from budgets at all levels, pensions, and other social expenses," the Russian Federation Ministry of Finance is not able to fully fund the expenses of the Russian Federation State Committee for Sanitary-Epidemiological Surveillance as provided in the federal budget or ensure a uniform allocation of the budget funds. Correspondingly, the Russian Federation State Committee for Sanitary-Epidemiological Surveillance is funding its establishments within the limits of the funds allocated by the Russian Federation Ministry of Finance for payment of wages and benefits. This money is directed to funding of expenses for wages, food, and medicines.

Thus for the first six months of the current year, the Russian Federation State Committee for Sanitary-Epidemiological Surveillance was funded under the "Public health" section at a level of 65.8 percent of the designated indicators for this period, including full funding for wages and benefits. The acquisition of medicines was funded at a level of 31 percent. There was practically no funding for the other expense items.

Moreover, the Russian Federation State Committee for Sanitary-Epidemiological Surveillance budget was approved by the Russian Federation Ministry of Finance at a level of 45 percent of the requested amount.

The Rostov-on-Don Anti-Plague Research Institute is funded on a monthly basis through the Federal Treasury (bypassing the Russian State Committee). During the first half of 1996, the institute was funded at a level of 90.9 percent of the approved budget, including full funding for wages and benefits. Funding for acquisition of medicines was at a level of 82.5 percent. In July, the Federal Treasury recalculated the wages and benefits for July of that year to 211.0 million rubles and also 2.4 million rubles for acquisition of medicines.

Therefore there is no shortfall in payment of wages for the first seven months of 1996.

Despite the serious difficulties in implementing the federal budget, the Russian Federation State Committee for Sanitary-Epidemiological Surveillance is doing everything possible to provide more complete funding for essential expenses of the State Sanitary Epidemiological Service during the current year.

Deputy Chairman of the State Committee A.A. Monisov

We immediately sent a copy of A.A. Monisov's letter to the director of the Rostov AP Institute and as result, the funding situation for the institute improved for a time. However, there were no substantial changes in the situation for the AP establishments. Therefore, a group of specialists who had left the AP system for various reasons got together and, after lengthy deliberations, wrote a letter to the Russian Federation MOH, the text of which is given below. Some of the signers were executives in the AP system in the 1960s and 1970s.

TO: TATYANA BORISOVNA DMITRIEVA, RUSSIAN FEDERATION MINISTER OF HEALTH

Dear Tatyana Borisovna:

At present, the anti-plague service of Russia is experiencing considerable difficulties related to the lack of full funding and the impossibility under these circumstances of supporting the normal operation of all anti-plague establishments. The need to safeguard public health with regard to high-risk infections (plague, tularemia, anthrax, brucellosis, and cholera) and to ensure sufficient funding prompted us, who worked for many years in anti-plague establishments, to propose a reorganization of the system to result in fewer establishments and changes in their assigned duties. Our proposals are based on the following principles:

1. There would be fewer practical anti-plague establishments, and also fewer anti-plague research institutes.

2. If the proposals are adopted, the financial burden on the federal budget would not exceed the real expenditures for 1996.

3. A local commission would be established to determine the structure, staff, and amount of budget funding for each specific anti-plague establishment. The commission would be obliged to complete its work by January 1, 1997.

4. To help these commissions during the reorganization period, the Russian Federation MOH would establish a Public Council consisting of experts with long experience in scientific, practical, and administrative work in anti-plague establishments.

5. In areas served by anti-plague establishments, these establishments would perform the functions of the high-risk infection centers of the sanitary-epidemiological service.

6. The anti-plague station divisions that would be shut down could be used as bases for temporary epidemic response teams, as well as for storage of chemicals and equipment for controlling rodents and high-risk infection vectors.

Attachment: Proposals for reorganizing Russian Federation anti-plague establishments.

K.A. Kuznetsova: worked in the anti-plague system 37 years, including director, plague prevention department, and deputy director, Main Administration for Quarantine Infections, USSR MOH.

L.M. Marchuk: worked in the anti-plague system 22 years, including director, high-risk infection department, and deputy director, Main Administration for Quarantine Infections, USSR MOH.

I.V. Domaradsky: academician of Russian Federation Academy of Medical Sciences, doctor of medical sciences, professor. Worked in the anti-plague system 25 years, including director, Irkutsk and Rostov anti-plague institutes.

Yu.G. Suchkov: doctor of medical sciences, professor. Worked in the anti-plague system 25 years, including director, Stavropol Anti-Plague Institute, and department director, Rostov Anti-Plague Institute.

M.I. Levi: doctor of medical sciences, professor. Worked in the anti-plague system nine years, including deputy scientific director and epidemic department director, Rostov Anti-Plague Institute.

N.N. Basova: doctor of medical sciences. Worked in the anti-plague system 10 years, including director, Virology Department, Stavropol Anti-Plague Institute, and senior scientist, Rostov Anti-Plague Institute.

R.S. Zotova: candidate of medical sciences. Worked in the anti-plague system 22 years, including laboratory director, Turkmen Anti-Plague Station.

Ye.G. Yudina: candidate of medical sciences. Worked 10 years as scientist at the Rostov Anti-Plague Institute.

L.A. Ryapis: doctor of medical sciences, professor, academician of Academy of Medical Sciences. Worked 16 years at the Rostov and Volgograd anti-plague institutes.

I.V. Ryapis: candidate of medical sciences. Worked in the anti-plague system 16 years: at Astrakhan Anti-Plague Station, Rostov and Volgograd anti-plague institutes, including five years as laboratory director.

Ye.V. Rotshild: doctor of biological sciences. Worked in the anti-plague system 24 years, including zoologist, Aral Sea Anti-Plague Station, and scientist, Mikrob All-Union Anti-Plague Research Institute.

L.V. Vuchetich: candidate of biological sciences. Worked 18 years at Rostov Anti-Plague Institute.

N.F. Darskaya: candidate of biological sciences. Worked in the anti-plague system 30 years, including

at Chita Anti-Plague Station and as director, parasitology laboratory, Stavropol Anti-Plague Institute.

G.D. Ostrovsky: candidate of medical sciences. Worked in the anti-plague system 33 years, including director, High-Risk Infection Department, USSR MOH.

I.V. Khudyakov: Worked 37 years in various anti-plague stations of the USSR MOH.

Please send your reply to: M.I. Levi, Director, Test Laboratory Center, 9 Yaroslavskoe Highway, Moscow, 129348. Telephone: 183-3747. Fax: 183-5038.

10/29/96

Attachment

Proposals for reorganizing the anti-plague establishments of the Russian Federation

1. Supervision of the anti-plague establishments

1.1. All anti-plague establishments would be supervised by the Russian Federation MOH for operational matters and by Mikrob (Saratov) for methodological and scientific matters.
1.2. Anti-plague establishments would report individually to the Russian Federation MOH.

2. Anti-plague stations

2.1. Anti-plague stations would operate according to traditional plans approved each year by the Russian Federation MOH.
2.2. The structure, staff, and operating plans of each anti-plague station would fully conform to the budget funding.

3. Anti-plague institutes

3.1. Mikrob All-Union Anti-Plague Research Institute would be the lead institute for plague, tularemia, anthrax, and brucellosis. The main functions of the institute would be:
3.1.1. Supervise methodologies used in all anti-plague establishments in western Russia.
3.1.2. Conduct research and interact with WHO and anti-plague establishments in the near abroad and other countries.
3.1.3. Provide information to anti-plague establishments in Russia, the near abroad, and other countries, and handle publishing.
3.1.4. Produce bacterial and immunological preparations.
3.1.5. Participate in measures during emergency epidemic situations.
3.1.6. Examine high-risk infection control activities of local public health agencies.
3.1.7. Conduct specialization courses and continuing education on high-risk infections and participate in licensing of anti-plague establishments and specialists.
3.1.8. Operate the Academic Council that qualifies the awarding of academic degrees.
3.2. Irkutsk Anti-Plague Research Institute would be the regional institute for Siberia and the Far East.

The main functions of the institute would be:
3.2.1. Supervise methodologies used in all anti-plague establishments in eastern Russia.
3.2.2. Conduct research and interact with anti-plague establishments in Mongolia and China.
3.2.3. Produce bacterial and immunological preparations.
3.2.4. Participate in measures during emergency epidemic situations.
3.2.5. Examine high-risk infection control activities of local public health agencies.
3.2.6. Conduct specialization courses and continuing education on high-risk infections and participate in licensing of anti-plague establishments and specialists.
3.3. Rostov Anti-Plague Research Institute would be the lead institute for cholera. The main functions of the institute would be:
3.3.1. Supervise cholera control methodologies used in all anti-plague establishments and local public health agencies.
3.3.2. Conduct research.
3.3.3. Provide cholera information to anti-plague establishments and local public health agencies.
3.3.4. Produce erythrocyte test kits for serologic diagnosis of high-risk infections, as well as culture media for the same purpose.
3.3.5. Participate in measures during emergency epidemic situations.
3.4. Stavropol Branch of Mikrob All-Union Anti-Plague Research Institute would have the following main functions:
3.4.1. Produce bacterial vaccines: plague, tularemia, and brucellosis.
3.4.2. Conduct research.

Table 4: List of Russian Federation Anti-plague Establishments After Reorganization

Name of establishment	**Division (branch)**
Mikrob All-Union AP Research Institute	Stavropol Branch
Irkutsk AP Research Institute of Siberia and the Far East	
Rostov AP Research Institute	
Astrakhan AP Station	Dosang Division
Altay AP Station (Gorno-Altaysk)	Yandyki Division
Dagestan AP Station (Makhachkala)	Kizlyar Division
Kabardino-Balkar AP Station (Nalchik)	
Moscow AP Station	
Novorossiysk AP Station	Sochi Division
Primorsky AP Station (Ussuriysk)	Nakhodka Division
St. Petersburg AP Station	
Chita AP Station	Borzya Division
Tuva AP Station	Kyakhta Division
Elista AP Station	

An article entitled "Are plague outbreaks inevitable?" was published in the *Meditsinskaya Gazeta* newspaper, No. 16(58), August 16-31, 1996. The author, Mariya Shchetinina, presented a detailed justification for the reorganization, thus making it unnecessary for us to do that here.

Thus, the proposed reorganization would provide for epidemic safety and preserve the basic framework of the anti-plague system. The cost of maintaining the system would not exceed the levels of funding in 1996. Anti-plague establishments would be funded directly without going through intermediaries. Three months have passed since this letter was sent to the Russian Federation MOH, with no reply. Telephone calls to the secretary of First Deputy Minister G.G. Onishchenko were fruitless. One time, the secretary said that she could do nothing to help us. This answer was followed by a question: do you have the letter? Thus, the leadership reacted to the collective letter, but at the same time negated our right to receive an answer. In the end, there was only silence...

Forgotten Photographs

Moisey Iosifovich Levi and Yury Grigorevich Suchkov (pp. 259-314). 48 photographs.

This section contains photographs (individual portraits and group photographs), some accompanied by brief biographical sketches, of AP system personnel.

The subjects of the photographs include the following:

Aleksandr Grigorevich Nikonov
Yury Mikhaylovich Rall
Petr Nikitich Stupnitsky
Vartan Nikitich Ter-Vartanov
Grigory Alekseevich Balandin
Lev Ivanovich Leshkovich
Nadezhda Nikolaevna Basova
Lyubov Nikolaevna Makarovskaya
Veronika Semenovna Uraleva
Lev Aleksandrovich Zilber
Viktor Mikhaylovich Gubarev
Aleksandr Iosifovich Tinker
Luka Yegorovich Khundanov
Gennady Borisovich Minkov
Ivan Khristoforovich Ivanov
Petr Andreevich Zinin
Mikhayl Lvovich Bekker
A.M. Mikulin
Umar Akhmetovich Mamed-Zade
Anatoly Zakharovich Lenchitsky

Nikolay Aleksandrovich Abesadze
Ivan Semenovich Maloletkov
Anatoly Mikhaylovich Myasnenko
Zinaida Vissarionovna Yermolyeva
Elena Alekseevna Vedmina
Yury Vladimirovich Kanatov
Innokenty Stepanovich Soldatkin
Margarita Vasilyevna Pryadkina
Valent Viktorinovich Kucheruk
Aleksey Ilich Dyatlov
Yury Grigorevich Chernukha
Ivan Danilovich Ladny
Vladimir Petrovich Sergiev

Alphabetized Index of Names in Volumes 1–5

(pp. 315-40)

Not included in this paper.

VOLUME 6 (1997)

Foreword

Moisey Iosifovich Levi (p. 3)

Introduction to the sixth volume of the "Interesting Stories..." series.

Full translation:

> The year 1997 marks the 100th anniversary of the Russian AP system, and we are doing what we can to mark this noteworthy date.
>
> To some extent, each volume has published materials illustrating the history of the AP system as personified by its leading participants. In addition to historical materials, this volume contains information reflecting the current situation in the field of high-risk infections.
>
> One good reason for turning to the past is to look through it as a prism into the future. However, to be a passive observer would not be appropriate here, because the nature of the future will largely depend on the constructive work that must be done in the present. This is the main intention underlying this series.
>
> The flow of "forgotten" photographs has begun to wane, and we again ask our readers to provide us with suitable photographic materials.
>
> M.I. Levi, Editor

100th Anniversary of the AP Service

Klavdiya Aleksandrovna Kuznetsova (p. 4-23). One photograph (portrait of author), 1 table, 13 references.

This essay describes the history of the institutions, activities, and leading personnel of the AP service during the tsarist, Soviet, and post-Soviet eras.

The first plague control measures were at ports of entry: in the 1840s, there were 66 quarantine points: 44 at land entrances and 22 at seaports. Plague research and vaccine development began at Fort Alexander near Kronstadt in 1899, and the first plague laboratory opened at Astrakhan in 1901.

During the Soviet era, Mikrob opened in 1918. The AP system expanded to a peak in 1970s; its institutes conducted wide-ranging research on [plague], cholera and other infectious diseases. However,

after the end of the Soviet Union, the AP system disintegrated and fell under the jurisdiction of new governments. Inadequate funding remains a problem to this day.

Logical Model of Plague Enzoosis (Supplement)

Moisey Iosifovich Levi (pp. 24-34). Eight references.

This chapter is an addendum to a chapter in previous volume, namely M.I. Levi, "Logical Model of Plague Enzoosis" (vol. 5, pp. 51-129).

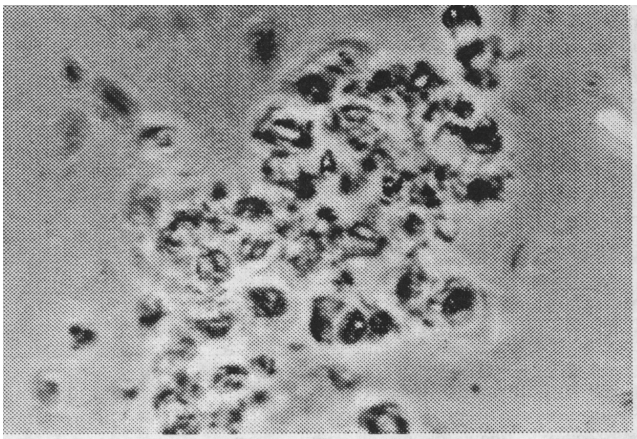


Рис. 1. L-формы чумного микроба. Фазовый контраст. Об х 90, Ок х 10 (фото Г.С.Дунаева).

Рис. 2. Колонии L-форм чумного микроба в виде "яичницы-глазуньи". Шестисуточная культура х40 (фото Г.С.Дунаева).

Figure 1 (top): L-forms of the plague microbe. Phase contrast. Figure 2 (bottom): Colonies of L-form of the plague microbe of the "fried eggs" type. Six-day cultures. (Photos by G.S. Dunaev.)

The chapter notes the differences in the education of zoologists and physicians, two major professions employed in the AP system. The author describes the pleasure of working in a scientific environment with many crossover specialists.

The article sets forth a possible explanation of how plague epizootics start explosively, acknowledging that proof of the hypothesis is lacking. It describes the variability of the plague microbe during epizootics. Manifestations of the different phenotypes of the plague microbe (i.e. "live" and "burrow" varieties) can explain the self-fluctuating nature of plague epizootics.[73]

History of an Idea

L.F. Zykin (pp. 35-52). One photograph (portrait of author), four figures, two tables.

This chapter is, in effect, a scientific essay describing the development of a new method of laboratory and field detection of the L-form of the plague microbe.[74]

[73] The plague microbe assumes a "live" form when it populates a mammal host, whereas it takes on a "burrow" phenotype when it exists in the soil environment, for instance, at a sub-critical temperature. This characteristic of the plague microbe allows it to survive between epizootic outbreaks, when signs of plague are not observed.

[74] The distinction of L-form microbes designates those strains of bacteria that lack cell walls, but which are derived from strains that normally do.

Zykin notes that there are a number of different views and controversies concerning the L-form of the plague microbe. Mikrob formed a commission to discredit the work on the L-form done at Volgograd AP Institute.

The methodology for detecting L-form in animals was officially adopted in 1983 and quickly resulted in new research findings. This enabled research to be undertaken to develop a method of detecting *Y. pestis* in ectoparasites. Highly sensitive radioimmune and immunoenzyme detection methods came out of such work, and various field surveys employing these new methods indicated that the L-form, in fact, played a unique role in epizootics.

The author criticizes the views published by V.S. Larina in 1992 regarding L-form residence in protists, arguing that her works lack specificity and are poorly written. Zykin concludes that research on the L-form has been fruitful and has great potential for the increased understanding of plague.

Bacterial Contamination of Culture Media and Yersinia pestis EV Vaccine

Yu.G. Suchkov and M.I. Levi (pp. 53-59). Two tables.

This chapter is a scientific essay that provides an overview of research conducted at Stavropol AP Institute between 1963 and 1993, which sought to understand the effects of contaminants in plague vaccines produced in culture media secured from Russian sources.

Studies undertaken at the Stavropol AP Institute demonstrated that the EV plague vaccine manufactured in Russia often contained bacterial contamination (*Bacillus stearothermophilus*), most likely due to spores persisting in the culture media. To reduce the possibility of such contamination, Suchkov and Levi recommend that manufacturers update their vaccine production technology and begin testing the sterility of culture media and vaccines.

Isaak Iosifovich Rogozin: Organizing the Control of Infectious Diseases

Ivan Semenovich Khudyakov (pp. 60-144). Six figures, timeline of life events, list of major textbooks and reference works.

This chapter is a biographical sketch of I.I. Rogozin, researcher, practitioner, field leader, government official, teacher, academic advisor, author, and editor.

Rogozin made many contributions to the theory and practice of infectious disease control. He accomplished much in his areas of expertise, which included plague, cholera, brucellosis, typhoid

fever, epidemic typhus, and various types of encephalitis. Rogozin entered the Red Army medical service in 1922, was director of the MOH Main Sanitary Anti-Epidemic Administration between 1939 and 1951, authored numerous books and articles, and served as an academic advisor to many graduate students. He traveled extensively throughout the USSR and worked in other countries, including China and Czechoslovakia.

Excerpt:

> In 1956, Rogozin was transferred to the Epidemiology Department of the Military Medical Academy, where he was involved in research on detecting microbes in the environment and protecting troops and civilians against bacteriological weapons (p. 106).
>
> Rogozin promoted collaboration between military epidemiologists and the AP system (1955), involving epidemic-control fieldwork (p. 110).

Magdalina Petrovna Pokrovskaya

N.F. Labunets (pp. 145-58). One photograph (portrait of Pokrovskaya).

This chapter is a biographical sketch of M.P. Pokrovskaya, an accomplished researcher who worked at several institutes within the AP system.

Pokrovskaya achieved much in her career. She discovered a plague bacteriophage and developed live intravenous and aerosol vaccines for plague, which she tested on herself. She worked at AP institutes at Saratov, Rostov, Stavropol, and Moscow. Pokrovskaya developed a successful method of treating tuberculosis that used antibiotics and biostimulators, although its details were kept secret and in 1997 had still not been revealed by her collaborators.

Nikolay Ivanovich Kalabukhov, as I Knew Him

Ivan Semenovich Khudyakov (pp. 159-66)

This chapter is a biographical sketch of N.I. Kalabukhov, a zoologist of the AP system. It describes the author's encounters with Kalabukhov on two occasions during fieldwork undertaken in Turkmenistan in 1952 and 1954.

Kalabukhov graduated from Moscow State University in 1932, and then worked at the Institute of Zoology until the start of World War II. He enlisted in the reserves, was wounded, and after having recuperated entered the military epidemiology service. Kalabukhov joined the AP system in 1951 at the Astrakhan AP Station, later taking a job at the Biological Institute, Far East Branch, USSR Academy of Sciences. However, he returned to Astrakhan after contracting tick-borne encephalitis.

General (About Nikolay Ivanovich Nikolaev)

L.F. Zykin (pp. 167-77). One photograph (portrait of Nikolaev).

This chapter is a biographical sketch of N.I. Nikolaev (1903-81), a military epidemiologist and microbiologist who became director of the Mikrob Institute.

After graduating from the department of medicine at Voronezh University, Nikolaev held various positions in the Soviet Army as a military epidemiologist and microbiologist. He served during World War II and was a pioneer in the use of streptomycin for treating plague in Manchuria. Nikolaev gained experience in cholera control and, in the mid-1940s, became a specialist in the production of bacterial preparations using the latest technologies.

He was director of Mikrob from 1960 to 1972, although the end of his tenure was marred by the controversy that resulted from the publication of various scientific works by his deputy director, A.K. Adamov, another former military officer. Nikolaev and Adamov were fired from their posts, although Adamov remained at Mikrob as a laboratory director. Nikolaev ended his career as physician-epidemiologist at a regional sanitary epidemiological station.

Yevgeniya Ilinichna Korobkova: A Serene Person

L.V. Samoylova (pp. 178-84). Two photographs (including portrait of author).

This chapter contains a biographical and character sketch of Professor Korobkova (1893-1970), who made important contributions to plague vaccine research and wrote an important monograph on cholera.

Korobkova began her university studies at the Sorbonne in Paris in 1913, transferred to the medical faculty of Saratov University in 1915, where she specialized in microbiology. As a third-year university student, she began working at Mikrob, which opened in 1918. Upon graduation in 1920, she served in the Red Army, but returned to work at Mikrob in 1921, where she remained for the rest of her career.

Our 'Immune Immunovich' (About Professor Vladimir Vladimirovich Akimovich)

L.F. Zykin (pp. 185-96). Two photographs.

This chapter is a biographical sketch of V.V. Akimovich (1912-68), a microbiologist whose research made important contributions to Y. pestis *genetics and virulence, as well as plague and cholera immunology.*

Akimovich spent most of his career at Saratov Medical Institute as a microbiologist although he moved to Mikrob in 1957. There, he had a full and rewarding career, beginning as a scientist, then rising to become director of the laboratory of experimental immunology and infection pathology. From 1964, Akimovich was the departmental head supervising the laboratory for microbiology and immunology of plague and cholera and the genetics laboratory. His laboratory was the first in Russia to develop methods for determining the virulence of *Y. pestis*. Through a process of selecting mutants with different sets of determinants, fundamental work conducted under Akimovich established the study of *Y. pestis* genetics in Russia.

Nikolay Prokofyevich Mironov

A.N. Mironov (pp. 197-210). Three photographs.

This chapter is a biographical sketch of N.P. Mironov (1911-86), a zoologist in the AP system, written by his son.

Born in a small village, Mironov was seven years old when his father died, leaving his wife to support herself and seven children by farming. Despite many hardships, Mironov earned an associate's degree in animal husbandry, then another degree in biology. After graduating in 1938, he became a zoologist at the Elista AP Station in Kalmykia. His lifelong specialization was natural foci (plague, tularemia, hemorrhagic fevers, and other infections) in the northwest Caspian area. He is noted for having developed methods of studying and controlling various types of epizootics.

After being seriously wounded in World War II in 1943, Mironov spent most of his remaining career at the Stavropol AP Institute. He began as a senior zoologist, but later became a laboratory director and then a consultant. Mironov also lectured at Rostov University. He defended his doctoral dissertation "Environmental Factors of the Natural Focality of Plague in the Northwest Caspian Region" in 1959. Over the course of his career, he served as an adviser to fifteen candidate and doctoral students.

Nikolay Nikolaevich Ginsburg: Developer of the STI Anthrax Vaccine

B.L. Cherkassky (pp. 211-26). Three photographs, list of 11 major publications.

This chapter is a biographical sketch of N.N. Ginsburg, a microbiologist who worked for many years in the closed medical research establishments of the USSR Ministry of Defense.

After retiring from the army with the rank of colonel of the medical service, Ginsburg worked at various research institutes of the Moscow area to develop vaccines against anthrax, plague, and tularemia. Near the end of his career, he directed the anthrax laboratory at the Central AP Station, Moscow. Ginsburg died on June 9, 1969, a day after completing the editing work for the monograph *Siberian Plague* (*Anthrax*), which was published in Moscow in 1975.

Ginsburg developed the STI vaccine, the first human anthrax vaccine, as well as studied its effectiveness. This vaccine was used during the 1979 anthrax outbreak in Sverdlovsk.

Reminiscences of Konstantin Vasilevich Durikhin

Alla Yevgenevna Popova (pp. 227-34). One photograph, list of ten publications written by Popova in collaboration with or under the supervision of Durikhin.

This chapter is a biographical sketch of K.V. Durikhin that was written by a student whom Durikhin supervised at the Volgograd AP Institute in the 1970s and 1980s.

Durikhin specialized in cholera pathogenesis, studied plague virulence, and developed a special culture medium. He had exceptional scientific insight and a very broad base of knowledge, but his potential in science was stifled by bureaucracy.

Citizens' Initiative in Scientific Research

Moisey Iosifovich Levi, Igor Vasilevich Khudyakov, and Yury Grigorevich Suchkov (pp. 235–250). Three photographs (portraits of authors), one table.

This chapter is a narrative essay about a field study undertaken by the authors in the summer of 1996. It describes the authors' approach to organizing the research, which they financed themselves in the absence of government funding. It ends with a discussion of their results and of various methodological challenges that they presented in a previous volume.[75]

Full translation:

> Many years ago, when *perestroika* was only a faint glimmer on the horizon, and Communist ideology still filled all areas of public consciousness, I met an old acquaintance, Professor Lyudmila Ivanovna Krasnoproshina, who worked at the I.I. Mechnikov Institute of Vaccines and Serums. At one point, Lyudmila surprised me with a heretical idea: individual scientists with similar scientific interests could get together at a research institute and work on a problem of mutual interest on a volunteer basis. This seemed to me to be an absolutely unrealistic idea at the time because all kinds of circumstances could stifle the idea before things even got underway, such as the lack of funding, equipment, working space, supporting infrastructure, or mechanism for approving the work plan.
>
> Some years after this encounter, the government tried to bypass the scientific bureaucrats by establishing temporary scientific teams with independent material resources. Almost nothing

[75] See M.I. Levi et al. "Investigation of the Soil and Substrate from a Colony of Great Gerbils in an Epizootic Territory of a Natural Focus of Plague," *Interesting Stories…* 5 (1997), pp. 141-62.

came of this initiative, and then times became very difficult. Scientists had their salaries deferred for long periods, and absolutely no funds were made available for the purchase of equipment or reagents. Science, which had been the government's mistress, became an impoverished cast-off, constantly begging for money. The idea of self-organized science had been forgotten, and the problem of human survival overshadowed everything else. At times, the government feverishly provided funding, but this had an unintended result, as the bits of funding that they would toss out often landed in the hands of those very same scientific bureaucrats and then would disappear into their bottomless pockets. It became clear that in the coming decades, science in our country would not be able to rise from its knees nor be able to exist on a self-funded basis.

For most scientific fields, this situation would not have been considered a catastrophe because during favorable times, such scientists were essentially copycats who, rather than building on the principles already discovered by scientists in other countries, went through the scientific motions to arrive at these same principles. Realizing that several branches of science related to the military industry were unproductive, the government simply turned to vulgar industrial espionage in order to cut costs.

However, the situation was worse for those branches of science in which our country held a leading position. Plague science was, in fact, one of these few branches. In this case, the loss of government support led to catastrophic chaos: advances in understanding of plague enzoosis came to a halt at the worst possible time of scientific crisis. Not only did science in this country suffer, but so did international science, which was riding the currents of our efforts.

Thus, something had to be done to break the stagnation, and here, I must admit, my attitude toward Professor Krasnoproshina's idea changed considerably. If it were possible to attract the enthusiasm of the anti-plague system personnel and enough funding from sponsors, this would make plague science less dependent on government support. The publishing of the *Interesting Stories*… aims primarily at reinvigorating the scientific and practical establishments of the AP system, attracting young people to this work, and maintaining our country's leading role in this scientific field.

However, all this could have gone no further than good intentions, so therefore we decided to act.

In the summer of 1996, I.V. Khudyakov set out in his old Zaporozhets car to obtain material for research.[76] Nothing really came of letters and telephone calls to local AP establishments asking for assistance in this work. The experience of funding this trip was an education in

[76] The *Zaporozhets* was a subcompact car built at the ZAZ (*Zaporizky Avtomobil'ny Zavod*, translated as Zaporizhia Automobile Factory) factory in the Ukrainian SSR between 1954 and 1994. Model 968 was the cheapest model, powered by a rear-mounted, air cooled V4 engine that was troublesome.

itself, as will be described below in tragicomic tones by Khudyakov himself. The total cost was 1,400,000 rubles [approximately $280 based on exchange rate of $1 = 5,000 rubles] of personal money. The expenses for government establishments, namely Rostov-on-Don AP Institute, Test Laboratory Center of Moscow Municipal Disinfection Center, and N.F. Gamaleya Institute of Epidemiology and Microbiology, were somewhat higher, but were not included in any preapproved plans and were based mainly on enthusiasm. In large part, the findings were published in Volume 5 of "Interesting Stories…" Here we would like to focus on the organization of this type of research, which was accomplished by raising outside capital and enlisting the enthusiasm of plague system workers and Gamaleya Institute staff. From time to time during the research, participants traveled between Moscow and Rostov, and the expenses for these trips came out of the participants' own pockets. As a result, we can now confirm that this way of organizing research can be useful in similar circumstances.

The Account by I.V. Khudyakov

As the saying goes, the new is just the long-forgotten old. However, the introduction of something new involves a lot of effort and hardship, and usually stokes fearsome hostility. This was the case with the hypothesis of Marcel Baltazard and Henri Mollaret concerning the long-term persistence of the plague microbe in soil (telluric plague). In fact, no one knows what the persistent form of the plague microbe might be. Advances in scientific thought on the genetics of the simplest microbial cells have produced encouraging findings that could shine light on some unanswered questions of how plague epizootics start and end.

Research on the persistence of insecticides (DDT and hexachlorane) in soil would offer the possibility of a simultaneous investigation of the persistence of plague microbes in great gerbil colonies. This idea was developed at the Test Laboratory Center and was brought to the attention of AP organizations in Kazakhstan and Russia. However, the plague specialists at Almaty, Kazakhstan, felt that they had already scaled the heights of plague science, so they categorically refused to take part in these studies. However, it was namely in Kazakhstan that insect control measures were conducted most often and on the largest scale, frequently covering vast areas, particularly in the former Guryev (now Atyrau) Region.

M.I. Levi's attempts to negotiate undertaking this research with the leadership of the Atyrau AP Station were fruitless. It was simply astonishing! Initially, the reason for the refusal was that the AP station did not have funds to pay for travel expenses. When some staff volunteered to do the work without pay, they were categorically forbidden to even think about it, although the work load on the station was less than half of what it had been, because nearly all the epidemic field teams and most of the zoological groups had been disbanded. Finally, finding no support or interest anywhere for this new scientific proposal, Professor M.I. Levi contacted me (I.V. Khudyakov) about helping and taking part in the research. The research methodology would produce new data on the persistence of the plague microbe. All that remained was to obtain and deliver material in the form of soil samples to be studied using this new method.

Given my good relationship with Satybaldy Khamzievich Khamzin, director of the Atyrau AP Station, it was decided that I should make a personal visit in an attempt to convince him to conduct research in their laboratories. If he refused, I would try to obtain soil samples from great gerbil colonies and deliver them for determination of DDT and hexachlorane residues.

The only way to transport the samples would be by car or truck, despite the fact that special closed containers would be provided for the samples. But where to get a vehicle? There was no choice but for me to repair my old, broken down Zaporozhets-968 car in a hurry and attempt to drive it to Atyrau through Astrakhan. That would be an adventure! Still, there was no other solution. I managed to repair the car myself and set off on the trip.

I was nearly to Ryazan when suddenly the old inner tube on one of the tires blew out. Plus, it was night! I pulled off the road in the darkness and slept in a field. In the morning I fixed the tire (fortunately, I had brought along an old spare inner tube) and got going again. Science requires sacrifices! In Ryazan, I was pulled over at the traffic police post. The young sergeant walked around my old Zaporozhets in wonder and asked me where I was planning to go in this old junker. When I explained that, well, I was going to Astrakhan, he shook his head but did not give me a ticket. So there are still some decent traffic police around![77] About 100 kilometers past Ryazan, my car's right front tire went flat. It turns out that I had driven over an iron pin. The damaged inner tube had to be thrown out. I put the wheel back on and slept out on the prairie. The next morning I made it to Volgograd. I thought about turning back. I wavered for a long time. But they were counting on me and waiting for the material… No, I had to go on!

After Volgograd, I was stopped at another traffic police post. This time the lieutenant looked over my car and looked at me like I was crazy: my car has a Moscow license-plate number. He took my documents, looked at me, and asked: "So you're from Moscow?" Getting my affirmative answer, he said: "Well, OK, keep going!"

I kept on driving. The engine is running just fine, so that is reassuring. I slept out on the prairie another night, 150 kilometers from Astrakhan. From there things got nerve-wracking. From Yenotaevka to Astrakhan, there was one traffic police post after another. Why they were there, I have no idea. And each post had police with submachine guns! Again the questions: "Where are you going? Why? In this junk pile? You're not really from Moscow are you? What are you hauling?" Before Astrakhan there was a traffic jam. A sergeant from the traffic police post abruptly asked me: "Why does your car have different kinds of wheels? Are the tread patterns

[77] The traffic police in Russia, particularly the gaishniki (derived from "GAI," the abbreviation for *Gosudarstvennaya Avtomobil'naya Inspektsiya*, or State Automobile Inspectorate), are notorious for accepting, if not demanding bribes of drivers who they stop. In the post-Soviet period, corruption was a systemic and particularly serious problem in the 1990s. As such, Khudyakov's surprise at not receiving a ticket and the forgiveness of the traffic officer supervisor he describes later was well-merited.

the same?" Things were going badly. I had been a driver for more than forty years, and I had never been asked about these things. "You'll have to pay a fine of 500,000 rubles."

Can you believe it! I didn't have that much money with me. I went upstairs to the supervisor. The traffic police booth is 5-7 meters above the roadway. There is a lieutenant sitting in the booth, and I tearfully begin to explain my situation. He checked my documents and said: "OK, keep going!" Thank God!

Great! I finally reached Astrakhan. Familiar places, and the familiar road to Atyrau. I take a ferry across a tributary of the Volga to Krasny Yar. Here I stopped in to see my friend who is chief of the Krasny Yar Police Department. I needed help—my gearshift lever broke off. They got it welded back on, and I was off again! I took another toll ferry, this one a sort of barge. After another 40 kilometers I came to the last ferry before Kazakhstan, but there was a customs station here.

"Stop! What are you carrying? From Moscow?! Oh! Tell the truth—are you hauling grass?"

"What do you mean, grass?" I said, not understanding.

"Don't play dumb! You're coming from Moscow, and you're not carrying anything?"

It took me two hours to prove to him that I was no pusher! They dumped out and shook out everything in the car. Furious that they did not find anything, they growled out: "Go on, get moving!"

From here, it is a clear shot to Atyrau. Once again, I slept out on the prairie, alongside a small creek. Finally, I was past all the ruffians, and could look forward to meeting comrade Satybaldy Khamzievich Khamzin, director of the Atyrau (formerly the noteworthy Guryev) AP Station. Incidentally, the former city of Guryev was a Russian settlement founded by Ural Cossacks back in the eighteenth century, but was obligingly given to Kazakhstan, in the same way that Crimea, some Baltic lands, and other territories were given away. Over 50 percent of the population is Russian in Atyrau. Toward evening, I arrived at the city and went straight to the AP station.

Khamzin warmly welcomed me into his home. We sat down around the table and drank cognac (mostly his wife and I). I swung the conversation toward the new research. First of all, it was important to know how long DDT and hexachlorane persist in the soil. But when he heard Professor M.I. Levi's name, his face immediately changed: "No! We cannot help at all. We won't get involved…" Why not? Finally he explains: "Igor Vasilevich, we cannot get involved with this, because I don't want any unpleasantness." Now I understand! He had been given strict instructions. By whom? There is no point in insisting. Somehow I will have to get along on my own. I drive through roadless countryside, across deserts, and along canals to the former

base of the Iskine Epidemic Field Team. Alone, with no help, and no hope… But I do have friends in the town of Iskine; the Yesenbaevs, who are oil workers and herders. They will help! It started to get hot. By eight in the morning, the sun is baking everything mercilessly. The sky is always clear here, and it rarely rains. In the sunlight, the temperature is 50 to 55°C, and I have to dig up great gerbil colonies. From early morning, a hot wind blows like it was straight from hell. The whole time, this song swirls in my head: "Here in Iskine, nature is different: dust, heat, mosquitoes, oppressive!" I hired two fellows for 100 tenge [approximately equivalent to $2] a day to dig up colonies down to the feeding and toilet chambers. Now we're working. We gather material for research. On the fifth day, my workers give up—they are worn out. They leave. Now I have to continue by myself. Burrow entrances, feeding chambers, toilets. You search and dig, where are they? The wind drives sand into your eyes. Sweat streams down! Finally, all the containers are full. I would not have had the strength to go on! That's it, now I can go back. Time to get out of this hell and somehow get back to "civilization," to Astrakhan. I didn't bother stopping by the AP station in Atyrau. I go right on by, onward to Astrakhan! Not far from Ganyushkino one of my inner tubes blows out. I put in the spare tube—my last one! If one more blows out, it'd be a catastrophe!

Through customs again. Again they rummage through the car. "What are you hauling, where are you going?" and the like. Somehow I freed myself from their clutch. Krasny Yar is just ahead. Suddenly, the engine starts running roughly, losing power, overheating. Again, I needed help. I made it to the police station, where my friend, the police chief, a really wonderful person, gives the order: "Help him out!" They call in some car mechanics. They take apart the distributor, find the problem, and fix it. The next morning, I set off to Astrakhan. On "a wing and a promise" I made it to Volgograd. There were still about 1,000 kilometers to Moscow. No spare inner tubes or tires left. If one of the tires goes flat, write home to say good-bye. But the engine ran fine, although it was overheating. I took off the rear hood over the engine and put it in the trunk. Now the engine wasn't running so hot. I hoped for the best. I spent the night camped out in a field. In Moscow, they were waiting for me to deliver the material. Somehow, I had to make it at least to Moscow *oblast*. There, I at least could pay some passing motorist to tow me to the Moscow Ring Highway.[78] Then I would've been more or less home. However, for now, all is well. I got to Tambov. What? No gasoline at the filling station? Wouldn't you know it! It turns out that it was Sunday, and they don't haul gasoline on Sundays. I had to wait. I spent the night right at the filling station. At 10 the next morning, the gasoline finally arrived. There's a huge line. Through a lot of cursing and shoving, I was able to fill the tank and keep going. Soon I was at Ryazan, and from there to Moscow, it's just a stone's throw, about 250 kilometers. My wheels were turning and the engine was going strong, what else do you need! It was getting toward evening, but I was already in Moscow Oblast. Only 120 kilometers to go. Whatever happens, I had to make it home that day. Dark now. I was going slowly, others were passing me, cars flying by. Finally I reached Domodedovo [Russia's largest airport]—this is Moscow!

[78] The Moscow Ring Highway (abbreviated MKAD) encircles the capital, separating Moscow city limits from Moscow Oblast (the province).

But, if there's something that can go wrong…! Just when you think that it's smoothing sailing, suddenly, bad luck will strike, and there go all your plans. Going up some hill near Domodedovo, I was following a KamAZ truck, which was also going slow and suddenly brakes.[79] I almost plowed into it, I pressed the brake pedal. Something clicked—and the pedal sinks. What's going on? The car started rolling backwards. Good thing there was nobody behind me. I pulled the handbrake, but it does not hold very well and the car stubbornly crept backwards down the hill. Somehow I get it into reverse and slowly edge off the highway toward some houses. It's dark. As some Volga goes by, its headlights afford a glimpse of the surrounding area. I stopped the car near the gates of a wooden house. There, I made it! I shut off the engine. It was raining. My home was nearby, but still not so easy to get to. What a shame! Cursing everything in the world, I get out of the car. I put rocks under the wheels because the car was still on a pretty steep slope. It poured rain again. Disgusted with everything, I settled in to sleep, airplane-style. I was tired from all that I have been through. Rain lashed against the car. One thing was clear—I wouldn't make it home tonight! With the noise of the rain beating down, I fell asleep instantly.

When I woke up it was already light. The day was overcast but there was no rain. So what happened yesterday? I jacked up the wheel to try to figure out why the brakes failed. Now I saw! The brake line burst. There is no way to patch it up. There is only one thing to do; I would have to drive without brakes and just rely on the handbrake alone. I took off the wheels and adjusted the handbrake. It seemed to hold. I started the engine and off I went! I drove slowly in the right lane. Under enormous stress, I made it to the ring highway. There's no way to describe how I made it any farther: somehow, at a speed of 20–30 km/hour I felt my way along to the exit for the Leningrad Highway. I was just about home. I arrived in the evening. That's it! Mission accomplished!

Soon the material was delivered to Rostov. The findings exceeded all expectations. All the hardships were not in vain. Contrary to the old Russian saying, that bit of fleece WAS worth the trouble!

Some of the research findings, as described by Yu.G. Suchkov

We knew that it would be extremely difficult to isolate the plague pathogen from soil. Therefore, we used all available methods to detect it: bacteriological, in vivo, serologic (passive hemagglutination, antibody neutralization, passive hemagglutination inhibition), and PCR. We reported all this in Volume 5 of the *Interesting Stories*… (Levi, Suchkov, Khudyakov, et al., 1997) with a detailed description of the results and a discussion.

We were somewhat surprised with the PCR results using pFra and pPsr primers. We did this

[79] *Kamskiy avtomobilny zavod* (translated as Kama Automobile Plant).

research at two establishments that we will call simply Laboratory No. 1 and Laboratory No. 2. At Laboratory No. 1, in the very beginning, we obtained positive results with PCR for material from several colonies, but a month later at Laboratory No. 2, the same material produced negative results, although a positive result was obtained with material from another colony (second passage on agar plates). Another half-year later in Laboratory No. 2, we investigated materials that had gone through 15–20 passages on agar plates that gave a positive result from passive hemagglutination, although the PCR was negative. A repetition of this research in Laboratory No. 1 also gave a negative result, but the same PCR result was obtained for a suspension of the EV plague vaccine strain.

Therefore we got the impression that, compared with other diagnostic methods such as serologic reactions, less research has been done on the use of PCR for the plague microbe. Therefore, we propose for the present time to consider only the positive PCR results while doubting the reliability of all the negative results.

Next, we focused our efforts on identifying the pathogen in those soil samples in which passive hemagglutination using diagnostic antibodies (including monoclonal antibody against F1) produced stable positive results during several passages. We decided to use soil samples from the burrow entrances of great gerbil colonies nos. 4 and 26. In this work, for sample 4-1 (the second number designates the burrow entrance), a positive result for passive hemagglutination coincided with the detection of the corresponding genetic structures by PCR using plasmids pPst and pFra. For technical reasons, sample 26 1 was not studied using this method.

Many different kinds of bacteria, including sporulating ones, were cultured from the soil of these and the other samples using agar or broth. Therefore, when transferring cultures we used several dilutions of the streak from the plate of the previous passage (from 10–1 to 10–7). The cultures were held 3–4 days at 28°C, then for two to three days at 37°C. They were examined every day, but no colonies of interest to us were seen. The bacteria concentration in the agar streaks was as high as 20-30 billion cells/ml. As a rule, the titers in passive hemagglutination with streaks of cultures from the 10–4–10–5 dilutions were higher than for the cultures of the more concentrated suspensions. In the streaks, after culturing from 10–6, the passive hemagglutination result was often negative, and from 10–7 it was always negative.

The explanation for this observation is apparently that a large number of the diverse "unwanted" microflora inhibit the producers of the active substance in passive hemagglutination. At dilutions of 10–6 and 10–7, the bacteria of interest are too few or altogether absent.

A comparison with the activity of F1 in passive hemagglutination shows that the number of producers of the unknown antigen is about 105 cells/ml of streak. Consequently, for each conditionally F1+ bacterium there are about 109–1010 unwanted cells. Try isolating that bacterium without a reliable selective method!

Concentrated and dilute suspensions introduced into white mice using various methods did not cause death due to a pathogen. Therefore, individual colonies of bacteria from sample 4–1 were studied. Substrate from this rodent colony stored for 4 months at 6°C in a culture container was used to prepare an extract that was cultured on agar with erythromycin and nystatin in concentrations of 0.1 μg/ml each. The unknown antigen was found in the streak, but was not detected in the extract. This showed that the source of the substance that reacts with the plague antibodies and monoclonal diagnostic antibodies in passive hemagglutination remained alive during prolonged storage. By this time, the primary sample 4-1 was cultured on agar in ten passages, always giving a positive result in passive hemagglutination. However, a gradual decrease in antigen activity began.

Table 5: Dynamics of antigen titers in passive hemagglutination with plague diagnostic antibody

Sample	*Culture temperature, °C*	*Antigen titer by incubation period, days*			
		2	*3*	*4*	*7*
4-1	28	< 1:2	1:4	1:160	1:160
	37	< 1:2	< 1:2	< 1:2	< 1:2
	28 (4 d) + 37 (3 d)	—*	—	—	1:160
P-4-1	28	< 1:2	1:32	1:80	1:80
	37	< 1:2	< 1:2	< 1:2	< 1:2
	28 (4 d) + 37 (3 d)	—	—	—	1:160
26-1	28	< 1:2	1:2	1:80	1:80
	37	< 1:2	< 1:2	< 1:2	< 1:2
	28 (4 d) + 37 (3 d)	—	—	—	1:80
Culture no. 2 from sample P-4-1	28	< 1:2	1:64	1:80	1:80
	37	< 1:2	< 1:2	< 1:2	< 1:2
	28 (4 d) + 37 (3 d)	—	—	—	1:8

*Note: *Not investigated. d = days*

A new sample designated P-4-1 [P denoting the Russian for "later" (*potom*)] gave a growth of isolated colonies on medium with antibiotics. Among 105 cultured colonies of gram-negative bacteria, two (nos. 2 and 5) gave a positive result in passive hemagglutination with a minimum concentration of 0.5x108–108 cells/ml.

Cultures nos. 2 and 5 isolated from sample P-4-1 in the first and second passages on agar after 18–20 hours of incubation at 28 and 37°C formed slightly bulging colonies with a thin lacy zone around the perimeter, which is reminiscent of *Yersinia pseudotuberculosis* in the R-form. Streaks of these contained ovoid gram-negative rods, while streaks of the uniformly turbid broth contained bipolar staining bacteria. After 3–4 passages, both cultures grew in the form of smooth colonies. Although growth occurred during ten days at 28 and 37°C, there was no change in the color on Hiss's culture media with glucose, sucrose, arabinose, rhamnose, and

glycerin. The bacteria were motionless at 20, 28, and 37°C.

Bacterial suspensions of the 4-day, 28°C (but not 37°C!) cultures at concentrations of not less than 107–108 cells/ml yielded a positive passive hemagglutination reaction.

A dose of 250 million cells of culture no. 2 was injected subcutaneously into six white mice. The animals died after three days. Bacteria identical to culture no. 2 were isolated from the blood of three of the mice. The minimum active dose in passive hemagglutination was lower by factor of 5-10 than the initial culture, and averaged 0.5x106.

A special experiment was conducted to determine the dynamics of the antigen titers in passive hemagglutination with plague diagnostic antibody (see Table 5). The initial concentration of bacteria in the samples from agar media was 109 cells/ml according to the optical turbidity standard for *E. coli*.

These data show that in all the investigated samples and in culture no. 2, positive passive hemagglutination results were observed only after culturing at 28°C. The antigen titers reached the maximum levels after four days and remained practically constant regardless of additional culturing at 28 or 37°C for three days.

In fairness, it should be noted that in subsequent passages of culture no. 5, glucose was added to the liquid culture medium. This gave a positive passive hemagglutination reaction with the F1 diagnostic antibody after culturing at 37°C, although at a greater titer than the culture obtained at 28°C.

Using the method of individual colony analysis as described above for sample 26-1, we were unable to obtain pure cultures of the bacteria of interest after different numbers of passages (up to 15). The cultures contained predominately large colonies of gram-positive bacteria, which obscured the unknown producers of the necessary antigen. At present, the passages have continued for more than six months for specimens 4-1-20, P-4-1-12, and 26-1-16 (the third number is the number of passages).

The possibility that the producer of the antigen, which reacts with the plague diagnostic antibody, could survive for such a long period in a mixture of soil bacteria indicates that the interrelationships are more symbiotic than antagonistic. The isolated pure cultures maintain their ability to produce this antigen for a long time. There are several possible explanations for this observed phenomenon.

First, the commercial diagnostic antibodies, including monoclonal antibody, may not be sufficiently specific, nor are the monoclonal antibodies against the plague bacterium F1 antigen.

Second, the bacteria may produce substances serologically close to F1. It is possible that S.A.

Lebedev and his colleagues observed something similar. They have several publications on this. Could it be that these soil bacteria are the unknown ancestors of the plague pathogen?

V.A. Zaydenov, G.A. Ignatyev, et al. (1991) demonstrated in a recent work using a panel of monoclonal antibodies that there could be several epitopes on the F1 molecule. But, this result might have been a case of differences in the affinity of the monoclonal antibodies, rather than qualitative differences in epitopes.

These and other possible explanations need to be tested experimentally using modern molecular-biological methods, and the isolated bacteria that produce what we might call the F1 serologically similar antigen need to be fully identified.

As such, through several examples, we have described the difficulties that researchers face in investigating plague enzoosis and which arise as soon as they try to determine the fate of the pathogen between epizootics. It is possible to isolate gram-negative bacteria that agglutinate the diagnostic antibody, but in the absence of other plague microbe characteristics ordinarily observed, the problem of identification cannot be considered resolved. In this regard, PCR seems quite trustworthy, but there are still doubts that these findings could be considered conclusive.

Obviously, the only way to accomplish a program like this at present is based on the enthusiasm and voluntary informal collaboration of specialists in various fields from various research establishments of a scientific, scientific-practical, and purely "applied" nature.
In the absence of normal funding for science, citizens' initiatives are about the only way of advancing our knowledge of the subject.

Forgotten Photographs

M.I. Levi, Yu.G. Suchkov (pp. 251-71). 19 photographs.

This section contains photographs taken during the 1920s through the 1980s, which consist primarily of group portraits from conferences and of teams conducting fieldwork.

Pneumonic Plague in Bakanas

A.L. Kartashova (pp. 272-81). Two photographs (including portrait of author), one table, three figures, three references.

This chapter is an anecdotal essay that describes the author's experience during a plague outbreak in Bakanas, Kazakhstan, in 1948. It discusses the circumstances of the outbreak, control measures that were taken, clinical symptoms and treatment of victims, and patient outcomes.

In 1948, a team that included Kartashova was sent from Moscow to deal with a pneumonic plague outbreak in Bakanas, Kazakhstan, which is located approximately 180 kilometers north of Almaty. During the team's stay in Bakanas, two nurses and the hospital director were accidentally infected because one of the nurses did not report having been exposed to the disease after an agitated patient had ripped off her mask.

I Like...

A.L. Kartashova (pp. 286-92). Five references.

This chapter provides an autobiographical sketch of the author's career and her reminiscences about colleagues in the AP system.

Kartashova's career began in 1944 when she served as a doctor at the Guryev AP Station (Guryev was renamed Atyrau in 1991), which was located in a key Kazakh port on the north Caspian Sea. After completing graduate studies at the Gamaleya Institute in Moscow, the author returned to Kazakhstan to work at the Central Asian Scientific Research AP Institute in Alma-Ata.

Correction

p. 293

This small section notes a correction to one verse of the previously published song "The March of the Plagueologists" by I.V. Khudyakov (volume 6, 1997, page 245).

Index of Names in Volume 6

(pp. 294-305)

Not included in this paper.

VOLUME 7 (1998)

Foreword

Moisey Iosifovich Levi (p. 3)

Introduction to the seventh volume of the "Interesting Stories..." series.

Full translation:

> The present volume, like the preceding ones, contains mainly materials devoted to the 100th anniversary of the AP system of Russia and the Soviet Union. The reader will learn about the lives of prominent people and institutions in the history of the system.
>
> There are now quite a few publications on the historical development of the AP system and its individual research institutes and stations, but there still has been no fundamental research on the rise and decline of this outstanding organization. There is a risk now that these very essential works may never be written.
>
> We continue to publish a "history in photographs," the quality of which leaves something to be desired, but every time you see the faces of colleagues, even if one knew them only from writings, it warms the heart and one feels a sense of belonging to that wonderful family of AP workers.
>
> For the production of this volume, as for all the previous ones, great help was given by Yu.G. Suchkov (correspondence with authors), L.G. Sorokina (computer typesetting), L.V. Manakhov (computer graphics), and M.V. Yevseenko (distribution of publications).
>
> M.I. Levi, Editor

Notes of a Physician–Plagueologist

Nina Kuzminichna Zavyalova (pp. 4-83). 21 photographs, One table, with afterword by N.N. Basova and Yu.G. Suchkov.

This chapter is an autobiographical sketch by N.K. Zavyalova, who served as a senior researcher in the plague treatment laboratory at the Rostov AP Institute.

After a difficult childhood, Zavyalova secured an education and graduated from medical school in 1943. She then joined the Irkutsk AP Institute and assisted in plague control work in Mongolia, where she contracted pneumonic plague, which she describes in detail. After her recovery, Zavyalova investigated the immunology of plague. As a result of a laboratory accident, she contracted plague a second time. This coincidence produced information on immunity to plague that can result from a

prior case of the illness. Later, Zavyalova was promoted to senior researcher of the plague treatment laboratory at the Rostov-on-Don AP Institute.

Plague Fort

Yu.P. Golikov, T.V. Andryushkevich, Yu.A. Mazink, and O.V. Tselyaritskaya (pp. 84-123). 15 photographs, eight references.

This chapter describes the history of Fort Alexander I, from its construction as a military facility in 1838 until its decommissioning in 1896.[80]

In 1898, the Imperial Institute of Experimental Medicine in the city of St. Petersburg, which conducted infectious disease research, took charge of remodeling the old Fort Alexander I into a medical research laboratory, at which high-risk infection research could be performed without threatening the population of St. Petersburg. The essay describes the personnel who operated the laboratory and explains the research they performed.

The laboratory at the fort was closed in 1918, and its equipment and staff were transferred to Mikrob in Saratov. It is unknown to the authors what happened to the pathogen collection kept in the fort's laboratory.

The essay provides brief biographies of major fort personnel, including Prince Aleksandr Petrovich Oldenburgsky, Vyacheslav Ivanovich Turchanovich-Vyzhnikevich, Manuil Fedorovich Shreyber, L.V. Padlevsky, Sergey Mikhaylovich Lukyanov, Aleksandr Aleksandrovich Vladimirov, M.G. Tartakovsky, Sergey Nikolaevich Vinogradsky, Markel Vilgelmovich Nentsky, Daniil Kirilovich Zabolotny, and Vasily Isaevich Isaev.

History of the AP Service in St. Petersburg–Leningrad

M.I. Rogozina, V.V. Kasatkin, P.V. Kolotvina, Yu.G. Lyutov, and P.I. Makhlin
pp. 124-36. One photograph (portrait of authors).

This chapter describes the history of the organization and the activities of the AP system in St. Petersburg from 1890 onward.

The first major microbiology research center in St. Petersburg was the Imperial Institute of Experimental Medicine, established in 1890. It operated a plague research center in Fort Alexander I at Kronstadt from 1899 to 1918. In 1934, the Leningrad seaport opened an AP laboratory. In 1939, a research division at the Pasteur Institute became the municipal AP observation station in Leningrad. In 1957,

[80] See also Alexander Melikishvili, "Genesis of the AP System: The Tsarist Period," *Critical Reviews in Microbiology* 32 (2006), pp. 19-31.

the municipal and port organizations were combined. This station was renamed the Leningrad AP Station in 1985, and renamed again as the Northwest AP Station in 1992.

These AP institutions undertook a wide range of research and development projects in the areas of microbiology, diagnostic preparations and methods, and epidemic control for a variety of diseases, including leptospirosis, tularemia, legionellosis, cholera, plague, and anthrax. The Leningrad AP Station was closely associated with the Rostov-on-Don AP Institute, and assisted in epidemic control and field investigations in various parts of the Soviet Union and in Mongolia. The directors of the municipal AP station, the port laboratory, and the Northwest AP Station are listed in the chapter.

His Heroic Life: Sketch of the Outstanding Life of Military Physician Lev Yakovlevich Margolin

Rostislav Alekseevich Taranin (pp. 137-44). Two photographs (portraits of author and subject).

This chapter is a biographical sketch of L.Ya. Margolin (18??-1931), a military physician who worked in the Caucasus.

Margolin was a graduate of the Kirov Military Medical Academy, Leningrad, and a physician at the Dzherbail Border Post in the Caucasus. Although he had no specialized training in high-risk infections, he was the first to correctly identify a plague outbreak in 1931 in Gadrut, Nagorno-Karabakh. Upon realizing that he had been infected by a patient, he acted heroically to isolate himself and inform the authorities of the outbreak. He died several days later. A street in Gadrut is named in his honor.

My Memories of the People of the AP Organization

I.Z. Klimchenko (pp. 145-49)

This chapter contains a collection of several poems expressing the author's reminiscences of historical figures, teachers, and colleagues in the AP system.

From Sanitary Border Control to Sanitary Territory Control

Grigory Dmitrievich Ostrovsky (pp. 150-61). One photograph, one table, 14 references.

This chapter describes changes over time in approaches to practicing epidemiology.

In the 1950s, the Soviet Union changed from sanitary border control, consisting primarily of quarantines, to a comprehensive approach of sanitary territory control, consisting of preventive hospitalization, investigation of epidemic sources and contacts, and preventive inoculations. This development was necessary since faster modes of transportation (i.e. air travel) allowed infected persons showing no

symptoms of disease at the time of entering the country but becoming sick and causing an epidemic at her or his destination. The author describes the techniques of plague and cholera control, which are illustrated with accounts of several outbreaks.

Phagocytosis as an Integral Indicator of Species of Experimental Animals in Immunogenesis

Nadezhda Nikolaevna Basova (pp. 162-87). One photograph, nine tables, ten figures.

This chapter is a scientific essay that describes research conducted at the Rostov AP Institute on phagocytosis and immune response of different laboratory animal species. The contributions of Yulia Aleksandrovna Filimonova to this research are highlighted.

Use of a Sample with Plague Bacteriophage to Identify Producers of Capsule Antigen

M.I. Levi and Yu.G. Suchkov (pp. 188-93). Two tables, three references.

This chapter reviews past research on the use of samples containing plague bacteriophages in the identification of capsule antigen producers.

Levi and Suchkov describe a new method of determining the sensitivity of Fraction 1 (F1) producers to the plague phage. They note this method proved suitable not only for investigating pure cultures, but also cultures containing mixed bacterial strains. Moreover, the application of this method identified a strain, which had been isolated from a soil sample taken from a great gerbil colony, to be sensitive to the plague phage. The strain fermented glucose, produced an antigen to the F1 plague diagnostic antibody, and after injecting it as an immunization of mice, accumulated antibodies identifiable by the plague F1 antigen.

Letter to a Friend

A.I. Tinker (pp. 194-97). Note from the series editor.

This chapter describes the work that the author and his colleagues completed over many years to develop a live vaccine for plague and other diseases and to improve the processes of manufacturing newly developed vaccines.

Professor Georgy Yakovlevich Zmeev

I.S. Khudyakov and Yu.G. Suchkov (pp. 198-216). Two photographs, list of nine selected publications written or edited by Zmeev.

This chapter contains a biographical sketch of G.Ya. Zmeev (1904-85), an epidemiologist, parasitologist, researcher, author, epidemic control expert, teacher, and founder of epidemiological geography.

The major scientific works by Zmeev, including his doctoral dissertation, *Microbiology and Epidemiology of Cholera*, were classified secret because they dealt with epidemics and epidemic control in border areas of the country. He performed epidemic control work in the Far East and Central Asia of the Soviet Union, Korea, Manchuria, and Iran. Zmeev was a student of academician E.N. Pavlovsky and, later, became his collaborator. During World War II, he served in the medical service as a colonel alongside Pavlovsky, a lieutenant-general, and Rostislav Alekseevich Taranin, another colonel. Zmeev is remembered as an outstanding scientist, an inspiring teacher, and a generous colleague.

How It Really Was

Leonid Fedorovich Zykin (pp. 217-25). 13 references.

This chapter recounts research completed in the 1970s at the Turkmen AP Station on the El Tor strain of the cholera bacterium, Vibrio cholerae*, which had been isolated from both the environment and patients. It includes criticism of various writings published in the 1980s and 1990s on methods of testing the El Tor strain for pathogenicity because their authors did not give due credit to the research the author oversaw at the Turkmen AP Station.*

Full translation:

> When reading through the current literature on the epidemiology and microbiology of cholera, the uninitiated reader might get the mistaken impression that it was only in the 1980s that two very important principles were established: that El Tor vibrios vary in their ability to cause epidemics and that a variety of epidemic control tactics should be used.[81] For example, E.A. Moskvitina writes in her doctoral dissertation: "In the 1980s, it was recommended that different preventive measures be taken depending on the virulence of the cholera vibrios isolated from environmental features" (1996, pp. 4-5). Further on, the author states that the key to solving this problem was the use of molecular-genetic methods to identify the Vct gene of cholera vibrios, and that in our country, these methods were first used by a group of specialists from the Rostov and Stavropol anti-plague institutes. A similar idea is expressed by G.M. Grizhebovsky (1997), as well as many other researchers.
>
> In fact, the problem of differentiating the epidemiological significance of El Tor vibrios obtained from the environment was studied in great detail back in the mid-1970s by a large

[81] El Tor is a strain of *V. cholera*. However, there are many serogroups (genotypes) of the El Tor strain whose properties can vary from one another. For example, vibrios of one serogroup might be able to cause hemolysis while vibrios of other groups cannot. The author is not clear in his use of the words "strains" versus "genotypes"; often he means the second when stating "strain."

group of specialists from Turkmen AP Station: R.T. Gerasimenko, V.I. Svyatoy, R.S. Zotova, V.M. Razvykh, and V.A. Friauf under our supervision, as reported in a number of publications (L.F. Zykin et al., 1978a, 1978b, 1993; B.A. Kiyatkhanov et al., 1977; V.I. Svyatoy et al., 1991a, 1991b). V.I. Svyatoy summarized all these materials in his candidate dissertation, but he died prematurely and thus was unable to defend it.

I consider it my moral duty to re-establish objectivity and tell the truth about the events of those years and about the difficulties and complexities of the struggle for scientific truth. However, before presenting the facts, let us briefly recall the Turkmen AP Station in that era and the people who were working there.

The Turkmen AP Station was headed by Rimma Timofeevna Gerasimenko, an energetic, intelligent, and principled woman who also had exceptional organizational abilities. Gerasimenko came to the station from the Turkmen SSR MOH, so she was able to use her established connections to focus the work in the mainstream of the public health tasks facing the republic.[82] B.A. Kiyatkhanov, then the Deputy Minister of Health for the Turkmen SSR, strongly supported the station.

Remembering those times, I have come to the conclusion that the Turkmen AP Station was one of the best in the Soviet Union. It had a staff of experienced, highly professional workers capable of solving all the tasks posed by epidemiological practice with speed, efficiency, and expertise. In addition to the specialists I mentioned above, I would add T.A. Burlachenko, G.M. Golkovsky, Ye.Ye. Punsky, D.V. Zheglov, and L.A. Traub, among many others.

Very typically, there was close scientific and practical collaboration with the research institutes and leading specialists of the AP system. Therefore it is not surprising that many new procedures, laboratory methods, and concepts had their first practical trials in Turkmenia.

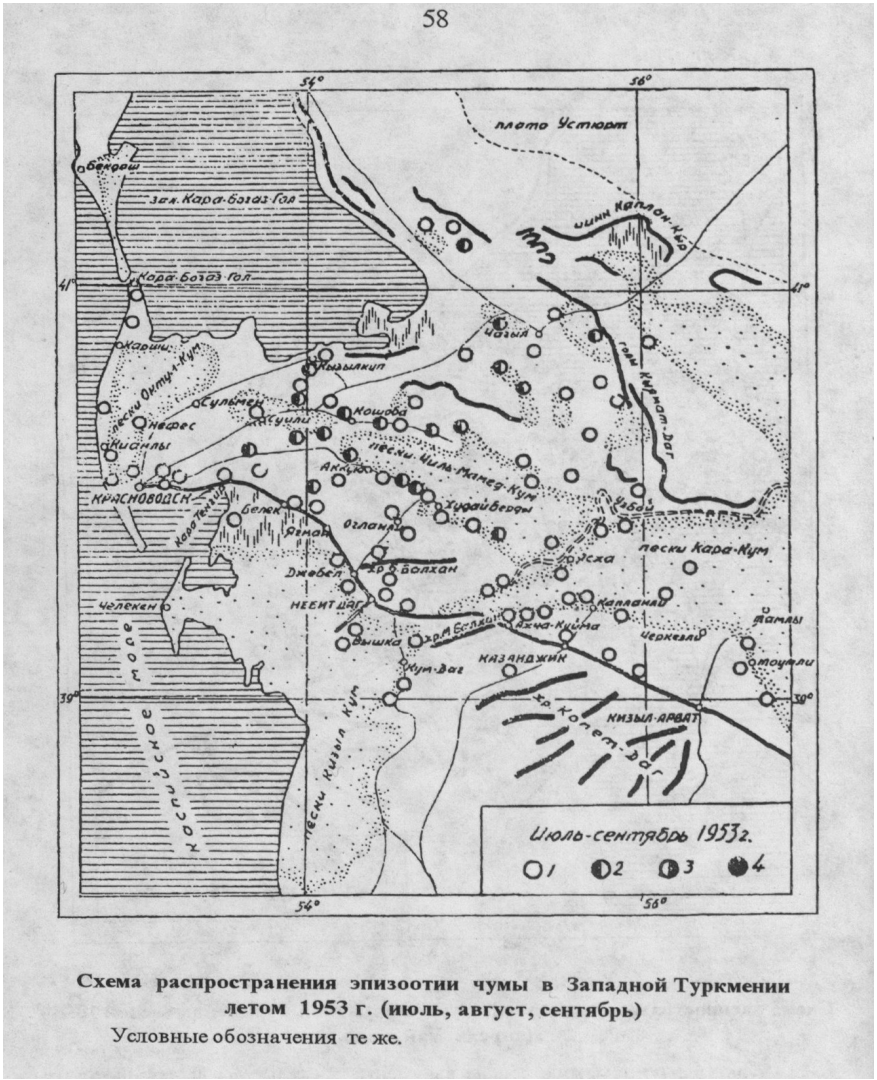
Major cholera outbreaks in the Soviet Union in 1965 and 1970 prompted a sharp increase in the testing of environmental samples, especially of samples from surface waters. The El Tor cholera vibrios were found in the waters of various regions of the country, including those where cases of cholera had never been recorded. These findings put the epidemiological service in a difficult position, raising issues about how to explain the new occurrences of these vibrios, whether epidemic control measures should be taken, what should be the scope of these measures, and whether waters containing the vibrios should be treated. According to the instructions in effect at the time, the discovery of cholera vibrios in water required bans on the use of the water for irrigation, bathing, boating, fishing, etc.

The most vigorous epidemiologists tried to disinfect these waters. For example, when El Tor

[82] The authors of this article and the following articles written in response to it also refer to the Turkmen SSR (Soviet Socialist Republic) as Turkmenistan, Turkmenia, or simply "the republic."

vibrios were discovered in a lake near Krasnoyarsk, tons of disinfectants were put into the lake, and in addition, dynamite charges were set off to produce better mixing of the water. You can imagine the damage this caused; the entire surface of the lake was covered with dead fish. Interestingly, two weeks after this barbaric measure, cholera vibrios were again isolated from the lake's water.

Large numbers of El Tor cholera vibrios were continually found in the surface waters of Turkmenia. This strain was first documented back in 1939, long before the current cholera pandemic. However, there were no cases of cholera in the republic in 1939 or in subsequent years, excepting 1965, 1969, 1970, and 1972.



Distribution of plague epizootics in West Turkmenia, summer, 1953 (July, August, September). 1—cultures of plague microbe not isolated; 2—cultures isolated from rodents; 3—cultures isolated from ectoparasites; 4—cultures isolated from both rodents and ectoparasites.

Rimma Gerasimenko repeatedly contacted leading cholera epidemiologists of the system, namely A.K. Adamov, G.M. Medinsky, and V.L. Semiotrochev to ask for help in understanding the situation. The answer was more or less, "Turkmenia is sitting on a powder keg, the waters are brimming with cholera, and an epidemic could break out at any time." And in response to the logical inquiry about why any cases of illness under the circumstances had not been seen, the answer came back quickly, "You are doing a poor job of finding the disease and the vibrio carriers."

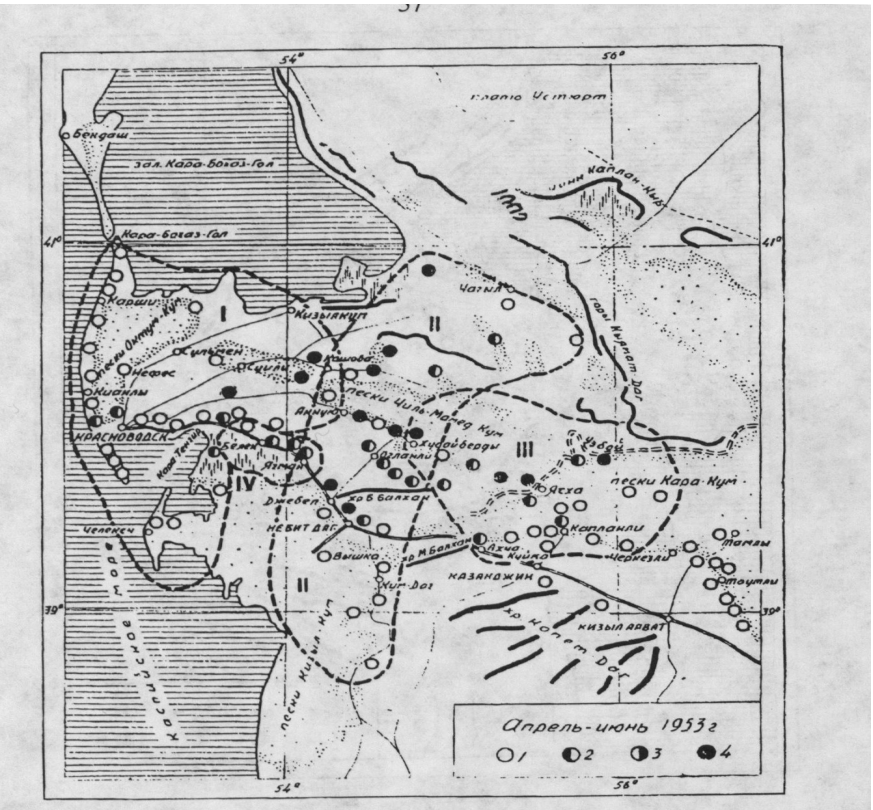


Схема распространения эпизоотии чумы в Западной Туркмении весной 1953 г. (апрель, май, июнь)

1 - культуры чумного микроба не выделены; 2 - культуры выделены от грызунов; 3- культуры выделены от эктопаразитов; 4 - культуры выделены и от грызунов, и от эктопаразитов.

I - зона обследования Красноводской лаборатории; II - то же, Небит-Дагской; III - то же, Тезе-Куинской; IV - то же, вагона-лаборатории.

Distribution of plague epizootics in West Turkmenia, spring, 1953 (April, May, June). 1—cultures of plague microbe not isolated; 2—cultures isolated from rodents; 3—cultures isolated from ectoparasites; 4—cultures isolated from both rodents and ectoparasites. Research zones: I—Krasnovodsky laboratory; II—Nebit-Dagsky; III—Teze-Kuinsky; IV—trailer laboratory.

In 1973, Rimma Gerasimenko asked me to help the station. It was recommended that Vitaly Ivanovich Svyatoy be the chief representative of the station, and he deserves special mention. Svyatoy had worked his way up from rodent exterminator to specialist. He worked on many outbreaks of plague, cholera, and other high-risk infections, and had excellent knowledge of the epidemiological situation in Turkmenia and the personnel of its anti-plague station. He was an excellent organizer and had an astounding capacity for work. One example will suffice. He personally determined the virulence of 1,057 strains by operating on 4,525 nursling rabbits. Only a high-capacity microbiological laboratory would be able to do this. Svyatoy commanded enormous authority among the staff because of his decency, principled nature, and his striving to help everyone teach the youth, support the weak, and intervene if someone had been wronged. He was one of the worthiest people that I ever met.

Svyatoy analyzed a huge amount of cholera material in Turkmenia over the course of 40 years, and paid particular attention to the virulence of strains. Of the 4,888 El Tor vibrio strains isolated from surface waters in the republic during 1965-88, 53 percent were classified

as weakly virulent and 47 percent were avirulent. There were no virulent cultures. Interestingly, hemolytic El Toro vibrios were present in water supplies, but there was a complete absence of cholera cases among the population using the water.

With all this evidence, by the mid-1970s, we were convinced that the detection of El Tor vibrios showed that these vibrios were constantly living, multiplying, and accumulating in Turkmenia waters. These findings fit well with sapronosis research showing that the environment is not only a factor in transmission, but also primarily a reservoir of infection.

Among the enormous number of virulent hemolytic El Tor strains, a few non-hemolytic virulent cultures were isolated from humans and from water during cholera outbreaks in Tashauz [Dasoguz] (1965), Firyuza [Pewrize] (1969), and Iolotan [Yoloten] (1972). These epidemic strains were easy to distinguish from avirulent strains. Numerous opponents immediately objected to the idea that weakly virulent strains entering a weakened organism could become more virulent and cause disease.

Svyatoy showed that the virulence increased after two to 12 passages through the intestinal tract of nursling rabbits. The cholerigencity syndrome was not demonstrated, but certain strains introduced with mucin or starch caused symptoms of enteropathogenicity in young rabbits.
While studying Turkmen strains, the author came to one other important conclusion. The combination method of determining the virulence of strains using bacteriophages KhDF 3, 4, and 5 (N.F. Bystry et al., 1970) gave results coinciding with the rabbit tests only for virulent strains. When studying cultures isolated from the environment, there were significant differences between the results of the phage tests and the rabbit tests.

These findings were later fully confirmed by T.A. Abolina and V.N. Savelyev (1989). They reported that the KhDF test results are not consistent with either the source of the strain or the in vivo test results. Therefore, G.M. Grizhebovsky (1997) could hardly be right in attributing the insufficiency of the combination method of determining virulence to the emergence of a large number of phage-resistant strains in recent years.

The unsuitability of this method was entirely obvious to specialists at the Turkmen AP Station 20 years ago, because the phage receptor and the enterotoxin have nothing in common. The validity of the Turkmen AP Station findings was questioned. On two occasions, the USSR MOH conducted commission investigations. The first commission worked in Ashgabat in February–March 1977. It included representatives from Mikrob, the Rostov AP Institute, and the Central and Turkmen AP Stations. The conclusions of this commission completely confirmed the findings of the Turkmen AP Station that El Tor strains are either pathogenic, nonpathogenic, or weakly pathogenic, and that primarily avirulent strains are circulating in Turkmen SSR.

The work of this commission resulted in "Provisional Methodological Recommendations for Determining the Cholerigenicity of El Tor Vibrios," which was released by the Main Administration for Quarantine Infections, USSR MOH. This document cut short numerous misunderstandings and arguments concerning the different evaluations of the pathological-anatomical presentation of the young rabbits killed by the experimental cholera infection. In particular, the commission confirmed that the results of the phage tests for determining virulence in many cases do not match the in vivo test results, especially for strains obtained from water.

The work of the second inter-institute commission (November–December 1978, Mikrob) was to verify the possibility of a reversal of virulence in the Turkmen strains. No reversal occurred, which confirmed that the strains do not cause epidemics.

Much later, a molecular genetic method was used to prove that there is no close relationship between the El Tor vibrio strains obtained from outbreak victims and the strains from the environment. It was hypothesized that the non-toxigenic environmental strains cannot be recipients of genes coding for toxin synthesis (G.M. Grizhebovsky, 1997).

The prolonged debate about the significance of the Turkmen strains ended with the results of a controlled epidemiological experiment in Kara-Kala [Garrygala] in 1980. The experiment was conducted by a group of specialists from the USSR MOH, Turkmenia MOH, Central Institute of Epidemiology, Mikrob, Rostov AP Institute, and Turkmen AP Station. The town of Kara-Kala, located in southern Turkmenia near the border with Iran, was chosen for several reasons. Water samples collected over a number of years very frequently contained El Tor cholera vibrios. Migration processes were limited, and there was a single water supply. The sanitary characteristics of the drinking water were extremely poor: 621 cultures of nonpathogenic El Tor vibrios were isolated from Kara-Kala drinking water during 1978-80.

During the epidemiology experiment, 35 El Tor vibrio cultures were isolated from the water in August 1980. The incidence rate of acute gastrointestinal infection was 1,499 per 100,000 people. Of the 3,120 people (40 percent of the population) checked for cholera during the epidemiology experiment, eight were identified as vibrio carriers. They were hospitalized, carefully examined by the commission, and pronounced healthy. Repeated paired serum studies of the blood of these carriers did not reveal any vibriocide antibodies or antitoxin. These vibrio carriers were essentially healthy and most likely were not convalescent, but instead were transitory carriers who had obtained the El Tor vibrios from water. Five-fold examinations of their contacts gave negative results. From these observations, it was definitively concluded that these vibrios are not contagious and do not pose any epidemic hazard.

However, despite the confirming results from the highest-level commissions, Svyatoy's dissertation did not pass the preliminary defense at Mikrob. Several specialists at the institute were particularly "active" in the discussion. Their comments were extremely prejudiced and

were well orchestrated. What seemed particularly strange was the position of those who had worked more than once at Turkmen AP Station, right along with Svyatoy, and had seen his results directly. Based on the criteria at the time, the dissertation was a classified secret, so it was impossible to bypass Mikrob and submit it to a different defense committee. The failure of the preliminary defense was very stressful for Svyatoy, who was exhausted from the scientific intrigues. The contents of the dissertation were later declassified and published in full in the journal *Zdravokhranenie Turkmenistana* (*Public Health of Turkmenistan*). But this occurred after his death. However the "victory" over Svyatoy was Pyrrhic. As our great filmmaker [Sergey] Eizenshtein said, "Justice sooner or later will prevail, but… unfortunately life is short."
V.P. Sergiev, then Director of the Main Administration of Quarantine Infections, USSR MOH, contributed greatly to the development of the new tactic for monitoring cholera in our country. Not long afterward, a differentiated approach for responding to the detection of vibrios in the environment was outlined in USSR MOH Order No. 105 of December 9, 1982, and in *Instruktsiya po organizatsii i provedeniyu protivokholernykh meropriyatiy*, 1984 (Instructions for Organizing and Conducting Cholera Control Measures). The guidelines recommended taking less intensive control measures when avirulent and weakly virulent cultures are detected, as compared with cases when virulent strains are detected. Later, USSR MOH Order No. 399 of October 1, 1990, and the instructions in 1991 and 1995 formulated this principle in more detail. It must be emphasized that the social and economic costs are greatly reduced with this approach.

According to E.A. Moskvitina (1996), the economic loss for one case of cholera with the isolation of virulent cultures was 10,042,170 rubles, while the cost for one case with the isolation of avirulent vibrios was 2,008,129 rubles.

What about the adversaries who so actively opposed the specialists of Turkmen AP Station and made no small effort to derail Svyatoy's dissertation? What did they do afterwards? When they caught wind of the new tack taken by the MOH, they promptly changed course and revised their views. For example, among the co-authors of the collective monograph *Epidemiologichesky nadzor za kholeroy v SSSR* (*Epidemiological Surveillance of Cholera in the USSR*) (Moscow, 1989), edited by V.P. Sergiev, we surprisingly find the names G.M. Medinsky and A.K. Adamov, who only a short time before had argued against Gerasimenko and Svyatoy.

Later, in the late 1980s, scientists started to use molecular-genetic methods of detecting the Vct gene that produces enterotoxin to determine virulence, see V.P. Vlasov and Ye.V. Monakhov (1988) and A.F. Bryukhanov et al. (1991). These new methods fully confirmed Svyatoy's results. The Vct gene was not found in the Turkmen strains.

Of course, in vitro methods have advantages over in vivo testing. But when will molecular-genetic methods become available for practical laboratory use? Meanwhile, testing the virulence of cholera strains is a daily necessity.

What can we learn from this history of the long dispute between Turkmen AP Station and the specialists from the anti-plague institutes? First, scientists should never underestimate the potential of practical establishments.

Second, scientific truth cannot be suppressed using unethical methods of attack. This can work for a while, but eventually fails.

Third, in a number of cases the moral and professional qualities of practical workers are far higher than those of the scientific masters.

References

T.A Abolina and V.N. Savelyev, "Study of the virulence of cholera vibrio isolated in Azerbaijan SSR" (in Russian), in: *Aktualnye voprosy epidem., profil. i diagn. OOI. Tez. dokl. nauch. konf. (Abstracts of Reports to the Scientific Conference: Current Issues in Epidemiology, Prevention, and Diagnosis of High Risk Infections*), Stavropol, 1989, pt. 1, pp. 3-4.

A.F. Bryukhanov, "Molecular-biological characterization of El Tor cholera vibrio strains of various origins" (in Russian), Author's abstract of candidate dissertation, Saratov, 1991.

N.F. Bystry, et al., "Method of differentiating virulent and avirulent vibrios using specific virulent bacteriophages" (in Russian), *Problemy OOI*, 1970, no. 1, p. 123.

G.M. Grizhebovsky, *Cholera in the Caucasus* (in Russian), Doctoral dissertation, Stavropol, 1997.

B.A. Kiyakhtanov, L.F. Zykin, R.T. Gerasimenko, et al., "Cholerigenicity of El Tor vibrios" (in Russian), *Zdravookhr. Turkmenistana*, 1977, no. 9, pp. 12-16.

E.A. Mosktivina, "Scientific basis for the principles of improving cholera control measures" (in Russian), Author's abstract of candidate dissertation, Saratov, 1996.

V.P. Sergiev (editor), *Epidemiologichesky nadzor za kholeroy v SSSR* (*Epidemiological Surveillance of Cholera in the USSR*), Moscow, 1989.

V.I. Svyatoy, V.M. Razvykh, and V.A. Friauf, "Distinguishing features of the ecology of El Tor vibrios circulating in Turkmen SSR" (in Russian), *Zdravookhr. Turkmenistana*, 1991, no. 1, pp. 30-33.

V.I. Svyatoy, R.T. Gerasimenko, and V.M. Razvykh, "Results of a controlled field epidemiological experiment to determine the epidemicity of hemolysis-positive El Tor cholera vibrios" (in Russian), *Zdravookhr. Turkmenistana*, 1991, no. 2, pp. 35-38.

V.P. Vlasov, and Ye.V. Monakhov, "Prospects for molecular-biological approaches to studying cholera"

(in Russian), Abstracts of reports to the All-Union Conference on Cholera, Rostov, 1988, p. 44.

L.F. Zykin, B.A. Kiyatkhanov, and R.T. Gerasimenko, "El Tor vibrios of various enteropathogenicities" (in Russian), *Zhurnal mikrobiologii*, 1978, no. 3, pp. 115-19.

L.F. Zykin, V.I. Svyatoy, and R.S. Zotova, "Study of enteropathogenic hemolytic El Tor vibrios" (in Russian), *Zhurnal mikrobiologii*, 1978, no. 2, pp. 118-19.

L.F. Zykin, and A.T. Yakovlev, *Ocherki po laboratornoy diagnostike opasnykh infektsiy* (*Briefs on the Laboratory Diagnosis of Dangerous Infections*), Saratov, Izd. SGU, 1993, pp. 75-82.

Editor's Note

M.I. Levi (p. 225)

This note discusses considerations for publishing "How it really was" by L.F. Zykin (pp. 217-225). It also discusses the emotions raised by questions of priority of scientific discoveries.

Full translation:

> The *Interesting Stories*… are not subject to censorship by the editor. The authors are solely responsible for their content. Authors must understand the responsibility they are undertaking. However, none of this excludes the possibility that different authors will express different opinions about a particular phenomenon or a particular person.
>
> Problems of priority rather often carry a heavy emotional load that makes them the subject of various claims and analyses. One of these conflicts is described by L.F. Zykin in his article, "How It Really Was."
>
> In a number of cases, some of the active authors for our series have had the opportunity to read through manuscripts before publication. In the present case, researchers who took part in studying cholera in our country were given the opportunity to read the article by L.F. Zykin. As a result, the editor received responses that we publish below. Readers should note that we did not feel we had the right to refuse to publish L.F. Skin's article or change its content, but we recognize that it would be reasonable to present other opinions.

What Do You Mean 'How It Really Was'

R.S. Zotova (pp. 226-29)

Commentary on the article "How it really was" by L.F. Zykin (pp. 217-25).

Full translation:

L.F. Zykin mentioned my name in his reminiscences. In fact, I worked at the Turkmen AP Station for a long time and was a direct participant in several of the events described.

In 1965, when cholera outbreaks occurred in Iran, Afghanistan, Uzbekistan, and elsewhere, extensive cholera prevention measures were taken in Turkmenia because the republic borders all these countries. At the time, I was working in the Kizil-Atrek (Gyzyletrek) district along the Iranian border. The Atrek (Etrek) River flows through this district and is the main water source for most of the district's population. Every evening, we heard Turkmen-speaking medical workers from Iran urging residents of Turkmenistan to wash vegetables and fruits in potassium permanganate solution, not to drink untreated water, and so on.

In two months of work, we isolated from Atrek River water about 50 strains of Heiberg group one vibrios agglutinating with O-cholera serum in diagnostic titers. At that time, similar cultures were isolated from nearly all the water bodies in the republic.

Around November or December, N.V. Uryupina, senior scientist at Mikrob, brought us Mukherjee phages. She familiarized us with what were then new methods (identification tests, differential tests, etc.). Working with her we identified strains isolated from the towns of Kushka [Serhetabat] and Kizil-Atrek. This work identified the strains as El Tor vibrios, most of which were Ogawa serotype, some were Inaba.

The director of the Turkmen AP Station at that time was Mariya Mikhaylovna Tikhomirova. She asked me to develop the results into a candidate dissertation. I took the data to Mikrob. Yevgeniya Ilinichna Korobkova agreed to direct my dissertation work. This took place at the end of the year, and the topics for the new year had already been approved. Boris Konstantinovich Fenyuk, deputy scientific director of Mikrob, convened the Academic Council, which approved my dissertation topic. In addition, Boris Fenyuk helped me learn new methods, including luminescence microscopy. I write about this in detail because I wanted to gratefully remember Mariya Tikhomirova, Yevgeniya Korobkova, and Boris Fenyuk, who lived, worked, trained students, and contributed very much to the study of high-risk infections, mainly the plague pathogen.

I defended my dissertation in 1969. During that entire time, there were no epidemics in Turkmenistan, but El Tor vibrios continued to be isolated from the environment (waters, wastewaters, fish, and frogs). There was an urgent need to determine the virulence of the strains. V.I. Svyatoy was assigned to study this problem and L.F. Zykin agreed to direct his work.

I.V. Isupov, D.L. Shmerkevich, N.S. Goncharova, and other scientists at Mikrob also studied the virulence of El Tor vibrios isolated from the environment in Turkmenia. In one instance,

the scientists observed a restoration of the cholerigenic properties of weakly virulent strains of El Tor vibrios by passing them through the small intestine of nursling rabbits.

This work was duplicated by a commission based at the Turkmen AP Station. There were different opinions about the cholerigenicity syndrome of the dead rabbit. In my view, the syndrome was positive, but other people thought it was negative. The dead rabbit's small intestine, which was swollen with clear liquid, contained several very small green lumps. This caused the dispute about the cholerigenicity syndrome.

It should be noted that at the same time as V.I. Svyatoy's work, other work was being done in the AP Station laboratory to study whether El Tor vibrios isolated from various environmental features in Turkmenia were capable of producing choleragen exotoxin in vitro (using the terminology of that time). This work was done by Elvira Zhukova, a graduate student at the N.F. Gamaleya Institute, and was directed by I.A. Shaginyan, director of the Genetics Laboratory at that same institute.

In the first stage of this work, Zhukova found that the "Turkmen" strains were differentiated by the following characteristic; El Tor vibrios isolated from patients produced large amounts of toxin, while those isolated from the environment produced little toxin or were atoxigenic vibrios.

At present, as Zykin already noted, the virulence of El Tor vibrios is evaluated based on the potential ability to produce cholera toxin (Vct+) or the absence of this ability (Vct–). L.S. Podosinnikova, who wrote a doctoral dissertation on El Tor vibrios isolated from various areas of the former Soviet Union, also noted a difference in strains based on the presence or absence of the gene responsible for the synthesis of cholera toxin (Vct+ or Vct–). I do not know what became of the work done by Svyatoy or Zhukova, because soon afterward I left Turkmenia and never did any more work with vibrios. But why did Zykin not mention Zhukova's work in his article? After all, this was unique work for those times.

From Zykin's article, I learned that Svyatoy did not defend his dissertation, and the author blamed D.L. Shmerkevich and N.S. Goncharova. The Academic Council makes the decision about the defense of a dissertation, and they were never members of the Academic Council of Mikrob Institute. Incidentally, Goncharova died of cancer, as did Svyatoy.

Now, about the reversing of cholerigenic properties of cholera vibrios: again, Podosinnikova showed that in two cases out of four, a stable reversal of cholerigenic properties of weakly virulent Vct+ strains of El Tor vibrios was obtained by passage through the intestine of experimentally infected nursling rabbits.

As for the philosophical statement of film director Eizenshtein, the only people who can answer that are personnel at the Turkmen AP Station who continue to live and work in Turkmenia.

After all, over 20 years have passed since the events described by Zykin. During that time, they could have analyzed the epidemiological situation and determined whether the strains did or did not have the Vct gene.

In this regard, I can again quote Podosinnikova: "In a number of areas (Uzbekistan, Turkmenistan, Rostov, Astrakhan, Donetsk, and other regions), repeated cholera outbreaks were recorded against a background of a long period of isolating El Tor vibrios from the environment."

So what do you mean, "How It Really Was"?

R.S. Zotova

P.S. On January 14, 1998, I called I.A. Shaginyan and asked what had become of Zhukova. He said that Elvira successfully defended her candidate dissertation and continued to work at Turkmen Institute of Epidemiology and Microbiology (TIEM). At one time, she was deputy scientific director there. In her dissertation, Zhukova concluded that some El Tor vibrios circulating in the environment of Turkmenia did not produce exotoxin (choleragen), while others produced it to varying degrees.

Dear Yury Grigorevich

Yu.M. Lomov (pp. 229-31)

Commentary on the article "How it really was" by L.F. Zykin (pp. 217-25).

Full translation:

Thank you for the chance to read L.F. Zykin's manuscript of reminiscences about one of the challenging periods for workers at the Turkmen AP Station.

Reminiscences are always subjective and emotionally colored, which places a certain responsibility on the authors and requires gentleness and accuracy, especially when talking not only about the fate of people, but about problems of the group. In this regard, I would like to note that the anti-plague system is a rare example of close collaboration and unity between science and practice.

At your request, I shared the manuscript with E.A. Moskvitina and L.S. Podosinnikova. During the 1970s and 1980s, they worked with specialists from Turkmen AP Station on cholera epidemiological surveillance taking into account the properties of El Tor vibrios isolated from Turkmenia. Podosinnikova also participated in the multifaceted study of the reversal of virulence in El Tor vibrios found in water bodies in cholera-free areas, including Turkmenia,

and also participated in the commission that verified the results of this work in 1978. We would like to note a certain bias of Zykin in describing a complicated time for public health science and practice in evaluating the epidemiological significance of cholera vibrios from surface waters. The article contains irritating inaccuracies, hence the bias expressed in the title. In fact, everything was more complicated than Zykin describes, but there was no standoff between science and practice. Neither scientists nor practitioners were able to provide factual data on the "safety" of the strains. They did not have suitable tools to do this. V.I. Svyatoy was not the only person who had this intuition.

The possibility of differences in the "local" El Tor vibrio strains isolated from waters in Turkmenia was first raised by R.S. Zotova, a scientist at Turkmen AP Station, in her dissertation work in 1969. In the 1970s, this work was continued by V.I. Svyatoy, a scientist at the same AP station, who examined a large number of cholera vibrio strains of local origin and showed that they were "weakly" virulent or were not virulent. However in those years, it was impossible to distinguish them from dangerous pathogens that had entered the water and lost their virulence. A situation similar to that in Turkmenia took place in the Sochi area, where, since 1969, cholera vibrios were isolated from certain rivers every year, although there were no cholera outbreaks. Specialists from all institutions of the anti-plague system searched for criteria to differentiate "dangerous" strains. Proof of this is shown by the collaborative research done during 1973-78 by all the AP institutes and Turkmen AP Station, as well as the commission at Mikrob in 1978 organized by the USSR MOH to investigate the possibility of reversal of virulence in strains isolated from cholera-free areas. This work failed to show that the strains isolated from waters in Sochi, Turkmenia, and other cholera-free areas could become virulent.

In the 1980s, based on the synthesis of data on cholera vibrios isolated from various environmental features in different areas of the USSR (Moldavia, Ukraine, Russia, Armenia, Azerbaijan, Turkmenia, Uzbekistan, and others), the Rostov AP Institute, as the lead institute for cholera, with the participation of leading specialists from other institutes, submitted to the Main Administration for Quarantine Infections, USSR MOH, data that became the basis for "Instructions for Organizing and Conducting Cholera Control Measures" (1981). This document established preventive measures, i.e., measures to identify cholera vibrios from environmental features, which, back then, helped reduce the social and economic costs of cholera epidemic surveillance.

The sorting of cholera vibrio strains into epidemically significant ones that have the cholera toxin gene versus non-epidemic strains (without this gene) became possible only in the 1980s with the introduction of the molecular probe method. Following on the work by American researchers who showed that the Vct– strains are not pathogens of epidemic cholera, this method was used by specialists in this country (G.M. Grizhebovsky, V.P. Vlasov, Ye.V. Monakhov, A.F. Bryukhanov, and others). The analysis of this characteristic for strains isolated in the USSR during the seventh pandemic in areas with different epidemiological situations (L.S. Podosinnikova) made it possible to evaluate the epidemiological situation in areas where

Vct– cholera vibrios had been isolated every year, in order to develop the basis for dividing the country into zones by type of cholera epidemic (E.A. Moskvitina), and also in order to propose differences in the extent of measures to be taken when cholera vibrios with different toxicities are isolated from patients.

Thus, the experience and factual data of practicing public health workers, supplemented by scientific research using new methodologies, served as the basis for the changes of tactics for conducting cholera prevention and control measures as formulated in standard documents, first in 1991, "Instructions for Organizing and Conducting Cholera Control Measures," USSR MOH Order No. 390 of October 1, 1990, and later, in the next edition of the document published in 1995 under the same title.

In addition, to placing V.I. Svyatoy in opposition to all the specialists of the system, several other inaccuracies found their way into Zykin's article, in particular, the rejection of the theoretical basis of the possibility of using the phage method to evaluate the virulence of cholera vibrios. At a certain stage during a period of over 15 years, this method was very convenient for practical public health purposes because of the difficulty of experimentally evaluating virulence. The resistance to phages became a hindrance to the method only in the 1990s.

This, briefly stated, is the viewpoint of specialists of the lead institute for cholera concerning the very complicated issue of the 1970s and 1980s of evaluating cholera epidemics in different areas and determining the epidemic significance of strains isolated from surface waters. This is somewhat different from Zykin's subjective bias expressed in each word of this article, because of which it is hardly worth publishing.

Institute Director, Honored Scientist of the Russian Federation,
Academician of the Russian Federation Academy of Natural Sciences,
Professor Yu.M. Lomov

In Response to the Request Concerning the Article by L.F. Zykin

R.T. Gerasimenko (p. 231)

Commentary on the article "How it really was" by L.F. Zykin (pp. 217-25).

Full translation:

… I agree with everything that is said and no changes are needed. If possible, please mention the physician L.I. Alieva in the section concerning the rabbit experiments. She was a virtuoso in the laboratory work of infecting rabbits and mice.

How It Was Proven That the Cholera Outbreak in 1965 Was Caused by El Tor Vibrio

Leonid Fedorovich Zykin (p. 232-38)

This chapter describes the investigation of a cholera outbreak in Kara-Kalpak that began in the summer of 1965 and lasted through early 1966. It discusses how the El Tor bacterium was identified as the cause of the outbreak and describes the controversy concerning these findings.

Isolation of Cholera Toxin by Soviet Scientists

Leonid Fedorovich Zykin (pp. 239-51). 16 references, one photograph.

This chapter describes developments in cholera research by the author and others from the 1960s through 1990s. It also discusses the changing theories on the nature of cholera toxin and its effects on animal models. Last, it describes the development of a cholera vaccine and diagnostic test.

Forgotten Photographs

M.I. Levi, Yu.G. Suchkov (pp. 252-94). 42 photographs.

This section contains photographs (group and individual portraits) of researchers and other AP system personnel that were taken during the 1930s through the 1990s. Most photographs are undated.

Plague Vaccine Strain Yields a Thermobiotic

M.I. Levi (pp. 295-97). 1 figure.

This chapter is, in effect, an abstract of recent research findings that demonstrate that the EV vaccine strain of the plague bacterium produces a thermobiotic similar to that produced by Bacillus stearothermophilus.

Index of Names in Volume 7

pp. (302-13)

Not included in this paper.

Volume 8 (1998)

Foreword

Moisey Iosifovich Levi (p. 3)

Introduction to the eighth volume of the "Interesting Stories..." series.

Full translation:

> Life goes on, and now, dear readers, the Eighth Volume of the *Interesting Stories*… is in your hands. Our cellar of memories is nearly bare, "some are far distant, some are dead…."[83] Therefore, along with historical articles, we are publishing thorough scientific reviews and original fundamental research. Even in these articles, we are trying to include elements in the lives of institutions and individual scientists.
>
> The mainstream media have noticed us; in particular, the monthly *Sovershenno Sekretno*, no. 10, 1998, published a long article by T.M. Belousova entitled "Plague."[84]
>
> In this volume, we acknowledge the 80th anniversary of the announcement, although not the actual founding, of Mikrob in Saratov. This institution occupies a glorious and honored position in the AP service.
>
> We will be grateful to our readers for any comments and criticisms about the published materials.
>
> M.I. Levi, Editor

High-Risk Infections in the Research of Zinaida Vissarionovna Yermolyeva

Elena Alekseevna Vedmina (p. 4-21). Four photographs.

This chapter is a biographical sketch of Z.V. Yermolyeva, a prominent microbiologist and administrator, which highlights her laboratory research and fieldwork with high-risk infections, including cholera and plague.

[83] This is a line by the thirteenth-century Persian poet Sadi which Aleksandr Pushkin cites in the final stanza of his epic poem, *Eugene Onegin*: "Of those who heard my opening pages / in friendly gatherings where I read, / as Sadi sang in earlier ages, / 'some are far distant, some are dead,'" (1979 Charles Johnston translation).

[84] A translated version of this article is included in Part II of this paper.

Enduring Lines of History

Gyulnara Asambaevna Temiralieva and Irina Semenova Arakelyan (pp. 22-36). Three photographs.
This essay describes the history of the Central Asian Scientific Research AP Institute, founded in 1949. It highlights major research findings and publications generated by institute personnel.

The chapter includes biographical notes on the following scientists and administrators: Mukhamedrakhim Kuandykovich Tleugabylov, Veniamin Vasilevich Shumaev, Masgut Aykimbaevich Aykimbaev, Vladimir Stepanovich Petrov, Lev Nikolaevich Klassovsky, Boris Mikhaylovich Kasatkin, Dmitry Ivanovich Bibikov, Leonid Aleksandrovich Peysakhis, Moyshe Fishelevich Shmuter, Natalya Lvovna Leshkovich, Valentina Aleksandrovna Bibikova, Mitrofan Alekseevich Mikulin, Olga Vasilyevna Afanasyeva, Vladimir Nikolaevich Kunitsky, Mariya Afanasyevna Krasikova, Bediya Rakhimovna Uzbekova, Ivan Lukyanovich Martinevsky, and Orynbay Seitovich Serzhanov.

The Volgograd AP Institute: From Sunrise to Sunset

Leonid Fedorovich Zykin (pp. 37-52). One photograph, four references.

This chapter describes the history of the Volgograd AP Institute as it unfolded during the author's career there as a researcher and administrator during 1971-92.

Zykin describes the major research areas of the institute, especially detailing the history of the detection laboratory he directed. These civil biological defense activities supported "Problem 5" activities of the Soviet BW program. Zykin notes the work of the first director of the institute, V.S. Surkov, an epidemiologist and retired colonel, as well as the research performed by Aleksandr Dmitrievich Manolov on use of radioimmune analysis to detect high-risk infectious pathogens, especially those that cause plague and melioidosis. Later, Zykin became frustrated dealing with new directors of the institute as the morale at Volgograd gradually declined.

Excerpt:

> Volgograd AP Institute was founded in 1970 to solve problems related to civil defense. It was officially under the USSR MOH, but many research fields were funded with the participation of *Glavmikrobioprom*. The institute was based on the Volgograd branch of the Rostov AP Institute, but its remote predecessor was the Stalingrad AP Station. Therefore, during the organizational period, the main staff consisted of practical workers from the former Stalingrad AP Station and its subdivisions, along with a few people who transferred to it from the Rostov AP Institute.
>
> The director during the organizational period was V.S. Suvorov, a retired colonel of the medical service and an experienced epidemiologist who had served for many years in military research

institutes. His deputy and right-hand man was B.G. Valkov, who was the de facto director of the institute at the time and directed personnel and management policy, as well as facility construction. Valkov had a wide range of connections in Volgograd and enjoyed the support of Communist Party and Soviet organizations. Within the institute, he relied primarily on S.L. Borodko, who was the academic secretary and long-time secretary of the party organization. The tasks that the higher authorities assigned to the Volgograd AP Institute could not be accomplished with the old staff of practical plagueologists who were at or near retirement age. Therefore, it was exceptionally important to hire leading specialists [i.e. scientists familiar with the principles of microbiology and genetics].

Specialists in genetics, mycology, laboratory diagnosis, and immunology were invited to become directors of newly constructed laboratories: L.A. Ryapis (who later left and was replaced by V.I. Ilyukhin), A.V. Lipnitsky, L.F. Zykin, and V.N. Metlin. The institute hired strong biochemists such as V.I. Zakrevsky and A.M. Loktionov, who were former students of Professor Yu.V. Galaev, who was well known in scientific circles. Others included the experienced epidemiologist and aerosol specialist V.M. Svistunov, and microbiologists K.V. Durikhin, L.S. Petrova, and A.I. Kishenevsky. Standouts among the local personnel included E.M. Beburishvili, A.Ye. Popova, L.K. Merinova, and N.P. Khrapova.

The main problems to be solved by the institute's scientists pertained to: pathogens of high-risk mycoses, namely coccidioidomycosis, histoplasmosis, and blastomycosis; pathogens that cause glanders and melioidosis; the detection and laboratory diagnosis of high-risk infections; the development of disinfection methods for these infections; and the efficient conducting of epidemiological investigations.[85]

At that time (early 1970s), cholera was of particular concern, since there had been several cases and even small outbreaks in the area. Zykin's laboratory developed diagnostic erythrocyte antigen for detecting cholera toxin.

It was during this time that major changes occurred in the structure and personnel of the laboratory. A new scientific-production group was established within the laboratory whose main task was the development and production of diagnostic preparations, luminescent immunoglobulins and, later, immunoenzyme test systems for rapid diagnosis and detection of pathogens that cause glanders, melioidosis, atypical plague, and other dangerous pathogens. The laboratory blossomed during late 1970s and first half of 1980s, when it actively collaborated with other departments at the institute, with large research institutes (the Gamaleya Institute, as well as the Central Asia, Irkutsk, and Rostov AP institutes), and with AP stations. It was able to rapidly and effectively solve major tasks of implementing new diagnostic substances and testing them under practical conditions.

[85] These were subjects that were investigated by the Soviet offensive BW program and Problem 5.

...because Suvorov allowed serious mistakes in personnel, administrative, and science policy at the institute, he was fired from his post as director in July 1976.

In 1985, N.G. Tikhonov was named director of the Volgograd AP Institute. He was a student and favorite of A.K. Adamov and P.I. Anisimov, and a major scientist in many fields, including biochemistry, microbiology, and production of biological preparations...

The anti-plague system stagnated in the early 1990s. There was a complete lack of any coherent concept for a modern anti-plague organization:

- No understanding of near- and long-term objectives for the system.

- Serious mistakes in hiring policy. As a result, many anti-plague institute directors and some anti-plague station managers were completely incompetent to solve scientific and practical problems.

All of this led to infighting and tensions. People would send anonymous letters, and teamwork suffered. Our microbiology, immunology, and epidemiology began to lag behind world-class levels because the leadership had no thought-out science policy, fought against those holding different viewpoints, undermined our organization's system of values, and instituted an overbearing, top-down command method of management. The AP system was left with practically no prominent scientists or true leaders. Publications became trivial and descriptive, and the quality of dissertations declined. We lost many young people because we did a poor job of working with them, and now there remains only a handful of truly gifted young specialists.

Grigory Alekseevich Balandin, as a Scientist and Person

V.S. Uraleva (pp. 53-56)

This chapter contains a biographical sketch of G.A. Balandin, a brucellosis specialist at the Rostov AP Institute, 1946-64.

Balandin made important contributions to the epidemiology, treatment, and laboratory diagnosis of brucellosis. In this chapter, his background and career are described. He is remembered as an active scientist, excellent teacher, and able administrator.

Memorial Essay on Academician Georgy Pavlovich Rudnev, 1899-1970

Rostislav Alekseevich Taranin (pp. 57-67). Four photographs.

This chapter contains a biographical sketch of G.P. Rudnev, academician, scientist, and educator in the field of infectious diseases. He worked as an epidemiologist in the army during World War II and later as a consultant to the Main Military-Sanitary Administration of the Soviet Army.

While consulting at an infectious disease hospital on the Russian western front in World War II, where tularemia was particularly prevalent, Rudnev was the first to correctly diagnose the tonsilitic-bubonic form of tularemia, which presented as an acute respiratory infection. Rudnev's clinical and epidemiological classification of tularemia was very important for identifying and controlling local outbreaks.

Taranin also describes his own career. He studied under Rudnev at the Rostov-on-Don State Medical Institute. After completing his studies, he entered the military medical service for a 30-year career as physician, epidemiologist, and teacher. He did research on anti-epidemic and anti-bacteriological defense, especially plague. He left the military to become senior scientist at a closed anti-epidemiological establishment, where he worked on special problems of anti-bacteriological defense. Later, he served as an AP epidemiologist in Leningrad and in the medical-sanitary unit of a defense-oriented science–production association.[86]

Reminiscences of Working in the Budennovsk AP Division and the State Commission (1958-59) for Approving New Plague Vaccine Strains

Aleksandr Iosifovich Tinker (pp. 68-87). Two photographs, 23 references.

This chapter describes research conducted at the Budennovsk Division of the Scientific AP Institute of the Caucasus and Transcaucasus, located approximately 175 kilometers east of Stavropol. It describes working and living conditions, as well as the research program initiated by the author to detect antibodies to plague Fraction 1 in rodents.

Equipment at Budennovsk in the 1950s was primitive: temperature chambers were kerosene heated (guards checked the temperature at night), and electricity was available only from sunset until midnight. After arranging for uninterrupted electricity supply from the local utility, Tinker wrote to Elektrosila Company to obtain suitable electrical equipment for his research. He made mention of epizootics in the letter, which was a breach of secrecy, but no problems came from the authorities over this.

When Tinker was ready to begin research, he was sent to Georgia to conduct summer fieldwork. Upon returning to Budennovsk in autumn, he was again sent away for six months to serve on the State Commission responsible for evaluating plague vaccine strains developed by Lev Ivanovich Leshkovich. Tinker describes the structure, personnel, and method of work of the State Commission.

[86] This "association" probably was Biopreparat.

At the end of one long day, he forgot the instruments he had left in a sterilizer, causing a fire in the laboratory, but this did not adversely affect their work. Eventually, the commission rejected the strains submitted by Leshkovich.

After returning from working on the commission, Tinker became a physician in the institute's vaccine department, which produced a live plague vaccine based on the EV strain.[87] He felt that the most promising direction of research was to develop the theoretical basis of and practical recommendations for stabilizing the EV plague vaccine strain and then lyophilizing it. He notes that good work had already been done in this area in the military institutes, but strict secrecy prevented civilian access to this information.[88] As a result, the USSR AP system had to conduct its own research on the subject, under the author's supervision at the institute.

Full translation:

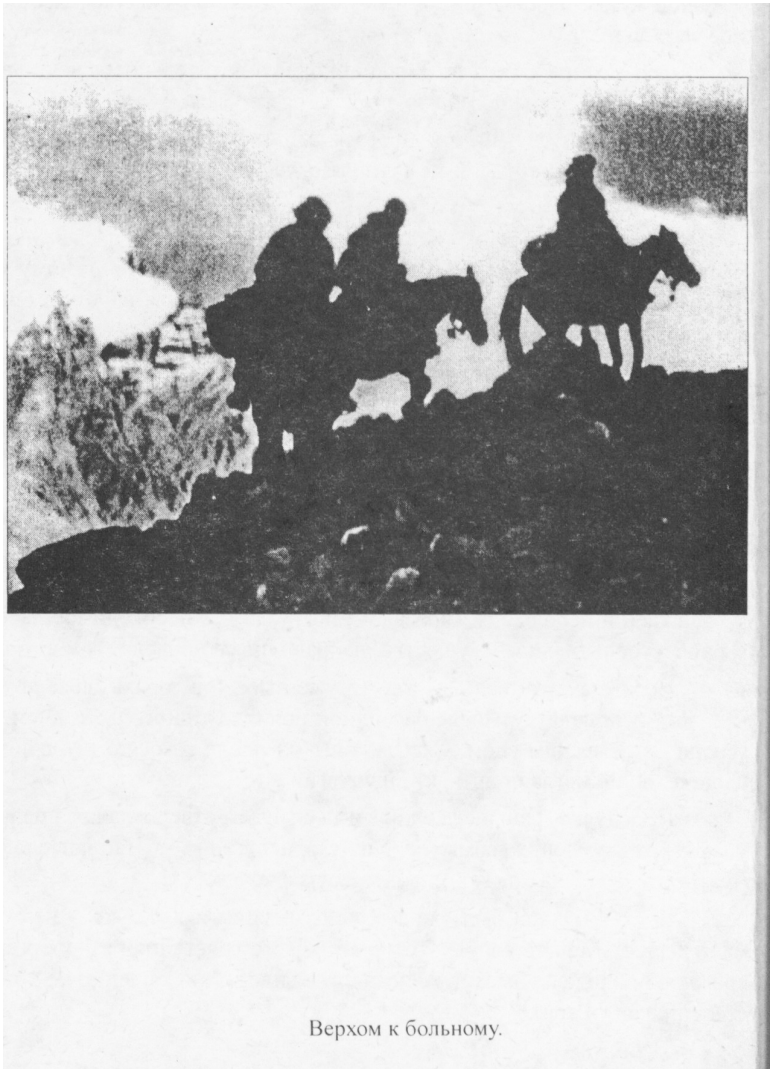
> After reading the article by Moisey I. Levi about the life and fate of Lev Ivanovich Leshkovich, I thought it might be interesting to share my reminiscences about the work of the state commission for approving plague strains 100 R6 and 3413 R6, which Leshkovich proposed as vaccine strains.
>
> In 1956, after working two years as a physician at the Guryev AP Station, I was transferred to the Budennovsk Division of the Scientific AP Institute of the Caucasus and Transcaucasus (Stavropol). Like many people who worked at outposts of the AP system, I wanted to undertake a research project in addition to my practical work. I took my request to Moisey I. Levi, doctor of medical sciences, who was the deputy scientific director of the institute. He proposed that I study rodents to detect antibodies to fraction 1 (F1) of the plague microbe *Yersinia pestis*. The institute would provide the facilities for the work. At that time, a method had been developed for preparing diagnostic erythrocytes for passive hemagglutination tests. The research would be conducted during the spring-summer and fall periods of planned field operations to search for the plague pathogen. Both traditional and serologic methods would be used in the research. Specialists at the Budennovsk Division routinely carried out epidemic surveillance in the northeastern Stavropol Region. This area is inhabited by susliks, which are the main hosts of the plague pathogen.[89] The plague pathogen had not been detected in cultures from this focus for several decades. The use of a sensitive serologic reaction might provide more precise information about the plague situation in the focus.

[87] Iu.V. Chicherin, V.A. Lebedinsky, and V.I. Yevstigneev, "Stability of the immunogenic properties of plague vaccine strain EV, Research Institute of Epidemiology and Hygiene line, during long-term storage" (in Russian), *Zhurnal mikrobiologii epidemiologii i immunobiologii* 4 (1979), pp. 39-42.

[88] In fact, a team led by M.M. Faybich and working at the Ministry of Defense's Scientific Research Institute for Epidemiology and Hygiene (the institute's Russian acronym was NIIEG) had developed an effective live plague vaccine called plague NIIEG vaccine already in 1941; see Leitenberg and Zilinskas, *The Soviet Biological Weapons Program*, p. 28. (A Russian vaccine was typically named after the institute that developed it.)

[89] *Susliks* are ground squirrels of the *Spermophilus* species.

The first step involved a lot of work preparing the diagnostic erythrocytes and obtaining equipment to set up the laboratory at Budennovsk. A second researcher in the project was Yury Vladimirovich Kanatov, who also had been hired as a physician at the Budennovsk Division after completing courses on high-risk infections. Later on, working with other specialists in the system, Yury contributed greatly to the introduction of passive hemagglutination for practical AP work. He eventually became a doctor of medical sciences and professor.



Riding horseback to visit a patient

However, at that stage, since I was the initiator and was a physician with greater practical experience, I was sent to the institute and given working space to learn the method of preparing diagnostic erythrocytes. Levi assigned me a place in the virology laboratory, which was managed by his wife, candidate of medical sciences Nadezhda Nikolaevna Basova. She was young, interesting, good-natured, and very energetic. For nearly a month and a half, she patiently helped me and taught me the laboratory techniques, which were new to me and which, as I now understand, I never really mastered.

Because the provincial AP establishments used a very narrow range of microbiological techniques, the workers there felt that they were lagging behind their colleagues who went directly to work at an institute after graduation. For a long time, I was unable to sensitize sheep erythrocytes to the F1 strain of *Y. pestis*. By the end of my stay at the laboratory, I was able to select high-quality tannin and obtain the diagnostic preparation. This was a positive, but far from decisive, step in organizing the research at the Budennovsk Division.

Despite the fact that it was the mid-twentieth century, the division had very primitive equipment. The incubators were heated by kerosene lamps. The temperature fluctuated as much as several degrees, and in summer often exceeded 40°C. In winter, the night guards were told to adjust the temperature, so the success in maintaining the correct culturing temperature depended on whether the guards faithfully performed their duties. The autoclave was heated with solid fuel. There was no centrifuge, among other things. The division received electricity only from early evening until around 11 pm or midnight.

In order to carry out my research, it would be necessary to have a continuous electricity supply for the laboratory and auxiliary facilities. This turned out to be a very difficult task, partly because of the prolonged illness of the division director, A.M. Tishkov, who was a strong administrator with clout at the institute and among the district officials. As such, Yury Kanatov and I had to handle all the arrangements.

Only a few factories in Budennovsk had around-the-clock electricity, and one of these was the lace factory, which fortunately was located across the road from us. We had to try to convince the local officials to connect the AP division to this circuit. They agreed on the condition that we pay for the necessary materials: poles, wires, and accessories. We contacted the institute director, Vartan Nikitovich Ter-Vartanov, for help. He was favorably inclined toward our initiative and ordered the facilities manager, A.N. Reshetnikov, who was very resistant, to send round wood from the institute's stockpile to Budennovsk. He also ordered the chief bookkeeper, V.I. Yudin, to transfer funds to our account to pay for the work and buy the equipment. The director of the lace factory, M. Preobrazhensky, graciously agreed to supply electricity from the line, which the factory had run from the municipal substation at its own expense.

Within just three months, the division had continuous electrical service, and so did the specialists' apartments. Happiest of all were the guards, who no longer had to patrol the area in the pitch-black darkness.

It was difficult to acquire equipment. The Soviet Union had a strict distribution system based on requests submitted to the respective ministries a year in advance. Because of all this, it looked like we might not be ready to start the research during the spring epidemic season. Therefore, we sent a letter to the director of the Elektrosila factory in Leningrad asking him to make an exception and provide us with two electric incubators and two drying ovens from its stock. As psychological pressure, we supported our argument by saying that the AP service had found cases of plague among rodents in the Stavropol steppes, and that these infections could grow into epidemic outbreaks, but that the lack of equipment would make it difficult to diagnose the disease in a timely manner. This letter could have backfired with unpleasant consequences, because plague epizootics were a strictly classified secret at that time; however, everything ended well. The main thing was that the invoice soon arrived, followed by the equipment. A centrifuge was obtained from Professor A.G. Kratinov,

director of the institute's parasitology laboratory. We contacted the nearest collective farm and obtained sheep to supply the blood.

Spring was approaching and everything was ready to begin the work. But, I unexpectedly received an order from director Ter-Vartanov sending me to Georgia to lead an epidemic field team for three months. All my plans were dashed, and I telephoned Levi to try to change the course of events. Living in an outlying area, we did not know about the problems between the institute director and his young deputy scientific director. It seemed to us that the research topic was so timely that the institute administration would want to have it performed. But, apparently, there was some kind of misunderstanding… Levi calmly explained that the order had to be followed and that my research would have to be put off until fall.

I turned my attention to putting together a team, supplying it with equipment and materials, and buying vegetables and other food products, which would be cheaper in Stavropol. The institute was sending an epidemic team to Georgia to investigate a somewhat puzzling epizootic situation. The Iori River runs along the border between Azerbaijan and Georgia. For a number of years, plague pathogen cultures had been repeatedly isolated from gerbils and their fleas on the right bank of the river, in Azerbaijan. On the left bank, despite the identical focal conditions, a plague bacteria strain was isolated only once, and that, according to unofficial rumors, was from field material that zoologists from the Georgia AP Station obtained in Azerbaijan and "smuggled" into Georgia. We were sent in to be independent arbiters and determine the truth, which was certainly of both practical significance and scientific interest.

I will spare the details about this period in my career, but I will describe one amusing incident, which put me in somewhat better standing with the institute director. The epidemic team was based at the district sanitary-epidemiological station in the town of Tsiteli-Tskaro. Laboratory technician M. Nazarova, sanitarian T. Khabarova, and I lived in the laboratory building, while the others lived a couple of blocks away in a private home. We usually stopped working around 6 or 7 pm. One day, I had to give a lecture at the hospital until 8 pm. An hour later, overcoming fatigue and the desire to put things off until the next day, I put on my special protective clothing and sat down to examine petri dishes with cultures taken from rodent organs and suspensions of crushed ectoparasites. Suddenly, I heard very light footsteps in the hall and, turning around, I saw Ter-Vartanov. He looked surprised, and clearly was not expecting such dedication to the work. It turned out that he, along with Professor V.N. Fedorov, director of the institute's epidemiology department, and N.M. Abesadze, candidate of medical sciences and director of the Georgia AP Station, had come on an inspection visit. Despite the late hour, Ter-Vartanov sternly interrogated me, demanding explanations in minute detail about all the activities related to trapping rodents and ectoparasites in various parts of the focus, the amount of material brought into the laboratory, the correctness of the investigations, the writing of reports and lab books, etc. The conversation lasted until late at night, when Fedorov noticed that it was time to get some rest. Our women had already prepared a table with various appetizers, and Abesadze obtained some excellent Georgian wines from his traveling "wine

cellar." He was an incomparable master of ceremonies, and on that evening, he gave eloquent toasts to the health, successes, and achievements of the top officials, and had kind words to say toward me. The next morning, the inspectors left, and within a month and a half, without finding a single plague culture from the natural focus, we returned home. I spent the summer with my family in Rostov, helping my wife care for our second son, Yury, who had been born during my time in Georgia.

At the end of this vacation, I returned to Budennovsk. Fall was beginning, and people in the division were starting to get ready for epidemic surveillance in the field. Suddenly the same thing happened as before. I received an order to go to Privolzhsky for six months to work as part of a state commission for approving new plague vaccine strains. Jumping ahead here, I would like to say that Levi, while traveling through Astrakhan, stopped in to see me at Privolzhsky. He told me that if I abandoned my research topic, this would put an end to my long travel assignments, which were related to the fact that institute director Ter-Vartanov was using every possible means to foil the scientific plans of his deputy. Fortunately for me, that old folk saying came true: "What God doesn't do will turn out for the better anyway." Fate prepared me for a very long and no less interesting scientific career because of my work on the commission.

Live vaccines are prepared from virulent mutants whose pathogenic properties are transformed under the influence of various environmental conditions (long-term storage of cultures with repeated transfers on artificial culture media, the action of specific serums or bacteriophages, etc.). Lev Ivanovich Leshkovich had obtained a radiation-induced mutant of the plague microbe by exposure to X-rays. As a result, these microbes had reduced virulence properties and thus met the requirements for vaccine strains. The main requirements are high immunogenicity, "residual" virulence, slight reactogenicity, and inability to revert to the initial form. Variability processes often lead to saprophytization of vaccine strains, so there is a constant search for new strains that can be kept in reserve. Also there is a need to develop new, more effective vaccines. This research has been going on in the AP system for over 50 years, but no successful results were achieved. Since the 1940s, our country has used the live vaccine of the EV strain, which Girard and Robic obtained in Madagascar in 1926 and that had spontaneously diminished virulence properties. Relatively recently, a bivalent plague vaccine was made from domestic *Y. pestis* strains 1/17 and K-1. According to the discoverer's own data, strain 1/17 had an inhomogeneous [not uniform] cell content. A.S. Zyuzin (1957) reported it to be highly reactogenic when used for immunization. The protective properties of the bivalent vaccine decreased sharply, and it was necessary to return to the EV vaccine. The same fate befell the K-1 strain. The strains reverted to the initial form and when used to immunize volunteers, several developed typical clinical symptoms of plague infection.

Given the circumstances, there is enormous responsibility placed on the developers of live vaccines and on the State Institute of Standardization and Control, which sanctions them for practical use. In order to obtain an objective and independent judgment on the quality of proposed vaccine strains, the MOH establishes an authoritative commission consisting

of highly skilled specialists in the areas of the theory, development, and production of live vaccines. These commissions are usually headed by an administrator with the rank of deputy minister, and the working group includes senior, mid-level, and junior personnel who come from various institutes and have experience in this area. This excludes the possibility of deliberate falsification and random mistakes in evaluating the results. The internal work of the commission is based on the same principle.

After many years of studying radiation-induced plague mutants 100 R6 and 3413 R6 and conducting his own tests, Leshkovich submitted the strains to the state commission for approval. The chairman of the commission was deputy minister, academician V.M. Zhdanov and the deputy chairman was Vartan Ter-Vartanov, director of the Scientific AP Institute of the Caucasus and Transcaucasus. The commission included doctors of medical sciences Ye.I. Korobkova and V.N. Lobanov, candidate of medical sciences O.R. Kuznetsova from Mikrob, candidates of medical sciences Ye.N. Aleshina and Khakhalina from the Rostov-on-Don State AP Institute, candidate of medical sciences V.Ya. Mikhaleva from the Scientific Research AP Institute of Siberia and the Far East, candidates of medical sciences L.M. Osadchaya and O.O. Slynko from the Central Asia Scientific Research AP Institute, and candidate of medical sciences V.I. Kuznetsova and physician R.I. Kotlyarova from the Scientific AP Institute of the Caucasus and Transcaucasus. The working group included physicians, laboratory technicians, and laboratory assistants brought in from all the above institutes, as well as nearly all the personnel from the Privolzhsky AP Station and some from the Astrakhan AP Station. There were many more people than shown in this old photograph of mine.

Most of the commission personnel were stationed at the Privolzhsky AP Station, which was closed during that time, but the purely morphological group headed by professor V.N. Lobanov was based at the Astrakhan AP Station, which was only 7 kilometers away, but on the other side of the Volga River.

The Privolzhsky AP Station had fairly extensive facilities: a laboratory for conducting experiments, a terrarium to provide disease-free animals, and two prefabricated two-story buildings. One housed the visiting participants and also included the food center (kitchen and dining room), while the other had rooms for recreation, writing, the facility management group, and a conference hall. The commission members arrived at Privolzhsky one by one and over a half month period. They thoroughly discussed and tentatively approved the experimental procedures, which were written in notebooks. They also helped prepare cultures and worked with the experimental animals, making sure that each group was equivalent in terms of sex, age, weight, etc. Then the commission members returned to their normal workplaces and returned after a certain time to review the situation and prepare the new building. One of the commission members remained on-site the entire time to manage the working group, which stayed for the entire duration of the commission.

When the assignments were given to the working group members, I received one of the most difficult sections: I was responsible for the biohazards unit that oversaw the terrarium, which, at any one time, contained several hundred each of white mice and guinea pigs immunized with the test strains and infected with virulent cultures. Assigned to the biohazard unit were an equal number of physicians, laboratory technicians, and sanitarians from each institute.

In order to characterize the strains submitted to the commission, it was necessary to conduct a wide array of research, including studying the culturing-morphological and biochemical properties and determining the minimum immunizing dose, immunity development time, duration of immunity, prevalence of cells, survivability, safety, reactogenicity, persistence of diminished virulence, histomorphological changes when the strains are administered to both types of animals, etc. The standard for comparison in all cases was the EV vaccine strain.

With permission of the USSR MOH, Lev I. Leshkovich, the discoverer of strains 100 R6 and 3413 R6, was present in Privolzhsky for nearly the entire duration of the commission. He was allowed to act as an advisor. At the sessions he mostly listened, but sometimes he gave advice and explanations on a number of issues under discussion. During the first two or three months, the atmosphere within the commission was very good-natured. Leshkovich was a physically powerful person. He was taller than average and had a crew cut and the straight posture of a soldier. He laughed with a loud, roaring laugh, so that behind his back people called him "Roaring Lion."[90] We shared a room in the living quarters. During the day, Leshkovich often looked into the terrarium, paid close attention to the condition of the disease-free animals, made sure that the animals were cared for properly, and checked the quality of the feed. As agreed to with the commission members, he did not intervene during experiments, but in the evening when the two of us were alone, Leshkovich was keenly interested in the status of the experiments, the number of sick and dead guinea pigs and white mice, and the clinical and anatomopathological picture. He often expressed his unease, all the while absorbing everything that was going on and closely watching the commission members' mood. He only really came alive when, not long before bedtime, he would get a group of the youngest people together for a 5–7 kilometers run on the steppe. At the end, most could barely drag their feet, but Leshkovich looked fresh and ready to do it again. However, there were days when no one had the strength left for these outings. On one of those days there was an unpleasant incident, which fortunately had a happy end.

In the terrarium, there had been a large attrition of its animals. The teams performing the autopsies had finished their work, while N. Matveeva from Alma-Ata and I remained to complete the investigation. It was a gray fall day and it started becoming dark early. Because of the poor lighting, we had to work faster than usual to finish our work. We removed our special protective clothing and put tools to be sterilized in the electric sterilizer, which was located on the wooden countertop of a kitchen cabinet, and planned to come back after dinner and turn it off. We then got to talking and afterwards went our separate ways, completely forgetting about

[90] The word "*lev*" doubles as the Russian word for "lion" and as the given name, Lev, the equivalent of the Latin Leo.

the tools. In the middle of the night, everyone was awakened by V.Ya. Mikhaleva yelling, "The laboratory is on fire!" She ran out into the courtyard in her pajamas and quite justly shouted some very terrible threats at me. Realizing what was going on, I quickly dressed and ran into the terrarium. The room where the tools were boiling was completely dark from smoke, even though the light was turned on. The sterilizer had dropped through the smoldering countertop and into the cabinet. Fortunately the doors and windows were tightly closed so that no air could enter the room. We quickly put out the fire, but were very concerned because a small amount of smoke got into that part of the terrarium that held the experimental animals. Eventually we were convinced that the incident had no effect on the experiment, but it did serve as a subject for the amateur poets, who composed a ditty about the incident and went about singing it to a familiar tune. This ditty, about a curly-haired "youngster" of about 30 years in a smoldering lab coat (me) who came to Privolzhsky to study immunity and got his answer from dead guinea pigs, expressed the fact that many commission members were beginning to suspect that the investigated [*Y. pestis* 100 R6 and 3413 R6] strains had high "residual virulence," although no official opinion had been issued yet.

During the first months, the experimental results were promising, especially those concerning the strength of immunity. The mood of the discoverer and all the investigators was buoyant because they recognized that they were taking part in an event of very great significance not only for the AP system, but for the entire public health system: the discovery of our country's own plague vaccine. Patriotic sentiment among Soviet people was very strong at that time.

At the commission meeting held to discuss the results from the next series of tests, it was pointed out that in some cases, levels of attrition were higher among guinea pigs immunized with small doses of the investigated strains. The autopsies on these animals showed an anatomopathological picture reminiscent of the typical changes of plague infection. V.N. Lobanov spoke candidly, confirming that the histologic results did not correspond to what was permissible after administration of existing plague vaccine strains, especially the EV control strain. Naturally, no categorical conclusions were reached at the session. The commission proceedings were strictly secret, and so, I have no draft documents for reference. However, I remember the essence of the events well, possibly because not only was I responsible for the biohazard unit, but also because I kept minutes of the commission sessions. Because of this, I was well informed about the opinions of each of the participants in the working discussions of the commission. Particular consideration was given to the opinion of Yevgeniya Ilinichna Korobkova, an outstanding vaccinologist and author of the wonderful monograph *Live Plague Vaccine* (1956). This book is still timely and the best textbook for beginners in the field.

Korobkova was hard of hearing. She sat next to me and watched what I was writing down. I tried to catch each word at almost a stenographer's speed. After the session, Korobkova attentively re-read the minutes, asking many questions and often correcting the draft. Being a wonderful teacher and a delightful person, she discussed the results with me at length and explained the sense of what was going on in a very understandable way. This obliged me to

prepare myself carefully before the commission members arrived for each session, which I did by studying the literature available at the station.

Leshkovich could not agree with the conclusions about the high virulence of the strains and attributed the results to sick animals in the disease-free terrarium. After long debates, it was decided that the experiments to determine the benignancy would have to be repeated using guinea pigs brought in from terrariums that were known to be disease-free. I no longer remember where these were obtained. For greater objectivity, it was recommended to use additional minimum doses of the investigated strains. The other experiments, the results of which did not pose any particular doubts, continued according to plan. Leshkovich became withdrawn and irritable, and spent quite a bit of time alone with his coworker, Olga Osievna Slynko, apparently discussing the situation. Ministry officials began to hassle him and even threatened not to pay him per diem for his months of time at Privolzhsky. The commission members noticeably distanced themselves from the discoverer of the strains and were more formal when dealing with him.

Unfortunately, the reproduced experiments confirmed the previous results, which did not conform to what was initially expected. It was considered that the death of animals inoculated with strains having diminished virulence should follow the same principle as when highly pathogenic strains are used; i.e., with increasing dose, the infected animals should die faster and in greater numbers. In experiments with Leshkovich's strains, the opposite pattern was observed. Guinea pigs survived 15 billion microbes, while the greatest number of deaths occurred after several hundred cells were administered. These animals developed typical anatomopathological changes. The parenchymatous organs were greatly enlarged, filled with blood, and riddled with grayish-yellow bodies of various sizes. The lungs had dark-red thickenings, often with fluid leaking into the chest cavity, among other symptoms. According to the findings of the group headed by V.N. Lobanov, the histomorphological changes also fit well with those caused by virulent plague bacteria strains.

The commission members unanimously concluded that strains 100 R6 and 3413 R6 had very high "residual" virulence. Yevgeniya Korobkova explained the results as due to the phenomenon of "survival" of a small number of virulent cells in a large population of avirulent cells. In this case, the course of the infection depends on the ratio of the two. When avirulent microbes are prevalent in the mixture, immunity develops quickly, causing pathogenic cells to be destroyed or eliminated from the body. These animals survive. If the level of virulent cells in a population is high enough, they multiply unhindered while specific defense is slowly established, and these animals die. There are two hypotheses about the cause of this phenomenon. One is related to the restoration of virulent properties in some microbes as a result of various circumstances: transfers on artificial culture media or passages through laboratory animals, which could have occurred while the strains were being prepared for approval by the commission. The evidence favoring this hypothesis was not scientific, but rather the high moral qualities of the people who had done the work. Lev Leshkovich, being a well-qualified specialist, would hardly have

submitted strains for approval to such an authoritative commission if he had even the slightest doubt about them being harmless. However, there could be another explanation. During the process of irradiating the strains with X-rays, a small portion of the cell population might not have been transformed and thus remained in the initial condition. These cells, because of their greater potential for growth and reproduction, gradually increased in number during the subsequent handling. This hypothesis might be confirmed by the findings of a number of researchers, including people in our laboratory (N.M. Kharkova, 1973; I.V. Pechnikova, 1966; A.I. Tinker at al., 1980), who analyzed the "latent" virulence of the EV plague vaccine strain and showed it to be very highly stable. To the present day, there is no clear distinction between the terms "residual" and "latent" virulence. The method developed by V.V. Akimovich et al. (1965) and modified by N.G. Ponomarev and S.K. Gizzatullina (1967) gives a value for "residual" virulence based on its LD_{50}. An analysis of 15 "latents" of EV strain's virulence determined by different experimenters showed that, regardless of the population of random-bred mice, the condition of the strains, the duration of the experiments, the individual errors in preparing the suspensions, etc., in 14 cases there was no statistically distinguishable difference between their LD_{50}. This indicates that the "latent" or "residual" virulence of the vaccine strain is a very stable property and is not influenced by environmental conditions. Other characteristics of EV strains vary widely. Yu.G. Suchkov et al. (1970) and E.G. Shpilevaya et al. (1978) found differences in nutritional requirements and sensitivity to antibiotics; E.A. Chernova et al. (1972) found differences in the culturing-morphological properties, the fibrinolytic, plasmacoagulase, and pesticinogenic activity, and the antigen characteristics; I.V. Pechnikova (1966) found differences in growth stability in the presence of calcium ions; B.M. Asvarov (1983) found differences in the fermentation of rhamnose, lactose, dulcitol, inositol, and glycerin and in the dehydrogenation of lysine, ornithine, and glutamine; N.Ye. Pechnikov (1991) found differences in serum sensitivity and thermal sensitivity; A.I. Bondarenko (1995) found differences in the integrity of the cytoplasmic membrane, the cell wall, and the cytoplasma content, etc.

Thus, the finding that strains 100 R6 and 3413 R6 were not free of harmful effects set the stage to end the operations of the commission. Lev Leshkovich looked forlorn. His hopes for the successful completion of many years of scientific research were dashed and the prospects for defending his doctoral dissertation were in doubt, because it was based on demonstrating the use of various environmental factors to accomplish controlled change in microbes in order to obtain vaccine strains. Leshkovich soon left for Alma-Ata. N.I. Kolesinskaya, a physician from the Scientific Research AP Institute of Siberia and the Far East, and I worked hard to compile the draft tables showing the results of all the experiments. There were over 100 tables. The microbiologists obtained pure cultures of the investigated strains and sealed the test tubes, which were placed in metal containers. The commission members carefully checked the minutes of the sessions. An index of the working notebooks was compiled, and the notebooks were checked to make sure that they were correctly formatted and filled out and that all signatures were present. Then all the out-of-town commission members left for home. Ter-Vartanov and I loaded the test tubes containing the strains, notebooks, and other documents into a car and left for Stavropol. The commission's investigation had lasted more than six months.

Postscript

Vartan Ter-Vartanov extended my assignment for one more month so I could finish writing the draft report in Stavropol. The draft report was corrected and supplemented by R.I. Kotlyarova, a distinguished specialist in microbiology. Final editing was done by state prize laureate professor Ye.I. Korobkova and professor V.N. Lobanov, who later was awarded the title of honored scientist of the Russian Soviet Federated Socialist Republic. The final report was submitted to the USSR MOH. So ended the work of the state commission to approve Lev. I. Leshkovich's proposed vaccine strains.

When my assignment ended, the director of the Scientific AP Institute of the Caucasus and Transcaucasus appointed me to the position of physician in the vaccine department, which produced live plague vaccine using the EV strain. I was very satisfied with this new position, because my half-year participation in the approval process for strains 100 R6 and 3413 R6 and the opportunity to associate with leading specialists of the AP system had sparked my interest in this problem. However, the literature, my personal observations about the difficulties of obtaining new vaccine strains, my intuition, and the given circumstances suggested that the most promising line of research would be to develop the theoretical foundations and practical recommendations for stabilizing the EV strain and the plague EV vaccine by means of lyophilization. It should be noted that the problem had already been fairly well investigated at the military institute system, but the strict secrecy that existed in those years prevented any access to these materials. Therefore, beginning in 1960, the USSR AP system had to start this research all over again. This was done under the supervision of the present author at the Scientific AP Institute of the Caucasus and Transcaucasus.

Nearly 40 years of work have produced important successes in improving the biotechnology of the EV plague vaccine, as described very briefly in the article "Letter to a Friend" (*Interesting Stories*…, 1998, no. 9, p. 194).

Since I have the opportunity here, I consider it my duty to at least give the names of those responsible for this success. I had enormous help in getting established in this field from my candidate dissertation supervisors and doctoral dissertation advisors, Mikhail Lvovich Bekker and Nikolay Ivanovich Nikolaev.

Mikhail Bekker, doctor of medical sciences and director of the biochemical laboratory at our institute, is an energetic and very good-natured person, erudite in many scientific fields. He helped me on a daily basis with his advice during the process of preparing and performing the first experiments, discussing the results, and writing articles and the dissertations.

Professor Nikolay Nikolaev, director of Mikrob, gave me confidence in the path that I selected and in my interpretation of the results. This person, who held high positions and titles

(institute director and major general of the medical service, among others), was accessible and straightforward in dealing with subordinates.

My work was helped by long collaboration with a number of leading specialists at Mikrob, but I would especially like to express my gratitude to professors T.I. Anisimova and L.V. Samoylova for their selfless help, advice, and continual interest in our work.

During my entire time of working at the institute, I experienced the friendly support of I.F. Taran, a charming person who was first a staff scientist and then deputy scientific director, professor, and honored scientist of the Russian Federation, and also the support of Yury Grigorevich Suchkov, director (1970-83), professor, and now corresponding member of the Russian Academy of Natural Sciences. Both of them are leading specialists of the AP system and thoroughly decent and principled managers, who judge their coworkers based on professional qualities rather than favoritism.

And of course, because of their diligence, enthusiasm, and love for their work, the personnel of the experimental laboratory of plague vaccines and the production department of our institute made great contributions to, among other things, improving the biotechnology of the EV plague vaccine, improving the quality of the vaccine, and writing and revising the technical standards. These people, in addition to their research, participated in producing hundreds of millions of doses of plague vaccine. Their research and development topics were relevant and directly related to the needs of production practice. The results of numerous research studies provided the basis for one doctoral dissertation and 14 candidate dissertations (A.I. Tinker, 1964, 1971; I.V. Pechnikova, 1966; E.A. Chernova, 1967; N.M. Kharkova, 1973; T.N. Funtikova, 1978; D.A. Budyka, 1980; M.N. Goncharova, 1981; B.M. Asvarov, 1983; E.G. Shpilevaya, 1983; Ye.L. Rakitina, 1988; G.F. Ivanova, 1991; N.Ye. Pechnikov, 1991; K.S. Gyulushanyan, 1996; and A.I. Bondarenko, 1995). Two other candidate dissertations were prepared, but were not defended for incidental reasons. D.A. Budyka will defend his doctoral dissertation "Ways of improving EV plague vaccine" this year.

Important contributions to the success of the research were made by highly professional practitioners in the department. They are physicians G.N. Verkhovtseva, V.F. Ivanova, A.D. Nekrasov, G.S. Novitskaya, N.A. Sarkisyan, A.V. Grebenyuk, V.V. Semenov, and V.D. Mayskaya, and engineer A.G. Khoroshenky.

Photograph caption:

January 23, 1959. First row (left to right): physician A.I. Yepifanov, commission members L.M. Osadchaya, V.Ya. Mikhaleva, V.N. Ter-Vartanov, V.N. Lobanov, physician T.V. Fedorova. Second row: physician A.I. Tinker, laboratory assistant T.I. Volkova, physician N.I. Kolesnikova, laboratory technicians M.M. Gerasimova, K.M. Romanova, V.I. Bulyatkina, A.I. Novikova, physician P.A. Pavlova, commission members O.O. Slynko and O.R. Kuznetsova. Third row: laboratory technician

P.G. Trofimova, laboratory assistants O. Lebedeva, M.A. Gerasimova, K.A. Larionova, Z. Ramkulova, laboratory technicians M.A. Nazarova, K.A. Toropchipova, laboratory assistants T.S. Kondratyeva, A.Ye. Murina, L. Nizhegorodtseva, … (?).

References

Akimovich, V.V., N.I. Nikolaev, L.F. Zykin, N.G. Ponomarev, and A.A. Popov, "In vitro selection of virulent *P. pestis* strain variants with vaccine properties" (in Russian), *ZhMEI*, 1965, no. 6, pp. 64-68.

Asvarov, B.M., *Experimental basis for increasing the immunogenicity of live plague vaccine* (in Russian), candidate of medical sciences dissertation, Makhachkala, 1983.

Bondarenko, A.I., *Development of an electron microscopic method for quantitative determination of damaged cells of EV plague vaccine* (in Russian), candidate of medical sciences dissertation, Stavropol, 1995.

Budyka, D.A., *Use of medicines to prevent post-vaccine reactions in people after subcutaneous injection of EV live plague vaccine* (in Russian), candidate of medical sciences dissertation, Stavropol, 1980.

Chernova, E.A., *Possibility of evaluating the quality of dry live EV plague vaccine during storage based on the amount of live microbes contained in it* (in Russian), candidate of medical sciences dissertation, Stavropol, 1967.

Chernova, E.A., V.F. Ivanova, and V.D. Mayskaya, "Cell composition of dry live EV plague vaccine with different storage times" (in Russian), Abstracts of reports to the scientific conference, October 1972, Stavropol, MOIP, 1972, pp. 56-57.

Funtikova, T.N., *Comparative study of dry live EV plague vaccine prepared from agar and broth cultures* (in Russian), candidate of medical sciences dissertation, Stavropol, 1978.

Goncharova, M.N. *Several aspects of comparative study of plague vaccines* (in Russian, candidate of medical sciences dissertation, Stavropol, 1981.

Gyulushanyan, K.S., *Use of culture medium based on maize extract in the production of EV plague vaccine* (in Russian), candidate of medical sciences dissertation, Stavropol, 1980.

Ivanova, G.F., *Improvement of culture inoculum and culture inoculation conditions in the plague vaccine production process* (in Russian, candidate of medical sciences dissertation, Stavropol, 1991.

Kharkova, N.M., *Influence of iron ions on the growth and several biological properties of the EV vaccine strain of the plague microbe* (in Russian), candidate of medical sciences dissertation, Stavropol, 1973.

Korobkova, Ye.I., *Live Plague Vaccine* (in Russian), Moscow, Medgiz, 1956.

Pechnikov, N.Ye., *Optimization of lyophilization conditions for live EV plague vaccine* (in Russian), candidate of medical sciences dissertation, Stavropol, 1991.

Pechnikova, I.V., *Influence of drying medium composition on the thermal stability of dry live EV plague vaccine during prolonged storage* (in Russian), candidate of medical sciences dissertation, Stavropol, 1966.

Ponomarev, N.G., and S.K. Gizzatullina, "Determination of the magnitude of 'residual' virulence of plague microbe strains proposed as vaccine strains" (in Russian), in: *Genetika, biokhimiya i immunologiya osobo opasnykh infektsiy* (*Genetics, Biochemistry and Immunology of High-Risk Infections*), Rostov-on-Don, 1967, no. 1, pp. 365-72.

Rakitina, Ye.L., Optimization of EV plague vaccine doses based on number of live microbial cells (in Russian), candidate of medical sciences dissertation, Stavropol, 1988.

Shpilevaya, E.G., Culturing of plague microbe by apparatus method on agar made of dry nutritional yeast (in Russian), candidate of biological sciences dissertation, Stavropol, 1983.

Shpilevaya, E.G., M.N. Goncharova, A.I. Tinker, and O.N. Lopatkin, "On spontaneous mutations in dry live plague vaccine consisting of strains EV and K-1" (in Russian), High-risk infections in the Caucasus. Abstracts of reports to the Scientific-Practical Conference on Natural Focality, Epidemiology, and Prevention of High-Risk Infectious Diseases, December 20-22, 1978, Stavropol, 1978, pp. 342-44.

Suchkov, Yu.G., "Isolation of induced auxotrophic mutants of EV vaccine strain of the plague microbe and characterization of amino acid requirements" (in Russian), *Problemy osobo opasnykh infektsiy, Saratov*, 1970, no. 6(16), pp. 61-65.

Tinker, A.I., *On the question of optimum conditions for lyophilization of live plague vaccine consisting of EV strain cultured on solid culture media* (in Russian), candidate of medical sciences dissertation, Stavropol, 1964.

Tinker, A.I., I.V. Pechnikova, M.N. Goncharova, and N.M. Kharkova, "Magnitudes of 'residual' and 'latent' virulence as indicators of immunogenicity of plague vaccine strains" (in Russian), in: Abstracts of reports to the All-Union Conference on Immunology and Immunoprophylaxis of Plague and Cholera, Saratov, 1980, pp. 8-11.

Zyuzin, A.S., "On the reactogenicity of dry live 1, 17 plague vaccine" (in Russian), Abstracts of reports to the scientific conference on natural focality and epidemiology of high-risk infectious diseases, January 25-February 2, 1957, Saratov, 1957, pp. 129-30.

On the History of the Study of Far East Scarlet-like Fever (Epidemic Pseudotuberculosis)

Ivan Semenovich Khudyakov (pp. 88-132). Five photographs, two figures, 29 references.

This chapter describes the author's work with Far East scarlet-like fever. A major part of the chapter is dedicated to a description of Vladimir Alekseevich Znamensky (1928-97), a naval microbiologist who led highly important investigations of epidemic pseudotuberculosis. Author I.S. Khudyakov won the contest for writing the best article of Volume 8.[91]

As chief of the 180th High-risk Infection Sanitary-epidemiological Laboratory at the Strelok Naval Base of the Pacific Ocean Fleet, author Khudyakov was assigned to investigate serious outbreaks of an unknown disease among Soviet naval personnel in the Far East in 1959. He describes the disease and the details of the investigation of this epidemic.

Khudyakov, a classmate of V.A. Znamensky, provides a brief biography of Znamensky and reminiscences of their student days, including thoughts on several classmates who suffered political persecution. He notes that Znamensky did his most important work in the Far East. Although an echovirus was first suspected, Znamensky eventually found that the outbreaks had been caused a previously unknown form of epidemic pseudotuberculosis.[92] He conclusively proved his finding by infecting himself with the pathogen. On June 16, 1967, the day before he defended his dissertation on the subject, *Komsomolskaya Pravda* newspaper published an article describing his self-infection. As a result, a large audience including television crews arrived at the Naval Medical Academy for the dissertation defense. Such unprecedented commotion annoyed the dissertation committee, but Znamensky was nevertheless awarded the doctoral degree. After Znamensky returned to Vladivostok, a film crew arrived to make a documentary film about him.

Znamensky retired from the military in 1970 and returned to his native Kiev, where he continued working as director of the Microbiology Department at Kiev Institute of Physician Continuing Education.

Confessions of a Former Plagueologist

Yu.A. Shtelman (pp. 133-40)

This chapter describes the author's career at the Astrakhan AP Station and provides sketches of the author's colleagues in the AP system.

[91] See *Interesting Stories...* 9 (1999), p. 218.

[92] This form of pseudotuberculosis is caused by the bacterial pathogen *Yersinia pseudotuberculosis.*

On one occasion, Shtelman was exposed to infectious material when an alcohol burner sputtered, but contrary to regulations, he did not report the incident.[93] No infection resulted. In another case that he failed to report that a plague-infected animal escaped in his laboratory although he was able to capture the animal. He eventually complete his dissertation work successfully without repercussions.

What Mr. Karimi Saw and Should Have Seen When Examining the Work of the Zooparasitology Brigade in the Territory of the Turkmen AP Station

Gertruda Stepanovna Starozhitskaya (pp. 141-50)

This chapter includes a narrative essay about the visit of an Iranian dignitary to an AP research camp in Turkmenistan. G.S. Starozhitskaya worked at Mikrob *from 1962 to 1996.*

Starozhitskaya describes typical field conditions and the daily routine of epidemic control work. She especially remembers a visit by an Iranian dignitary to their research camp in Turkmenistan. This particular camp was selected for the visit because it exemplified the difficult conditions in which workers conducted field research in an open environment. The primitive conditions, lack of amenities, and the presence of female staff members without their husbands surprised the visitor. The Iranian informally talked with Starozhitskaya, which made her fear that her offhand remarks would violate the secrecy restrictions imposed by the KGB.

Partial translation:

> During the 1970s, as a parasitologist in the parasitology laboratory at Mikrob, I collaborated with specialists at the Turkmen AP Station on research, which involved digging up entire great gerbil colonies and collecting fleas from different parts of the burrow (entrance, passageways at depths of 0-60 cm, 60-120 cm, and 120-180 cm, as well as feeding chambers and nests). We trapped all the rodents from these colonies and then collected fleas from them. The ultimate goal of the work was to be able determine the flea population in colonies based on the percentage of fleas on the gerbils, thus avoiding the considerable work of digging out the entire colony.
>
> Because this was a multiyear endeavor covering all seasons, the administration of the Turkmen AP Station proposed that the work be done at the permanent zooparasitology outpost where the staff zoologists made regular observations about the condition and habitation frequency of marked colonies. This outpost was located at Energache Oasis, 40-50 kilometers north of Ashkhabad. This site was particularly attractive because it had a dugout 2 meters deep with

[93] An alcohol burner produces a hot, sootless, non-luminous flame that microbiologists use to sterilize the looped end of an inoculating needle. If there is too much material in the loop, it can sputter and thus the unsterilized material can splash widely.

about 15 m^2 of floor space that was well equipped for living quarters, and also had a shallow dugout laboratory with good lighting. In addition to these two dugouts, there were two small tents. One was a well-equipped kitchen with a large table, two pantries, decent cookware, etc. The other was a sleeping tent with cots and beds for the seasonal workers. There was a large metal barrel filled with water, which could be heated up in an hour, but which made the water somewhat rusty. We had to conserve this water. These details will be of significance later in my story.

In addition to the laboratory technician Olya from Mikrob and myself, the expedition team included Zamira Laktimirovna Kusova, a zoologist from the Turkmen AP Station. She was from the mountainous region of Ossetia and proud of it, which was obvious from all her mannerisms and behavior, which sometimes caused difficulties in our daily affairs. But she was an excellent zoologist; serious and thoughtful, with outstanding scientific intuition and ability to analyze materials. The fourth woman was the middle-aged cook: it is very difficult to find a cook for fieldwork in Central Asia, but we were fortunate because our project did not involve traveling from place to place. The male portion of the team consisted of one truck driver, two experienced rodent extermination technicians from the station staff, and five seasonal workers. We worked earnestly and enthusiastically, all the while enduring the everyday hardships and the heat.

One day, a car arrived from the station. We were told that a special guest would be coming – Mr. Karimi, from the Baltazard's laboratory in Iran. He had come to Ashkhabad to learn about how the USSR anti-plague service operated. They showed him and told him about many things, and apparently he had been received at the Turkmen SSR MOH. However, Karimi was really interested in seeing primary field surveillance work by a zooparasitology field team. Apparently, his insistent requests raised some concerns among the administrators of the Turkmen AP Station, but something had to be done. It was decided that our scientific group would be the "showcase" team. The messenger gave me a number of instructions, the gist of which, among other things, was that no "science" was being done here. The situation was explained to the workers, who were told to do nothing more than greet the visitors and not get into any conversations whatsoever with them, and fortunately, no such occasions arose.

The next day, we waited for the visitors, but lunchtime came, and they still had not arrived. Finally, we could see the car approaching. Karimi had the appearance of an interesting, strong (well-built) middle-aged man. He was dressed simply and elegantly, although clearly he was dressed for the field, not the city. He was accompanied by Aziz Kurbanovich Akiev, who was from the Scientific AP Institute of the Caucasus and Transcaucasus and was head of the WHO Plague Collaborating Center in the USSR. There also was an interpreter, although Akiev knew the Farsi language very well (it was said that he belonged to a high-mountain Turkmen clan). Senior zoologist I.V. Zhernovov, an excellent specialist and a worthy subject for a separate memoir, represented the Turkmen AP Station.

We introduced ourselves, and they inspected the camp, the laboratory, and our dugout living quarters. We talked a bit about general topics. By then, it was already time for lunch so everyone was invited to the table. We had practically no way of preparing a celebratory feast, but our cook somehow managed to do it. The guests from Ashkhabad had brought brandy, green vegetables, and some dessert, so everything turned out rather well. During lunch, there were the traditional toasts and conversations. Everyone got to know each other better and loosened up somewhat. Karimi began making general conversation. But this was what I feared the most. We were so frightened by ending up at the Lubyanka Prison, the "gray" building (in Saratov the KGB offices were in a beautiful gray stone building), because of the various secrecy pledges we had signed that I was afraid not only to speak, but to even open my mouth.

I was sitting next to Karimi at the table. After lunch, he asked permission to smoke and having received it, graciously offered me a Winston cigarette (I remember the brand well, because this was an exotic item at the time). I was in a quandary, not knowing what the best thing to do was, and not wanting to sully the reputation of Soviet women. I gave Akiev a what-to-do glance, and he replied with a discreet approving nod. I took a cigarette and stalled for time, hoping to put off any further questions. Then Karimi asked how long we usually stayed here. I was afraid to say how long because a real zoological team usually works three to five days. I gave a vague reply of about seven to 10 days. Akiev got me out of a jam by saying that the time varied, depending on the assignment. Seeing that Akiev was inclined to be "truthful," I calmed down somewhat. Karimi asked some very simple questions, but we suspected a covert motive. For example,

"Where is your shower?"

"We don't have one," I answered.

"Where is the toilet?"

"To the right for women, to the left for men. We use the sand dunes and a shovel. We dig a hole and fill it with sand," I answered in an attempt at humor."Do you have an electric generator?"

"No."

"Then how does the refrigerator run?"

This question threw me off, because at the time what I knew as a "*refrizherator*" was what they used to transport frozen fish from Astrakhan. I did not realize that he only meant an ordinary household appliance (*kholodil'nik*].

"We don't have a refrigerator," was my reply.

Karimi asked:

"And where do you get fresh water?"

I apparently did not hear something about cold water, but as for fresh water, I pointed at the barrel. With near-disgust he asked:

"Can you drink that?"

"We don't drink it. We drink green tea, hot or tepid. Sometimes if we want something refreshing to drink, we visit the nearest shepherd, about two or three kilometers away, and there our whole team can drink either *shubat* (sour camel's milk) or *ayran* (sour cow's milk diluted with water). These are quite tasty, especially when the temperature outside is 50°C."

Karimi told us about how people live and work in his country. They live in proper prefabricated buildings with all conveniences. Women never work on field assignments. Then he began asking about the personal lives of women working in the desert. He asked if I was married and who my husband was. He could not have come up with a better question, since at the time, my husband worked for the KGB. I had to tell him that my husband was a physician in the general healthcare system. When asked about what my husband thought about my long absence, I answered that we respect each other's work. Karimi asked the other women the same question. We hardly noticed how quickly the time went by. Akiev, who seemed displeased with the conversation, began to insist on leaving. Karimi did not respond positively to this proposal and even stated his intention to spend the night here, which brought a heated negative reaction from his companions who mentioned the events planned for the next day. But the inquisitive guest, ignoring Akiev's displeasure, expressed a desire to see the colonies we had dug up after finding out that they were not far from the camp.

Forgetting about any conspiracies, we drove out to the object of our pride: a colony dug down to the nest, about 2.8 meters deep. The picture was rather impressive; a deep pit and a pile of excavated sand. Karimi was not so much delighted as surprised; why do this? Quickly getting my bearings, I said that, of course, we usually do not dig out the whole colony, but that in this case, we had a special assignment to gather fleas from the nest to see whether they were infected.

Upon our return to camp, we began to say goodbye and the guest asked to be photographed with the women. Again I threw a secret glance at Akiev, fearing that our faces would be on the record "over there." He secretly nodded his approval, and our encounter was recorded on film.

Later one of the people who accompanied Karimi that day told us another interesting thing about the visit. It turns out that the guests were delayed in arriving at our camp for the following reason. When Karimi expressed an insistent desire to see a zoological team at work, this caused

a great panic among the leadership of the Turkmen AP Station because the route had to be approved by the KGB offices (as in our popular song, "can't go there, can't go here").[94] The road into the desert north of Ashkhabad (the usual route and the shortest) crosses the Karakum Canal, and it is probably considered a strategic target. On the eastern road, there is a large area rimmed with barbed wire, also apparently a strategic target. To the west of Ashkhabad is the Kartlinskoe freshwater reservoir, but not far from that is the municipal dump. And although everything at the dump is properly handled, irresponsible garbage truck drivers just drop their loads of household and construction trash a few kilometers short of the dump rather than going all the way out there. Therefore, the visitors' driver took the longest route, bypassing the Kartlinskoe reservoir. This took a lot of time, especially because cars cannot drive very fast over desert sands.

In recalling this encounter, I think that Karimi understood the entire "game" from the very beginning. When the visitors got in their car to leave, I noticed Karimi looking sadly and dejectedly at the three young women working under such conditions for the good of their austere Motherland.

Results of a Three-Year Investigation of the Earth and Substrate of Rodent Burrows from Natural Plague Foci

Yu.G. Suchkov, M.I. Levi, I.V. Khudyakov, I.Yu. Suchkov, and B.N. Mishankin (pp. 151-76). 15 tables, two figures, 23 references.

This scientific chapter describes research techniques for identifying Yersinia pestis in samples taken from the soil and substrata of natural plague foci in Central Asia, Central Caucasus, and Northwest Caspian Region. It is a continuation of M.I. Levi, I.V. Khudyakov, and Yu.G. Suchkov, "Citizens' Initiative in Scientific Research," Interesting Stories... *6 (1997), pp. 235-50.*

What is the Plague Toxin? (Facts and Hypotheses)

Viktoriya Ivanovna Tynyanova, G.V. Demidova, V.P. Zyuzina, A.N. Kravtsov, V.I. Anisimov, A.E. Platnitsky, O.N. Podladchikova, A.Yu. Goncharov, E.P. Kubantseva, and I.A. Bespalova (pp. 177-206). Two photographs, eight tables, eight figures, 42 references.

This chapter contains a literature review on the exotoxin and endotoxin properties of the plague toxin and on environmental factors that affect toxicity. It discusses the hypothesis that a biological activator in mammals might activate the toxicity of the murine toxin-endotoxin complex.

[94] The song referenced "Stop, who goes there!" by Valerii Evgenievich Shapovalov, was extremely popular when it was released in 1989. Full of the political commentary that defined popular art of the *glasnost* period, the lyrics jeer at the restrictions on movement and travel in the USSR, suggesting even that birds and fish should require passports.

The plague toxin is a glycolipid-protein complex with at least two functionally independent units: the murine toxin and the endotoxin. The murine toxin-endotoxin complex activator is a polar glycolipid with a low molecular weight that is bound in the host mammal, but when liberated, causes the plague pathogen to become virulent. The activator causes substantial changes to the capsule that envelops the *Y. pestis* cell. Methods of investigating its toxicity are described. The author poses several questions to motivate further research.

Role of $Ca2^{+}$ Dependence at 37°C in Increasing the Virulence of *Y. pestis* and the Proliferation of Malignant Tumor Cells (Facts and Hypothesis)

Aleksandra Leonidovna Kartashova (pp. 207-36). One photograph (portrait of author), three tables, seven figures, 21 references.

This scientific chapter examines similarities between the growth of malignant tumor cells and the proliferation of virulent plague strains when exposed to elevated temperature and placed in an ionized environment.

The author asserts that the main determinant of tumor malignancy is the presence of an excessive, negatively charged hydrophobic surface structure, which makes tumor cells hyperadhesive and damages some cell membranes. This environment alters cell structure forms at elevated temperatures, thus triggering uncontrolled cell division. Cells of malignant growths, including tumors and *Y. pestis*, are also temperature-sensitive mutants. Kartashova explains that plague outbreaks after quiet periods could be due to changes in cell division regulation, which are brought about by an environment with higher temperatures and ionization caused by solar radiation.

Brief Conclusions From All My Scientific Work

S.P. Rasnitsyn (pp. 237-42)

This chapter consists of a collection of 95 maxims about science and the human experience.

Thermobiotics

M.I. Levi, Yu.G. Suchkov, Yu.S. Zueva, and V.G. Slizkova (pp. 243-67). Four tables, 13 figures, 12 references.

This scientific chapter discusses thermobiotics. It includes a literature review, discussions of theories relating to thermobiotics of bacteriological origin and to thermobiotics in higher organisms, and methods for deriving them.

Thermobiotics are a class of substances that can be derived from many living organisms and which

are capable of destroying the spores of *Bacillus stearothermophilus* at a high temperature (120°C). The authors compare the three methods used to study the activity of these substances and describe the methods of obtaining thermobiotics from bacteria, mice, and humans.

Result of Contest for Best Article in Volumes 1-7 of "Interesting Stories About the Activities and People of the AP System of Russia and the Soviet Union"

Yu.G. Suchkov (pp. 268-71)

This small section honors I.S. Soldatkin for his contributions to the series by awarding him a prize of 500 rubles.

Forgotten Photographs

M.I. Levi, Yu.G. Suchkov (pp. 272-337). 64 photographs.

This section contains photographs of groups and individuals, as well as scenes of teams conducting plague control field work.

Index of Names in Volume 8

(pp. 338-46)

Not included in this paper.

Volume 9 (1999)

Foreword

Moisey Iosifovich Levi (p. 3)

Introduction to the ninth volume of the "Interesting Stories..." series.

Full translation:

> We continue to publish historical articles on the activity of outstanding scientists and practitioners. Volume 9 is noteworthy also for the flood of poetry that AP workers found the time to compose, giving wings to their creative potential. However, we would have betrayed ourselves if we had not devoted pages to the discussion of momentous scientific problems. Moreover, we hope that in future volumes we will give more attention to scientific matters, considering the scant opportunities for publication in Russian-language scientific journals.
>
> M.I. Levi, Editor

On the Anniversary of Klavdiya Aleksandrovna Kuznetsova

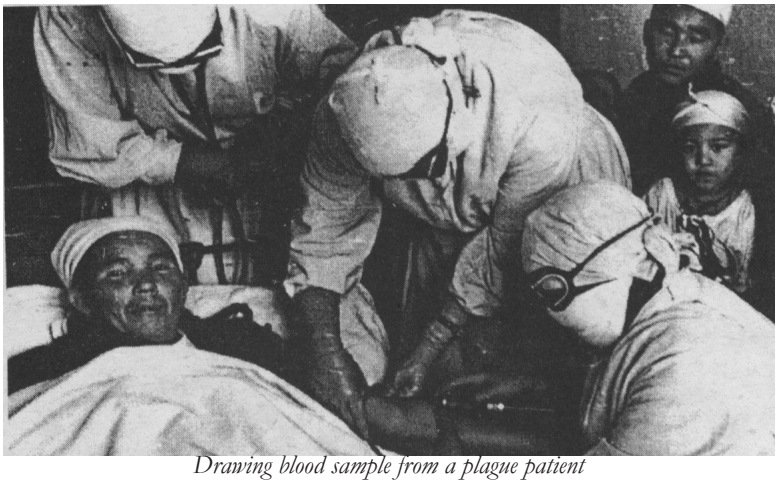
I.V. Khudyakov and Yu.G. Suchkov (p. 4-13). One photograph (portrait of Kuznetsova).

This chapter contains a biographical sketch of K.A. Kuznetsova, a plague control physician, researcher, and administrator in the AP system.

Kuznetsova served at AP facilities in Turkmenistan and Kazakhstan in the 1950s and early 1960s, became deputy director of the Kyrgyz AP Station in 1966, and transferred to the Central AP Station in 1970. From 1971 through 1983, she served as the deputy director of the Main Administration of Quarantine Infections, USSR MOH.

In Soviet times, the KGB and the USSR MOH competed to be the first to report plague outbreaks to higher authorities. In the case of a laboratory infection in Alma-Ata in the late 1970s, Kuznetsova arrived at the scene and diagnosed pulmonary plague, which was confirmed by the laboratory. She prepared an incident report for the Minister of Health to submit to the CPSU Central Committee and the Council of Ministers, but Deputy Health Minister P.N. Burgasov would not accept a report that mentioned "plague." The ostensible reason was that the KGB had reported the plague outbreak first, so a MOH report that did not mention plague would serve to refute the KGB. Kuznetsova thereupon wrote a detailed report describing the incident, but did so without using the word "plague."

Excerpt:



Drawing blood sample from a plague patient

On more than one occasion, she [Kuznetsova] was called on to investigate cases of plague infection originating in laboratories, something that occasionally happened within the confines of AP establishments. When this occurred, it was always considered an emergency.

In the late 1970s, one such incident occurred in the laboratory at the Central Asian Scientific Research AP Institute in Alma-Ata. A laboratory technician was preparing a culture of a highly virulent plague strain. In violation of all regulations for handling dangerous microorganisms, especially high-risk ones, she was using her mouth, rather than a rubber bulb, to draw a liquid substrate that contained pathogens into a pipette. She realized that some of the liquid laden with bacteria had gotten into her mouth. She did not tell anyone, but as a precaution began taking antibiotics, figuring that this would take care of it. Alas, the disease began to develop and by three o'clock in the morning she had chest pains, a high temperature, and difficulty breathing. With these symptoms, she immediately called on her neighbor, who was a physician at the institute, told him what happened, and asked him to take her to the institute's isolation ward. The building where they lived was right next to the institute. The physician placed her in the isolation ward, stayed there with her, and informed the institute's management. All the necessary measures were taken, an investigation was begun, and antibiotics were administered. The plague pathogen was cultured from the patient's mucus on the second day of the investigation. Specialists at the institute made an initial diagnosis of pulmonary plague based on the clinical and epidemiological findings. In the morning, in accordance with regulations, the emergency was reported to the Main Administration of Quarantine Infections.

That same day, Kuznetsova flew in from Moscow to investigate the cause of the event and evaluate measures taken to prevent the infection from spreading. She confirmed the diagnosis of pulmonary plague even before the pathogen had been cultured from the patient, and she so notified the Main Administration of Quarantine Infections. This information was passed further along the chain to Deputy Minister of Health P.N. Burgasov and then to the USSR Minister of Health. The Main Administration of Quarantine Infections prepared a draft report for the CPSU Central Committee and the Council of Ministers "according to established procedures." However, Burgasov delayed submitting the report until Kuznetsova returned. In a telephone conversation, he asked her whether the local KGB knew about the event, and was

somewhat comforted to know that the KGB still knew nothing of it. It should be noted that, at the time, there was a sort of competition between the KGB and the USSR MOH as to who would be the first to report an emergency through its channels to the country's top leadership.

Kuznetsova returned to Moscow on Sunday, and on Monday officials of the Main Administration of Quarantine Infections called her in to report to Burgasov. The chief sanitary physician [Burgasov] tried to convince Kuznetsova that if it were pulmonary plague, there would necessarily be other cases as a result of the patient's contact with them, as he had so informed the Minister of Health the day before. This meant that it was not pulmonary plague! Kuznetsova attributed the absence of epidemic consequences to the fact that the patient was isolated within three hours of the time when she had begun coughing, which is the major mode of pathogen transmission via expelled mucus. In addition, the physician brought the patient in at night, and they had encountered no passersby. The physician voluntarily isolated himself along with the patient and began preventive treatment. After a long discussion, Burgasov agreed with Kuznetsova's conclusions and with the diagnosis of "pulmonary plague," but requested—ordered—her to write the report without using the word "plague." So as a result, Kuznetsova had gained only a moral "victory." In the revised document, she related the actual events but without mentioning the word "plague." "There, this is a completely different matter!" said the deputy minister as he accepted the report, and sent Kuznetsova to take the report to the minister for signature, which was not the accepted procedure in the USSR MOH.

The Minister knew Kuznetsova because they had worked together during a cholera epidemic on the Central Anti-Epidemic Commission, of which he was the chairman and she was its secretary. After reviewing the report, the minister became agitated and began asking questions about pulmonary plague. Kuznetsova defended her opinion, and proposed that a sentence be added to the document as proof that she was correct: "the diagnosis of pulmonary plague was confirmed bacteriologically." This proposal was rejected, and the report was signed without mentioning the word "plague." This meant that the KGB, which had been the first to report the plague case to the top leadership, had made a hasty diagnosis and the MOH was thus overturning its diagnosis!

These are the time kind of "games" that serious people with the highest scientific credentials were forced to play during the memorable Soviet period.

Moisey Fishelevich Shmuter: Organizer of Diagnostic Erythrocyte Production

M.I. Levi (pp. 14-24). One photograph (of Shmuter).

This chapter contains a biographical sketch of M.F. Shmuter, a laboratory director at the Central Asian Scientific Research AP Institute in Alma-Ata for many years.

Shmuter was instrumental in organizing the production of various erythrocytes for serologic testing. His broad professional interests included research on several unnamed potential plague vaccine strains. He is remembered as a dedicated researcher and fair-minded professional.

Excerpt:

> He studied various strains collected from the Central Asia desert natural plague focus. He concentrated on two strains [not named] and proposed them as potential vaccine candidates. He worked for many years on a plague vaccine containing a combination of strains, but was unsuccessful; the strains that he investigated were not entirely benign, and the existing EV vaccine had superior properties.

On the 145th Anniversary of the Birth of the Prominent Naval Doctor, Scientist, and Public health Organizer V.I. Isaev

Ivan Alekseevich Klimov (pp. 25-41). Two photographs (of Isaev and author Klimov), seven references.

This chapter is a biographical sketch of V.I. Isaev, Chief Physician of the Kronstadt Hospital. It is based on archival material stored at the Society of Naval Physicians at Kronstadt (OMVKr).

Isaev directed the special laboratory at the Kronstadt "plague" fort and participated in fieldwork, research, and patient treatment related to tuberculosis, syphilis, cholera, and plague. Under Isaev's leadership of the OMVKr, a monument was erected there in 1909 to the naval physicians who were killed or who had died from illness as a result of the Battle of Tsushima Strait (located between Japan and Korea), which was fought in 1905 during the Russo-Japanese War. The monument was lost, but a photograph of it remained, though it was not included in the article.

He advocated an "ecological" approach to public health, which considered the effects of land, water, and air when investigating outbreaks. He held society meetings on topics of water supply at Kronstadt, drunkenness in the fleet, poor sanitary conditions of the working class, improved food on naval vessels, children's health and the role of school doctors, infectious diseases, and aid for orphaned children of naval physicians killed in action.

Always in good health, Isaev died suddenly and unexpectedly in June 1911 with a diagnosis of pleuropneumonia. However, when his remains were transferred to a different cemetery in the 1960s, they underwent further examination, the results of which suggested that Isaev died of a virulent disease possibly related to his work at the special AP laboratory.

Excerpt:

> *At a time when public health measures still represented a novel public institution, Isaev led several civic initiatives to improve the public health of Kronstadt, some of which the article describes.*

Isaev reported at meeting that many workers in Kronstadt fort were living in basements in "horribly filthy" conditions.

During 1909 cholera epidemic in Kronstadt, Isaev instituted boiling of water. St. Petersburg periodically dumped cholera patients at Kronstadt. The city later became the first to disinfect its water supply with chlorine.

He organized an inspection of sanitary conditions in each building and described all public buildings (food preparation and sales establishments, bathhouses, homeless shelters, apartments for unskilled workers, etc.). He was involved in improving the sewer system and garbage collection. He had all basement apartments lined with concrete, and those that were not were condemned for habitation.

Isaev exhorted public officials of organizations, schools, institutions in Kronstadt to do a better job of preventing and treating tuberculosis.

What To Call Them Now: Scarlet-Like Fever or Pseudotuberculosis, False Tuberculosis, or False Plague?

Gennady Dmitrievich Serov (pp. 42-76). One photograph (of author), 47 references.

This chapter contains a review of the author's research of Yersinia pseudotuberculosis and its categorization. It includes a historical overview of related studies, describes a proposal to rename Y. pseudotuberculosis *as* Y. pseudopestis*, and a proposal to rename Far-Eastern scarlet-like fever as "Znamensky's scarlet-like fever" or "Znamensky's pseudopestiosis" in honor of the Soviet scientist who, by self-infection, demonstrated the pathogen-disease link.*[95]

Serov argues that much misunderstanding has resulted from the naming of *Yersinia pseudotuberculosis* based on autopsy findings, rather than clinical indicators. He hypothesizes that this probably resulted in the underreporting of the disease known as Far-Eastern scarlet-like fever, which Soviet scientists in Vladivostok demonstrated that *Y. pseudotuberculosis* caused.

Other clinical and bacteriological studies show that the pathogen thrives in soil and water at relatively low temperatures, does not require a mammalian host for survival, and is not contagious among humans. A higher incidence of Far-Eastern scarlet-like fever in Russia is an attribute of the larger amount of residual soil on the fresh vegetables marketed in Russia, compared with those in Western countries.

[95] Other details of Znamensky's self-infection are described in I.S. Khudyakov, "On the History of the Study of Far East Scarlet-like Fever (Epidemic Pseudotuberculosis)," *Interesting Stories...* 8 (1998), pp. 88-132.

The article also includes several reminiscences. Once, Serov accidentally infected himself with a *Shigella* strain during laboratory work, but hid this fact to save his professional reputation. In another instance, local Soviet officials, on the eve of a national holiday, brought a large container of high-grade caviar to the microbiology laboratory for investigation of bubbles on the surface. The scientists performed laboratory analyses, but also "tested" the substance on themselves [this incident is described in the following paragraphs].

Excerpt:

The Heroic Physicians of the Pacific Ocean Fleet

In the Soviet Union, the most important holiday was November 7, the date of the Great October Revolution. In ordinary years, each military unit and workplace would have ceremonies with the obligatory no-less-than-half-hour speech about our national and local achievements. According to these speeches, everything was going well for everyone in the Soviet Union. If it was a large gathering, after the speech there might be an amateur concert, otherwise they went straight to business: some people received certificates with the Leader's portrait, others were merely congratulated.[96] The professional organizations carefully regulated the sequence of awards, so someone who received a certificate in May would only be congratulated in November. If it was a major anniversary, then nearly all military personnel received medals and there were banquets for the top leadership. The biggest banquet of all was somewhere in the Kremlin, but for us in Vladivostok it was at the Officer's Club. This particular year—1967—was a special anniversary; it was the 50th year of the Soviet Union.

It was a very ordinary day about a week before the holiday. We had already decided which treats to buy for the holiday and where to buy them. The time when you could obtain luxury items in any store of the city was long past. Everything was there, as in the past, but there was not enough for everyone, so you had to know someone on the inside. Nevertheless, military service being what it is, we knew that we were guarding our sacred Eastern Border and that at any moment we had to be ready to take orders, etc., etc.

I was standing near the receptionist when suddenly we heard a car pull up. The door opened and in walked a very well-dressed man. He carried a package and right away began to unwrap it, meanwhile explaining what he had brought us. The contents of the package astonished us. It was a large beautiful can, weighing about a kilogram, with a picture on the lid showing a large sturgeon swimming in blue water. The gold lettering read "Osetra Caviar."[97] The director of the hygiene laboratory was summoned. He questioned the visitor about the situation and the reason for needing an analysis. It turned out that the military store had received several cans of caviar from the central authorities. When they opened one, they saw a layer of bubbling foam

[96] The particular word used in the expression "the Leader" (*vozhd'*) most often referred to Joseph Stalin during the pre-1953 Soviet era.

[97] This was a particularly expensive and superior brand of caviar, which comes from the Ossetra sturgeon.

on the surface of the caviar. A short time later, we saw this for ourselves when we were starting to discuss our plan to investigate the product, which could have been capable of annihilating our entire leadership, both naval and civilian, within an hour.

It was morning, we were full of energy and got going right away, realizing the importance of the work entrusted to us. The hygienists took a sample with the end of a knife and described the appearance. In our department we took only one not-quite-full measuring cup of this very foamy, but good-smelling, caviar. We all knew that this was a once-in-a-lifetime situation. One person prepared culture media for a wide variety of microorganisms, while another brought white mice in a container and sterilized the hypodermic needles. One particularly patriotically inclined person suggested that we go upstairs right away, but the supervisor stopped him, saying that everyone would remain at their stations until the office workers left. Answering with our naval "Yes, sir!" we continued to work. No one even went to lunch (we did not have a cafeteria, so everyone brought their own bread with butter, cheese, or sausage—this was an important point). By 3:30 p.m., the inoculated Petri dishes were in the incubator, and so was the culture medium for propagating anaerobes.[98] But what anaerobes could they be, when the caviar surface had air bubbles, and the can was wrapped in the usual gray insulating tape (this is the factory seal!). The mice, after receiving a small injection of emulsified caviar with or without antitoxic serum, had settled down and were chewing oats and drinking water.[99] It was idyllic. The administrators left for a meeting, now we could go upstairs to the office of the chief warrior against the rodent kingdom, the honorable Nikolay Pavlovich Levtsov. Everything was already prepared for our arrival there. The table was set, with a pitcher in the middle, surrounded by plates and beakers. I will not try your patience any longer; you already understand that these five people, all of whom, by the way, had taken part in controlling outbreaks of far-east Scarlet-like fever and investigating its etiology, were ready for anything. Each person understood the importance of the moment, and therefore had decided to undertake this truly heroic feat; to test the Osetra caviar on themselves at the same time as on the mice. We prepared our canapés; whatever had been in our sandwiches we put on the plate, then we took the bread and smeared it with the lovely caviar. There was a good layer of caviar and each beaker was nearly full with exactly the right amount of liquid for the analysis. We did everything just as if we were sitting at a banquet, even the alcohol was distributed according to Dmitri Mendeleev's dying wish.[100] After eating our canapés, we looked at each other to check for any symptoms of illness. Someone went to the first floor to check on the mice. He turned on the light in the box and saw that the mice were sleeping peacefully and all appeared to be

[98] The party delivering the can containing the caviar probably suspected that it was infected with *Clostridium botulinum*, which produces *botulinum neurotoxin*, the cause of botulism. *Cl. botulinum* is an anaerobic bacterium, which means that it cannot grow in the presence of oxygen so special techniques must be employed by microbiologists to make certain that the sample is inoculated and grown under anaerobic conditions.

[99] Mice are particularly sensitive to the effects of botulinum neurotoxin.

[100] "After his death in 1907, a host of myths emerged about Mendeleev, several of them centering on alcohol (that he invented vodka, or at least the 40 percent alcohol-water ratio, being the most salient), and none of these alcohol ones that I know of are true. None of this, of course, contravenes that the physicians eating the caviar believed that there was such a tradition." (Michael D. Gordin, professor of history, Princeton University, personal communication with the editors, July 2012.)

feeling fine, giving us a signal to continue the experiment.[101] The testing was completed by dusk. The testers unanimously acclaimed the excellent taste of the product, all the more so because they had started to forget who had brought the caviar. Excited and happy, with a glint in our eyes, we headed for home. We had honorably fulfilled our special assignment for the Communist Party and our government.

A day later, things took an irreversible turn. Having decided to repeat the "main part of the experiment," we went to hygienist N.I. Abramov to get the next portion of caviar under the pretext that something suspicious was observed in our cultures. He, by the way, had been excused from participating in our act of bravery. Then, something happened that I will remember for the rest of my life – he announced that he had destroyed the caviar. Seeing the puzzled look on our faces, he took us over to an enamel bucket and took off the lid. A horrible smell came out of the bucket, and on the surface of the stinking liquid was floating that beautiful can that we had sacrificed ourselves for. What had happened was this. The morning after our experiment, the same courier came back and asked for the remaining caviar. Our hygienist panicked and, not knowing what to say, poured a mixture of half isopropyl alcohol and half water into the can right in front of the courier. We forgave him for this action only because he had not been working there very long. For one thing, our orders were that any product submitted for testing cannot be returned, and in addition, it shouldn't have been destroyed until we issued our conclusion.

I would add that no one knew of our heroic bravery. Both we and the mice remained healthy. The top leadership had their banquet and everything they had was delicious. They ate their caviar with hearty appetites, not knowing that on the outskirts of the city, in the neighborhood officially known as Green Corner but known to the locals as Soggy Corner because of its frequent fogs, five officers in naval uniforms with Medical Corps insignias sacrificed themselves for the health of the banqueters. Will they ever receive medals for their bravery?

Amaliya Samoylovna Fomicheva

L.G. Voronezhskaya, L.S. Podosinnikova, and N.N. Basova (pp. 77-82). One photograph (of Fomicheva).

This chapter is a biographical sketch of A.S. Fomicheva, who graduated from a medical institute in 1942 and immediately entered the Army as a company physician.

After the war, Fomicheva was a physician in a children's sanatorium, and in 1946 began work at the Rostov AP Institute as a teacher of specialized training courses for physicians. She also performed extensive fieldwork in plague control. After her retirement from the Rostov AP Institute, Fomicheva worked with children, including serving ten years as a physician in a children's sanatorium.

[101] If any botulinum toxin had been present in the sample injected into mice, it would have sickened or killed them.

Biblical Stories of Early Witnesses of Plague

N.N. Basova (pp. 83-88). Seven references.

This chapter describes references to hygienic practices and responses to epidemics in ancient texts, including the Bible and the Torah. It offers interpretations of the texts from a public health standpoint, seeking to identify specific diseases, including plague.

Svetlograd, 1978. Trial of a new anthrax vaccine strain. Dissecting a sheep.

Anthrax Outbreak in Sverdlovsk in 1979

B.N. Mishankin (pp. 89-113). Eight figures. 29 references.

This chapter consists of the Informational-Analytical Report presented on February 11, 1999 at the scientific conference on the 20th anniversary of the Sverdlovsk events, held at the Rostov-on-Don AP Institute.[102]

Excerpt:

In late April 1979, medical and sanitary brigades consisting of hospital and municipal employees and medical institute students visited the apartments of confirmed and suspected cases of anthrax. They interviewed the residents, distributed tetracycline as a preventive medicine, and

[102] On April 2 or 3, 1979, *B. anthracis* spores were accidentally released from a BW agent production unit at the USSR Ministry of Defense's Military Technical Scientific Research Institute located within Compound 19 in Sverdlovsk. A plume consisting of spores was carried by wind over parts of Sverdlovsk and into rural areas, causing over 105 human cases of anthrax of whom approximately 68 died. Both the USSR government and the current Russian government have asserted that the outbreak had a natural etiology despite strong epidemiological and other evidence to the contrary. See Leitenberg and Zilinskas, *The Soviet Biological Weapons Program*, pp. 103-12, 423-49.

disinfected kitchens and bathrooms. They took meat samples from homes for bacteriological investigation. Notices were placed on flyers and in newspapers to warn against consuming uninspected meat or approaching sick animals. Uninspected meat coming into the city from the south was confiscated and burned in pits. The police shot stray dogs.

Some portions of Chkalov District next to the ceramic factory were paved over with asphalt (this ceramic factory was situated on a hill and had a powerful ventilation system). The wet method was used to disinfect suspected disease foci. Fire hoses were used to spray down trees and the walls and roofs of residential buildings and garages with decontamination fluid.

Emergency prophylaxis was given to family members of patients. Immunizations were given to people living in areas where stricken people or animals lived. The vaccine was administered by a needleless method in the city and using needles in the villages. The veterinary service disinfected foci of animal disease and carried out massive immunization of livestock. Meat from privately slaughtered animals was removed from consumption.

Sergey Volkov, who holds the candidate of geological sciences degree and is the former director of the Environmental Department of the Sverdlovsk City Administration, provided various pieces of information about Military Town 19. His father had been deputy commander for political affairs of the special division of Ural Military District until the 1960s, and thus had been one of the people in charge of security at the facility. The son lived and grew up in Military Town 19 until he wrote a book about it.[103] After the book was published in the early 1990s, because of his honest account about the anthrax outbreak, he lost his administration job and had to move away from the city with his family.

According to Sergey Volkov, Military Town 19 contained the Ministry of Defense Center for Military-Technical Problems (P.O. Box 47051), which did work relating to the Soviet bioweapons development program. The center included a research institute, laboratories, and an underground experimental production facility. A munitions explosion at that production facility, in a transport tunnel leading to a storage area, had caused the outbreak of disease (Timashov, 1998).

According to other sources (Pluzhnikov and Shvedov, 1998), the leak occurred on the morning of April 3, 1979, during the installation and startup of a new system in the drying department.

…The only questions still unanswered are the technical details about the source of the accident, as Meselson (1994) indicates. Thus the story is not yet over.

[103] Sergey N. Volkov, *Yekaterinburg: Man and City* (in Russian), Yekaterinburgsky Gumanitarno-Ekologichesky Litsey (1997).

In summary, the 1979 anthrax outbreak was unprecedented for its suddenness and scale. The anti-epidemic measures undertaken by the local public health agencies, without the help of Military Town 19 personnel, were extremely effective: the epidemic lasted from April 4 to May 18 with no recurrence after 20 years of observation. The production facilities at Military Town 19 were relocated from Sverdlovsk (now Yekaterinburg) to other places (Belousova, 1999).

References

T. Belousova, *Sovershenno Sekretno* 2 (1999) pp. 14-15.

M. M. Meselson, *Science* 266 (1994) pp. 1202-1208.

S. Pluzhnikov and A. Shvedov, *Sovershenno Sekretno* 4 (1998) pp. 12-13.

N. Timashov, *Vecherny Rostov* 10 March 1998 (No. 45).

About the Founding of "Interesting Stories About the Activities and People of the AP System of Russia and the Soviet Union"

M.I. Levi (pp. 114-19)

The chapter written by the editor and founder of the Interesting Stories… *describes his concept and motivation for the series: to publicize the accomplishments and personalities of the AP system, particularly in order to inspire the next generation to enter this service. It includes a narrative of how his proposal to have the series published through official channels went unanswered, which prompted him to publish on a private basis.*

Full translation:

In the early 1990s, after the first earth-shaking successes of *perestroika*, it struck me that there was a need to legitimize the true activity of the AP system, to which I had a direct relationship and which I valued very highly.[104] I proposed that USSR MOH employees and AP system personnel, primarily those at the lead institute, Mikrob in Saratov, write a history of the organization. You cannot say that the history of various AP institutions is not reflected in scientific journals, monographs, and collected works, but in my opinion, these writings have a too narrowly professional focus, are too stilted and formal, and do not sufficiently reflect what it was like to work in the system. I wanted the young people coming to work at AP institutions not only to know the end product, namely the research results, but also to be familiar with the process itself, the people, and the conditions of their research and other work, how they

[104] *Perestroika* was national program of economic and political reform in the Soviet Union initiated in 1986 by General Secretary of the Communist party Mikhail Gorbachev.

lived, who they were, and their economic conditions. I wanted to instill respect for the older generation of AP workers.

With this in mind, I contacted my old friend, Yury Mikhaylovich Fedorov, who at the time had a direct connection to the leadership of the AP institutes. He listened to me intently and heartily agreed, saying that we should contact the directors of the institutes and AP stations. Several months later, Yury told me that he had won over Artur Viktorovich Naumov, the director of Mikrob. A short time later I met with Naumov in Fedorov's office to discuss my project. We agreed that I would develop a proposal and present it to the Scientific Council of Mikrob. With the council's approval, a group of authors would begin writing.

I sat right down and wrote the proposal, showed it to several friends, and sent it to Naumov. However, my hopes were in vain. I never received an answer. I told Yury Fedorov that yet another project in my life had "flopped."

Had it not been for one sad circumstance, the project would have never become reality (we were all products of the Soviet era, when about the only hope for anything like this rested on those who held power). With age, I, like many others, became burdened with illness, heart problems in particular. I suffered a severe heart attack and ended up in the hospital. It was only then that I realized that I had duties to fulfill while I was still alive.

One of my students, Konstantin Vasilevich Durikhin, had a leading role in many research projects in our laboratory, and I was indebted to him for establishing important concepts of our scientific field and showing the way forward. However, Konstantin died at an early age, and I felt it was my duty to tell about this scientist, who was little known during his lifetime. While still in the hospital in very serious condition, I began dictating an article about Konstantin Durikhin to my wife, Nadezhda Nikolaevna Basova. When I began feeling better, and while still in the hospital, I finished writing the article myself. I used whatever paper I could find and put my writing materials on the bed, while I worked from the floor, mostly on my knees. When the article about Konstantin Durikhin was finished, I realized right away that there could be insurmountable obstacles to getting it published. At that moment the idea came to me of publishing a collection of articles similar to the one I wrote about Durikhin.

By that time, there were various private publishers who published uncensored works. Many authors published their own brochures and books independently. It turned out that printing services were available, you could buy paper and there was no particular difficulty with setting type on a computer. The only limiting factor was money. In short, I had found proof of *perestroika* in the intellectual arena. All that was needed was my own perseverance and, of course, my wife who often pointed out the gaps in our family budget.

One way or another, things started happening. The first volume came out in 1994. I embarked on one other useful task. I began recruiting authors to write articles and other people to handle the technical tasks. What was new and most important was that this could be done without government institutions, bureaucrats, and decision makers of various types. The main purpose of the *Interesting Stories*… was to pass the baton to the younger generation and explain the work of the system's founding fathers that, for many years, operated an enlightened government machine unlike anything in any other country. I wanted the articles to be stimulating and show life as it really was, but above all they had to be instructive.

It is a pity that our project came about at a time when many of the leading figures, as well as those who could describe their lives and activities, had already died.

More authors came on board, and I am infinitely grateful to them for their selfless work. Other people helped recruit authors, correct manuscripts, set type, and so on. Of course, some people were reluctant to write articles because they did not feel capable of writing compositions of their reminiscences. Several authors, such as K.A. Kuznetsova and G.A. Temiralieva, stated from the outset that they would write only about the good, regardless of what had happened in life.

By now, it is clear that the historical possibilities have been practically exhausted. We can hardly expect to get more articles about the people of the AP system. Therefore, there will be a higher proportion of current scientific reviews and articles. We publish only those scientific articles that shed light on fundamental problems, with no restrictions on the length of articles or the manner of presenting the material.

Our *Interesting Stories*… have not described the lives of many of the founding fathers of the AP system, nor have they described major fields of activity that were the purview of this organization alone. For instance, there have been no articles on training courses for AP specialists. In fact, courses were held at the Saratov, Rostov, and Irkutsk AP institutes, and this was a sort of government within government. Separately, the Stavropol Institute held two-month training courses for civil defense specialists. Needless to say, the training courses had a separate isolation unit that was usually a large structure set apart from the other rooms. All physicians, regardless of whether they were going to work at an institute, a station, or a division, had to successfully complete six months of coursework and obtain a certificate before they were allowed to work with infected material. Thus 50 years before our present, sanitary-epidemiological service established a certification process, the AP system already had a well-structured system for training and certifying specialists.

Nor have our *Interesting Stories*… described how the research work was organized. By no means was all the work done in the AP institutes. It was often done in laboratories at the AP stations, divisions, or even at epidemic field posts, where there were good opportunities for work that included local personnel. For example, I personally conducted major research not only at the

Stavropol, Rostov, Central Asia, and Volgograd AP institutes, but also at the Guryev, Turkmen, Azerbaijan, Dagestan, Astrakhan, Kabardino-Balkaria, and Elista AP stations, at several divisions of AP stations, and even in epidemic field laboratories. Moreover, people preferred working in the AP stations. Their laboratories were spacious and well serviced, there were good living accommodations, clean air, a balanced life, and good relations with helpful local personnel, making an unmatched atmosphere of comfort for scientific work. Unfortunately, the *Interesting Stories…* give only an incomplete and fragmentary picture of this style of work within the AP system.

This article would not be complete if I did not address my personal satisfaction. Many former workers in the AP system experienced great pleasure from reading articles about familiar events and close friends and remembering their best years, their youth, and the years gone by. Some people even wrote letters with comments and thanks (several letters, especially those with comments, are given below). This feedback encouraged us to continue publishing the *Interesting Stories…* and gave us a sense of satisfaction in doing this work.

The press run of 1,500 copies for the first volume was too large, so this was reduced to 500 copies for subsequent volumes. Unfortunately, half of the copies printed remained unsold, as a result of which the income covered no more than 10-20 percent of the publishing costs, but this in no way dampened our efforts to publish more volumes.

We donated copies of the *Interesting Stories…* to the country's leading libraries and to libraries of the AP institutes and stations so they would be freely available there. Then we had the idea to offer a small prize for the best article in each volume.

The publication of the *Interesting Stories…* was made possible by great efforts contributed not only by my wife, but also by Yu.G. Suchkov, L.G. Sorokina, L.V. Manakhov, and N.F. Darskaya. We also received much support from people who wrote us letters pointing out various things, including glaring errors, such as mixing up names in the text, getting the wrong names in photograph captions, wrong initials, etc. In these cases we counted on the goodwill of our readers and did not print any lists of errata. We frequently got letters pointing out substantial shortcomings. Several of these letters are reprinted below.

> The title is too long. "Interesting" is extraneous. It would be enough simply to say "Stories." I would shorten "Russia and the Soviet Union." The uniqueness of the system is obvious from the forewords. Some articles were a bit long and of interest only to specialists. In many articles I do not sense anything truly "interesting."
>
> I.V. Shentsev, Protvino, Moscow Region

I am extremely grateful for the latest volume. I read it from beginning to end, as I had the previous ones. However, I do get the impression that the quality is slipping. Perhaps it is the authors, or perhaps the people described are not that outstanding (such as N.P. Mironov).

I.S. Soldatkin, Saratov

That same evening I opened one of the volumes of your *Interesting Stories*… and really got into the stories, forgetting about the novels that I had been reading. You have done a really great job producing this superb material. You can imagine how interesting it all was for me, because I knew all the AP personnel at Saratov. Yu. Rall and B. Fenyuk presented lectures to us. I was close friends with Boris Fenyuk, and he even came to visit us in Kharkov, sometimes by himself or other times with his son or Vera [his wife]. My husband I.B. (M. Levi's note: Ilya Borisovich Volchanetsky) knew Rogozin, Pastukhov, Ioff, Pokrovskaya, Ter-Vartanov, and many, many others. We talked about it at home and read much of the literature. From encounters with AP personnel, we used to receive some limited information about outbreaks at the time. However, all this was strictly kept secret, and now from these articles it is all clear and makes sense. How interesting it was for me to read all this, and what great writing! All the humor, warmth, and sometimes ill will (for example toward Rall, who deserved it). Do not stop now, keep on writing more and more if you still have any material left. With sincere thanks and appreciation,

G.I. Volchanetskaya, Kharkov

I think the most interesting and valuable articles are those that present not the purely scientific data, but the results, and describe the personalities of the authors and their colleagues, the working conditions, the relationships, the equipment used in laboratories and in the field, etc. This recreates the atmosphere and level of technology at different periods of the AP system and will give future generations the opportunity to get an idea of its history… I think that your "children" will be particularly grateful in future generations, when the people who knew and worked with the founders of the AP system are no longer around.

A.I. Tinker, Rostov-on-Don

Give our greetings and best wishes to everyone who has worked on publishing these priceless collections. You have taken on a noble and useful task. Because of this damned secrecy, even those of us who worked in the system for nearly 40 years are, for the first time, learning about the heroic, tragic, and unusual pages of the true history of the AP workers.

L.G. Voronezhskaya and L.S. Podosinnikova, Rostov-on-Don

These are only a few of the excerpts from the numerous letters, most of which expressed gratitude for publishing the articles and photographs. We are trying to the best of our strength and ability to continue publishing *Interesting Stories…* in the hopes that the new generation of plague workers will not lose sight of these efforts.

A famous person once said, "Beauty will save the world." At my brother's grave, I expressed a similar, but not identical thought: "Goodness will save the world." One way or another, we will try to bring joy to our authors and readers.

Evolution of Concepts About the So-Called NAG Vibrios

Lidiya Georgievna Voronezhskaya (pp. 120-38). Four photographs, one figure.

This scientific chapter reviews research on the taxonomy, identification, and distribution of nonagglutinating (NAG) vibrio cholerae strains. It includes anecdotes of the author's research under Anasatasia Georgievna Somova, V.S. Uraleva, and others. It also describes the intensification of research efforts at Rostov AP Institute and other institutions of the AP system once the seventh cholera pandemic began.[105]

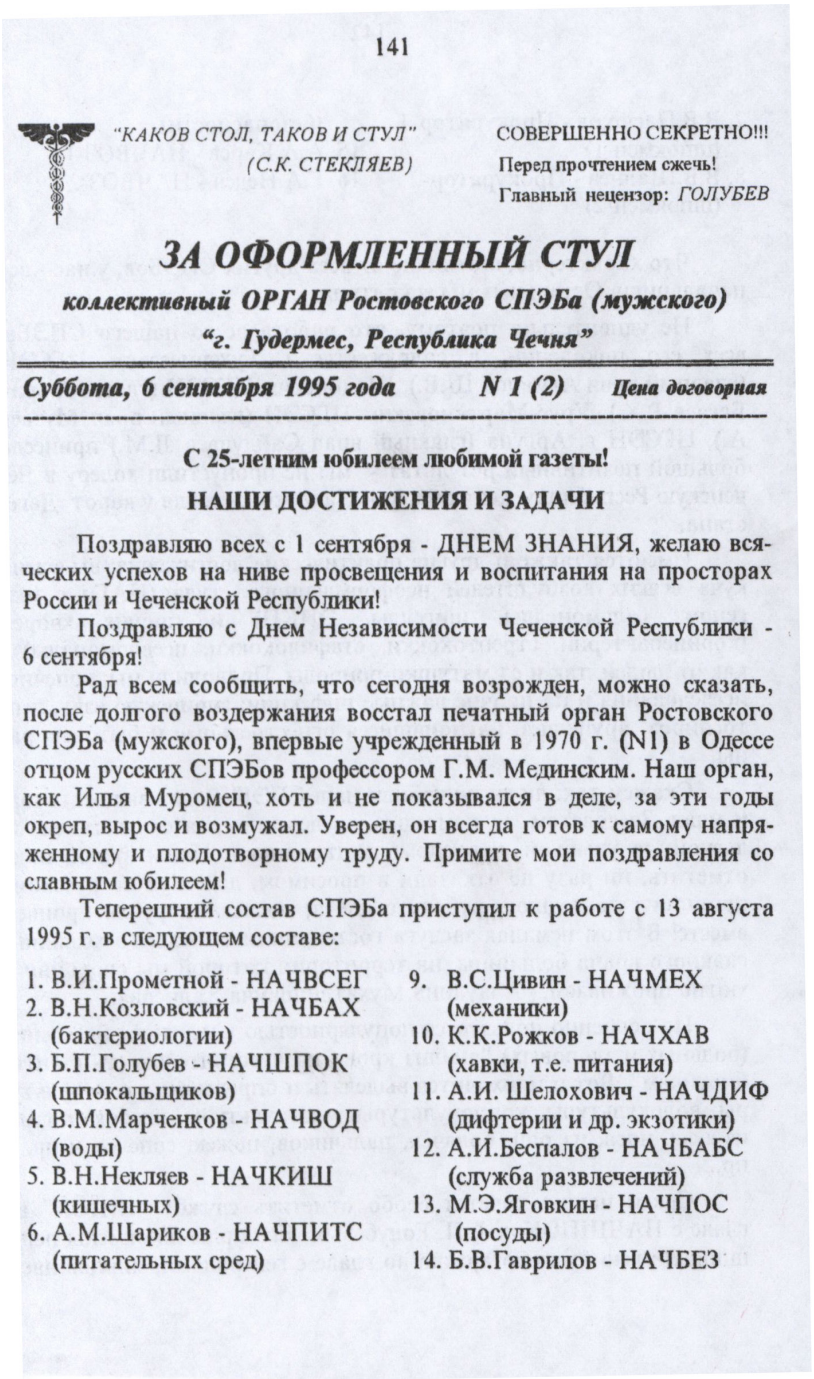
For the Well-Formed Stool

Yu.G. Suchkov, ed. (pp. 139-80). Foreword by Yu.G. Suchkov

This chapter reproduces an edition of a satirical mock newspaper published by the staff of Rostov Specialized Anti-Epidemic Brigade (SPEB) while deployed to Chechnya in 1995 during a cholera outbreak that occurred during the armed conflict there.[106] *The chapter begins with a foreword by Yu.G. Suchkov. The reproduced gazette contains articles, anecdotal sketches, and poems written by staff members. These describe epidemic control work, the living conditions, and the local residents encountered by the SPEB personnel.*

[105] The world's seventh pandemic of cholera is estimated to have begun in 1961. It reached its height in the 1970s, yet continues to the present day. It is caused by the El Tor strain of *Vibrio cholerae*. There were several outbreaks caused by the El Tor strain in the Soviet Union, but as noted in several articles of the *Interesting Stories…*, information about them was suppressed because it was considered a state secret.

[106] On February 22, 1995, Russian newspaper *Izvestiya* reported 400 cases of cholera in the Chechen Republic in 1994. In early 1995, the international community organized medical aid to Chechen refugees in response to the outbreak, although Russian military personnel suffered from the disease, as well. See Lester W. Grau, "Viral Hepatitis and the Russian War in Chechnya," *U.S. Army Medical Department Journal* (May/June 1997), pp. 2-5, and "Funding to the UN Consolidated Inter-Agency Appeal for Persons Displaced as a Result of the Emergency Situation in Chechnya as of 31 March 1995," United Nations, Humanitarian Affairs, April 7, 1995.



141

"КАКОВ СТОЛ, ТАКОВ И СТУЛ"
(С.К. СТЕКЛЯЕВ)

СОВЕРШЕННО СЕКРЕТНО!!!
Перед прочтением сжечь!
Главный нецензор: ГОЛУБЕВ

ЗА ОФОРМЛЕННЫЙ СТУЛ

коллективный ОРГАН Ростовского СПЭБа (мужского)

"г. Гудермес, Республика Чечня"

Суббота, 6 сентября 1995 года N 1 (2) Цена договорная

С 25-летним юбилеем любимой газеты!

НАШИ ДОСТИЖЕНИЯ И ЗАДАЧИ

Поздравляю всех с 1 сентября - ДНЕМ ЗНАНИЯ, желаю всяческих успехов на ниве просвещения и воспитания на просторах России и Чеченской Республики!

Поздравляю с Днем Независимости Чеченской Республики - 6 сентября!

Рад всем сообщить, что сегодня возрожден, можно сказать, после долгого воздержания восстал печатный орган Ростовского СПЭБа (мужского), впервые учрежденный в 1970 г. (N1) в Одессе отцом русских СПЭБов профессором Г.М. Мединским. Наш орган, как Илья Муромец, хоть и не показывался в деле, за эти годы окреп, вырос и возмужал. Уверен, он всегда готов к самому напряженному и плодотворному труду. Примите мои поздравления со славным юбилеем!

Теперешний состав СПЭБа приступил к работе с 13 августа 1995 г. в следующем составе:

1. В.И.Прометной - НАЧВСЕГ
2. В.Н.Козловский - НАЧБАХ (бактериологии)
3. Б.П.Голубев - НАЧШПОК (шпокальщиков)
4. В.М.Марченков - НАЧВОД (воды)
5. В.Н.Некляев - НАЧКИШ (кишечных)
6. А.М.Шариков - НАЧПИТС (питательных сред)
9. В.С.Цивин - НАЧМЕХ (механики)
10. К.К.Рожков - НАЧХАВ (хавки, т.е. питания)
11. А.И. Шелохович - НАЧДИФ (дифтерии и др. экзотики)
12. А.И.Беспалов - НАЧБАБС (служба развлечений)
13. М.Э.Яговкин - НАЧПОС (посуды)
14. Б.В.Гаврилов - НАЧБЕЗ

"For the Well-Formed Stool"

Excerpt:

In lieu of a foreword

I had frequent contact with younger colleagues, including my son, who were members of specialized anti-plague teams working in Dagestan to contain a cholera epidemic and in Chechnya to prevent acute intestinal diseases and other infections. I asked them to describe their experiences for *Interesting Stories*… while the events were still fresh in their minds. However, none of them got around to it. Then in May 1999, by chance I ran into Aleksandr Ivanovich Shelokhovich in the library of Rostov AP Institute. He told me about the existence of a "top-secret" newspaper called "For the Well-Formed Stool," which was published in September 1995 while the team was on assignment in the field. A portion of this newspaper (some items excluded) is presented to the kindly judgment of our readers.

I recall that specialized anti-plague teams had their first test during the 1965 cholera epidemic in Uzbekistan (Termez, Kara-Kalpakia). Some of the team members later went to Afghanistan (laboratory assistants A.F. Belaya and B.M. Buravchenko and physicians Yu.V. Kanatov and Yu.G. Suchkov). Their experiences are reflected in the article "Shuravi in Afghanistan, 1965" (No. 4,

1996). These specialized teams were most active during that memorable year of 1970, working in Makhachkala, Odessa, Kerch, and later, Donetsk.

The events in Chechnya in 1995 were preceded by an epidemic in Dagestan in the summer of 1994, when over 1,200 people became ill. Military action in the Chechen Republic began in late 1994, resulting in poor living conditions. Fearing very serious epidemic consequences, the Russian Federation MOH was compelled to send in specialized anti-plague teams from the Stavropol-in-Caucasus and Rostov-on-Don anti-plague institutes, despite the continuing military actions in various areas of the republic.

The teams began working in mid-April in Grozny then, in late June, the Rostov team was redeployed to Gudermes, a relatively quiet place.

The team members examined people and took samples from the environment (water sources, pit toilets, etc.) in various areas, including places with frequent crossfire. Reading this published material will give a better idea of the special working conditions of these teams.

In May 1999, the Stavropol AP Research Institute held a scientific-practical conference with papers and discussions on the past and future work of the specialized anti-plague team. Professor B.N. Mishankin, deputy science director of Rostov AP Institute, gave one of the invited papers, entitled "Psychological aspects of specialized anti-plague team activity under emergency conditions." Humor, including the "For internal use only," is also one of the most important ways of overcoming stressful situations, along with other ways noted in A.I. Shelokhovich's published article.

From my own experience in many epidemic teams and the 1965 specialized anti-plague team, I know how much more difficult work, and everything else in life, can be when for various reasons this sense of humor is lost.

Now I turn over the podium to the new generation of plagueologists.

Yu.G. Suchkov

[…]

	*"AS ON THE TABLE, SO IN THE STOOL"*[107] *(C.K. STEKLYAEV)*	TOP SECRET!! Burn before reading! Non-censor-in-chief: GOLUBEV

FOR THE WELL-FORMED STOOL

collective ORGAN of the Rostov Specialized Anti-Plague Team (men's)
Gudermes, Chechen Republic

Saturday, September 6, 1995 No. 1 (2) Price negotiable
Celebrating 25 years of your favorite newspaper!

OUR ACHIEVEMENTS AND TASKS

To everyone, a happy September 1st, "DAY OF KNOWLEDGE." I wish you every success in your educational and training work in the wide-open spaces of Russia and the Chechen Republic![108]

Happy Independence Day of the Chechen Republic, on September 6!

I'm pleased to announce to everyone that today, after holding back for a long time, you might say, we are resurrecting the printed organ of the Rostov Specialized Anti-Plague Team (men's). The newspaper was established in 1970 (No. 1) at Odessa by the father of Russian specialized anti-plague teams, Professor G.M. Medinsky. In the intervening years, our organ has not been in evidence, but like Ilya Muromets, nevertheless it was growing, maturing, and gaining strength. I'm sure that it's always ready to take on the most demanding and fulfilling work. Please accept my greetings on the occasion of this glorious anniversary.

MOMENTOUS ANNOUNCEMENT

Yesterday, September 2, 1995, Russian TV broadcast extraordinary news. Here's how it happened. I was in one of the rooms visiting with members of the specialized anti-plague

[107] The rhyme in Russian reads, "*Kakov stol, takov i stul.*"
[108] September 1, or the Day of Knowledge, is the first day of school and is still widely celebrated in the former Soviet Union.

team. Suddenly, at 9:15 p.m., a loud yell came from the hallway where the television was going: "Guys, come here!" The walls and floors shook as hundreds of feet raced to the television at breakneck speed. On the screen was the deputy minister known to all, telling about how he was captured by unknown persons and kept prisoner for a day. They took his car, cell phone, documents, and money. His life was in danger!

Everyone kept their eyes glued to the screen, their hearts wrenching with sympathy, fury, and pain. At the end, the TV announcer mentioned them, the physicians, from Rostov, Stavropol, and Moscow, faithfully performing their duty of helping the Chechen people: "Their lives are also in danger!" I noticed cold sweat on the faces of many. They discretely tried to wipe it away using a shirt cuff, a corner of a snow-white starched napkin, or the front of a laundered shirt. Everyone was silent. But then their eyes once again blazed with determination to see their righteous work through to the end. Onward!

Special correspondent, *For the Well-Formed Stool* B.I. Ivanov

The Road Home (Reminiscences)

A.I. Shelokhovich (pp. 181-98). One photograph (of author and colleague).

This chapter is an account of the author's service in the Rostov Specialized Anti-Epidemic Brigade (SPEB), which was deployed to help control a cholera outbreak in Chechnya in 1995. It describes the brigade's living and working conditions, the living conditions of the local population, and the stresses of working and traveling in a conflict zone. A poem composed by the author is included. Author A.I. Shelokhovich won the contest for writing the best article of Volume 9.[109]

Having departed the SPEB quarters near the hospital in the early hours of the morning, the return trip of the brigade's vehicle convoy through the conflict zone in Chechnya to Rostov was tense, but all arrived safely.

Excerpt:

Yet, all sorts of people—rich and poor—would come to us with questions about different diagnoses or for medical help. In their eyes, it seemed, we stood higher than local doctors, so few of whom remained in Gudermes. This assumption is confirmed on paper by the grateful reviews from the local administration in Gudermes and from the simple Chechen medics, and even the kind words of the French doctors from Doctors Without Borders. Chechen women worked for us in the subsidiary branches, and we lived completely openly. And not for a minute did we doubt that Dudaev's partisans were well aware of what went on in our SPEB. Further,

[109] See *Interesting Stories...* 10 (2000), pp. 280-281.

I will reveal a sort of secret—our passport of entry into the Chechen zone had been signed by the then-president of the Chechen Republic himself, Aslan Maskhadov, who had, in fact, allowed us to continue our work in good faith on the whole of his territory. Finally, the fact that people would come to us with their illnesses from locations all across Chechnya doubtlessly speaks to how the population knew and trusted us. But, what would have happened had we lived in isolation and refused to give medical help to these people? Each of us well understood that it was beyond the simple population to appreciate our efforts fighting cholera and, thus, our fulfillment of our humanitarian function in what were far from peaceful conditions…

Poems

I.V. Khudyakov (pp. 199-203)

Poems

Albert Samsonovich Avakov (pp. 204-16). One photograph (of author).

Poem

Irina Alekseevna Yavorovskaya (p. 217)

Results of Contest for Best Article Published in Volume 8 of "Interesting Stories About the Activities and People of the AP System of Russia and the Soviet Union"

Yu.G. Suchkov (p. 218)

This section honors I.S. Khudyakov for his article "On the History of the Study of Far East Scarlet-like Fever (Epidemic Pseudotuberculosis*)" in Volume 8.*[110]

Proscriptions

Irina Alekseevna Yavorovskaya (pp. 219-20)

This chapter lists personal information about five staff members of the Rostov AP Institute who were arrested for political crimes in 1937. It includes full names, dates and places of birth, dates of employment and position in the AP

[110] Ibid, pp. 88-132.

system, records of their arrests, and their fate.

Forgotten Photographs

M.I. Levi, Yu.G. Suchkov
(pp. 221-47). 26 photographs.

The section contains photographs of the Aral Sea AP Station and its site, as well as and staff members.

Index of Names in Volume 9

(pp. 248-54)

Not included in this paper.

Volume 10 (2000)

Foreword

Moisey Iosifovich Levi (p. 3)

Introduction to the tenth volume of the "Interesting Stories..." series.

Full translation:

> In this tenth (anniversary) volume of *Interesting Stories*…, the contents are divided into two sections: historical articles and scientific reviews.
>
> The historical articles are likely the last that can be published, because not only are the actors themselves gone, but so is the health of the potential authors. Nevertheless, an enormous amount of work was done, and in the pages of the 10 volumes, we have tried to present the history of the AP system, its people, and its work. I would like to think that the spirit of this work will live on in the life and work of new generations of researchers, and possibly on a completely different plane.
>
> The original diary of Colonel D'Artagnan describing events in seventeenth-century France was hardly a literary masterpiece when the great French writer Alexander Dumas got hold of it and used his talent to turn it into *The Three Musketeers*. For 150 years, young people in many countries have read the fantastic adventures of the novel's heroes and learned the importance of noble action and bravery (writers only seek attention when they say that art and history do not teach anything, for this only applies to bad art). By analogy, I would like for writers, filmmakers, and television journalists to use the historical articles of the first 10 volumes to make solid literary works describing the life and times of that period and acknowledge the contributions made by the people of the AP system of Russia and the Soviet Union. Repeated attempts to interest the writing community in our subject matter have been fruitless, and the effort ended with only several newspaper articles having been produced.
>
> As for the second section of Volume 10, it has an unusual history. When I turned 70, some of my friends expressed the wish to honor the occasion by publishing a collection of scientific works in my fields of interest. This eventually came about, and I was sincerely grateful to those who suggested and sponsored it. When I turned 75, I was honored with a banquet at which I jokingly gave a speech that amounted to the following. The editors of my birthday collection hoped that after celebrating the accomplishments of 70 years of living, my activity would cease, but in fact the opposite happened; my activities became even more diverse. Consequently, if they were to mark my 75th birthday in the same way, then by analogy, you see, I would keep going until 80. Those present at the banquet understood it was a joke, but several months later, my main sponsor asked if it was a joke or a real proposal. I answered that it was a joke, but that I would not object if it became a reality. However, this time the collection should not be about

me, but should be devoted to futuristic reviews. It was agreed that the theme would be society and science 15-20 years from now in areas of the contributors' expertise.

I prepared a brief abstract of the requirements for the review and sent it to about 15 researchers whom I knew and who had expressed an interest in participating in the project. However, not all of them followed through (including myself). Therefore, we had to abandon the initial intention to publish a separate collection, but instead made use of the futuristic reviews we received by publishing them in this volume of *Interesting Stories*… I hope that this theme will continue in subsequent volumes, if published.

Volume 10 of *Interesting Stories*… is in a sense an anniversary volume. Since 1994, the series has published 127 articles with a total of 3,000 pages, along with 152 photographs ("Forgotten Photographs" section, Volumes 4-10). It is a sort of saga of the AP system, which is a creature of the twentieth century. The first AP institutions arose at the beginning of the century, the system was in full flower at mid-century, and at the very end we witnessed its demise.

The volumes have taken on a life of their own, and everything now depends on whether the public will make use of them.

M.I. Levi

Materials on the History of Brucellosis Work at Rostov AP Research Institute

V.S. Uraleva (pp. 5-21). One photograph, 54 references.

This chapter describes the history of research at the Rostov AP Institute. It includes descriptions of studies on brucellosis epidemiology, infection control and prevention, vaccines, treatment, laboratory diagnostics, immunity, and pathogenicity.

The Rostov AP Institute brucellosis department was established in late 1946 in response to epidemics in areas of Russia occupied during World War II, especially the North Caucasus, including Rostov *oblast*. The initial staff consisted of five members, which later increased to fourteen. Staff members worked with local clinics that treated brucellosis patients, and carried out epidemic control field work and physician training.

Work on new vaccine strains and the development of criteria for strain selection were not completed before the department was closed, and the results were not published because of its security classification.[111] Nevertheless, the department had a production section that supplied brucellosis vaccine and diagnostic antigens.

[111] This secrecy is likely related to the research conducted by the Soviet BW program into the weaponization of brucellosis. See Eric A. Croddy, "Brucellosis (Brucella bacterium)," in Eric A. Croddy and James J. Wirtz, eds., *Weapons of Mass Destruction: An Encyclopedia of Worldwide Policy, Technology, and History*, edited by Eric A. Croddy and James J. Wirtz, (Santa Barbara, CA; ABC-CLIO, 2004), p.75.

The department closed in 1964 because the brucellosis situation improved. However, work on brucellosis at Rostov resumed in 1991 due to increasing brucellosis problems, locally and elsewhere in the Russian Federation. Currently, brucellosis is a greater threat to cattle, rather than to sheep and goats, than it was in the past.

Beginnings and Rise of Histopathology at the Mikrob Institute

Igor Viktorovich Isupov (pp. 22-40). Ten photographs.

The chapter describes the establishment of the histopathology laboratory at Mikrob, which conducted research primarily on the histology of plague, pseudotuberculosis, and other diseases. It describes leading figures of institute and their areas of research in historical perspective.

The histopathology laboratory at Mikrob was founded in 1926 by P.P. Zabolotny. Subsequently, laboratory directors Aleksey Mikhaylovich Antonov (1943-56, researcher of oncology, infection pathology, military and cardiovascular pathology, theory and practice of medicine) and Vladimir Nikolaevich Lobanov (1956-73, specialist in the pathological anatomy of plague) contributed greatly to its growth. The work of the author, who succeeded Lobanov as laboratory director, focused on patho- and immuno-morphology, as well as the pathogenesis of various high-risk infections.

A.A. Verzhbitskaya and D.T. Verzhbitsky at a plague epidemic in a Tatar encampment.

Reminiscences of Dmitry Titovich Verzhbitsky

Kseniya Borisovna Ilina (41-72). 14 photographs, six figures (reproduced documents).

This chapter contains biographical sketches of the author's grandparents, D.T. Verzhbitsky and A.A. Verzhbitskaya, who both worked

in the Soviet health system. Author K.B. Ilina won the contest for writing one of the two best articles of Volume 10.[112]

Dmitry Titovich Verzhbitsky was born in 1873 and graduated from the Military Medical Academy in 1899. He performed epidemic control fieldwork in the Samara and Astrakhan regions, where he met his wife. His experiments demonstrating the role of fleas in transmitting plague earned him his degree as doctor of medical sciences. Verzhbitsky served as a naval ship physician, and then resident physician at the Nikolaev Naval Hospital in Kronstadt until his death in 1912.

His wife, Anastasiya Alekseevna Verzhbitskaya, was born in 1878 and graduated from the Women's Medical Institute in St. Petersburg in 1911. She became Russia's first woman naval doctor, serving at the Nikolaev Naval Hospital, and in 1916, she became senior attending physician there. In 1928, Verzhbitskaya began her life's work at a children's clinic.

Multicolored Fears During the Cholera Outbreak in Kara-Kalpakiya in the Summer of 1965

Moisey Iosifovich Levi (pp. 73-81)

The chapter describes three "levels" of fear that the author experienced as an AP worker in the field during the 1965 cholera outbreak, associating each of these levels with traffic light colors. It includes anecdotal accounts of fieldwork undertaken during the outbreak.

Levi experienced "green" fear, which he characterizes as a positive learning experience, when he thought he was showing initial signs of cholera, which instead were the result of a diet of almost exclusively Central Asian melons during the initial period of fieldwork. He experienced "yellow" fear when reprimanded by officials after the body of a cholera victim was stolen from the hospital morgue by family members for traditional burial rituals. He characterizes this fear as unproductive, because it was due to the fault of others (police were guarding the hospital) and could not have been prevented by him.

His "red" fear occurred after he diagnosed a case of cholera after the epidemic had apparently ended. This was at a time when the epidemic control teams and officials, including USSR Deputy Minister of Health Avetik Ignatyevich Burnazyan, anxiously awaited the end of the mandated quarantine before they could return home. Burnazyan, who had close ties to the KGB, was enraged at the delay and berated Levi fiercely.

The author recounts that another deputy minister of health, Danilov, who did have experience with epidemiology (Burnazyan did not), expected that he would be put in charge of the cholera control work. He flew to the site but, realizing this expectation was wrong, flew directly back to Moscow without

[112] See *Interesting Stories* 11 (2001), pp. 360-61.

getting off the plane. It was Burnazyan who was to lead this work. Danilov died in an automobile accident shortly thereafter, which Levi suggests might not have been a real accident, but rather a KGB operation.

Once Again About Plague

Nadezhda Nikolaevna Basova (pp. 82-87)

This chapter discussed the attitudes, behaviors, life, and death of citizens of Florence, Italy, during the plague of 1348. It contains references to Boccaccio's Decameron, a medieval literary work describing life in Italy during the Black Plague through series of allegorical tales.

Infection and Mankind: A look at the Interspecies Battle at the Threshold of the Third Millennium, Sine Ira et Studio[113]

Vladimir Petrovich Sergiev (pp. 88-146). One photograph (portrait of author), four tables, 115 references.

This scientific chapter discusses the relationship between infections and humans across history. Author V.P. Sergiev won the contest for writing one of the two best chapters of Volume 10.[114]

Sergiev philosophizes about the role of infections in human evolution and about the process of adaptation by single-celled organisms to human parasitism. He reviews the role of epidemics and disease prevention in wars and civilizations, from the earliest historical accounts through Operation Desert Storm. Sergiev discusses human infections and parasitic diseases as a modern phenomenon, noting variations in reporting methods as well as the imbalance in how resources are allocated in such a way that favors treatment of disease in adults of developed countries and disease in children of developing countries. He reviews the threats of new pathogens, drug-resistant strains, and the link between infections and cancers.

On the Problem of Mathematical Modeling and Predicting the Parameters of the AIDS Epidemic in Russia

Boris Vasilevich Boev

pp. 147-88. One photograph (portrait of author), six figures, five tables, 14 references.

This scientific chapter assesses the AIDS epidemic in Russia, in the industrially developed countries, in Asia, and in Africa. It includes a history of the use of mathematical modeling in epidemic research, including the epidemic dynamics

[113] "Without anger or fondness" (Latin).

[114] See *Interesting Stories*… 11 (2001), pp. 360-61.

theory developed in Russia in the mid-1960s. Also, it describes the System Groups Models for AIDS (SYGMA), a model developed at N.F. Gamaleya Research Institute of Epidemiology and Microbiology.

Results from the modeling of the HIV-AIDS epidemic in Russia predicts that in 2030, 6.1 million will carry HIV, 1.73 million will suffer from AIDS, annual treatment costs will reach US$17.3 billion, and 6.3 million in Russia will have died of AIDS.[115]

The Future of Entomological Systematics

S.P. Rasnitsyn (pp. 189-96)

This scientific chapter describes contemporary problems of taxonomy associated with practical entomology. It proposes that scientists adopt a hierarchical numbering system to identify species.

For practical entomologists (i.e. those who are not taxonomists), the current binomial taxonomic system for insects based on type specimens poses many challenges. Frequent name changes and the difficulties of accessing type specimens complicate classification. Rasnitsyn poses that a hierarchical numerical identification system based strictly on specimen characteristics, rather than on evolutionary relationships, would have many practical advantages. Under this system, taxa would be identified by a series of numbers, eliminating the problem of nomenclature changes. Rasnitsyn notes that the current binomial system would, however, likely be retained for the study of evolutionary relationships.[116]

Life and the Cell

Renat Rashitovich Ibadulin (pp. 197-279). One photograph (portrait of author), two figures, two tables, 33 references.

The author proposes a philosophic framework for thinking of the cell as an information-processing entity whose functioning and components are compared to those of a computer. He uses principles of information science to conceptualize the origins and essence of life.[117]

[115] These estimates are roughly in line with those provided in other sources. The Center for Strategic and International Studies predicts that 5.4 million individuals could be infected with HIV by 2020, only serving to add to Russia's demographic crisis. See Center for Strategic and International Studies, "HIV/AIDS in Russia & Eurasia," Center for Strategic and International Studies, (undated) <http://csis.org/program/hivaids>.

[116] The current debate over numerical identification systems and other potential developments in taxonomy are reviewed in J.M. Guerra-Garcia, F. Espinosa, and J.C. Garcia-Gomez, "Trends in taxonomy today: An overview about the main topics in taxonomy," *Zoologica Baetica* 19 (2008), pp.15-49, and in Hong Cui, "Converting taxonomic descriptions to new digital formats," *Biodiversity Informatics* 5 (2008), pp. 20-40.

[117] See also Renat Rashitovich, "Multicellular Organisms as Information-Computer Systems," *Interesting Stories…* 11 (2001), pp. 73-137.

Results of Contest for Best Article Published in Volume 9 of "Interesting Stories About the Activities and People of the AP System of Russia and the Soviet Union"

Yu.G. Suchkov (pp. 280-81)

The editors of Interesting Stories... honor A.I. Shelokhovich for his article "The Road Home (Reminiscences)" in Volume 9 (pages pp. 181-92).

Forgotten Photographs

M.I. Levi and Yu.G. Suchkov (pp. 282-99). 17 photographs.

This section features group and individual portraits of AP system personnel. One photograph depicts the Kok-Kabak outpost of the Aral Sea AP Station.

Bibliography

(pp. 300-431)

This section contains bibliographies for I.V. Domaradsky (337 works), M.I. Levi (399), N.N. Basova (201), and Yu.G. Suchkov (193).

Index of Names in Volume 10

(pp. 432-38)

Not included in this paper.

Volume 11 (2001)

Foreword

Moisey Iosifovich Levi (p. 3)

Introduction to the eleventh volume of the Interesting Stories… series.

Full translation:

> Time moves relentlessly in one direction, and its path is paved with the fates of individuals and organizations.
>
> The AP system of our country belongs to the twentieth century; it was founded at the dawn of the century and is disappearing now as the sun sets.
>
> The task of *Interesting Stories…* is to describe this unique phenomenon. We have done our best to accomplish this, traveling the path of Time and collecting the fates of people who would otherwise be forgotten. Many were not accounted for, and now there is no hope of finding them with so many years gone by and with no witnesses remaining. However, shining through our articles is the edifice of the AP system and, emblazoned on it, the faces of its founders. It is our fault that our *Interesting Stories…* do not illustrate the roles of many people, among them some of the most important architects of the service. But as the saying goes, "*C'est la vie.*"
>
> The publishing of *Interesting Stories…* began a new genre of scientific literature that we called "parallel scientific literature," somewhere between "purely" scientific and popular literature. Stellar examples of the latter are Paul de Kruif's *Microbe Hunters*, and [Daniil Semenovich] Danin's books on Rutherford and Bohr. However, "parallel scientific literature" is a different literature. These are works that give an accessible, but not simplified, exposition of scientific achievements set against the details of life that show the atmosphere of the time, personality conflicts, doubts, and other things.
>
> It is mainly this type of articles that we printed earlier in *Interesting Stories…*, mixing them with historical stories about AP workers. This is the mainstay of the present volume and probably will be for any future volumes of *Stories…* if they are published.
>
> It must be admitted that scientific and technical innovations have an enormous influence on human life and it is now time for scientists to stop hiding behind the fence of scientific literature. It is all the more so, since society creates the conditions, be they bad or good, in which scientists and engineers work, and the success of their work depends on the attitude of the public.
>
> M.I. Levi

Progress Toward Controlled Antibiotic Therapy of Patients with Purulent Septic Infections

Mikhail Iosifovich Levi (pp. 4-72). One photograph (portrait of author), 13 figures, four tables.

This scientific chapter discusses the theoretical bases for developing the principles of controlled direct antibiotic therapy for purulent septic infections. It includes a narrative of the author's difficulties gaining acceptance for the idea from the medical establishment. Also, it summarizes the results of a 2001 scientific symposium on the subject. Seventeen publications on the subject by the author's organization, the Test Laboratory Center of Moscow Municipal Center for Disinfection, are listed. Author M.I. Levi won a prize posthumously for writing the best chapter of volume 11.[118]

Multicellular Organisms as Information-Computer Systems

Renat Rashitovich Ibadulin (pp. 73-137). 27 references.

This chapter discusses biological systems in terms of information system concepts, expanding upon the author's previous article "Life and the Cell" in volume 10 (2000, pp. 197-279).

Little-Known Plague Epidemic in Primorsk Region and Vladivostok in 1921 and Plague in Odessa in 1910

Yury Grigorevich Suchkov (pp. 138-219). Seven figures, 10 photographs, 21 tables, reproductions of title pages of the reviewed books.

This chapter contains reviews of four books published in the early twentieth century about pneumonic plague epidemic in Russian Far East in 1921 and about the 1910 plague outbreak in Odessa. Includes book excerpts, summaries, and commentaries.

Suchkov identifies *Plague Epidemic in Primorsk Region in 1921* edited by P.V. Zakharov (Vladivostok, 1922) as the only detailed account of a pneumonic plague epidemic in a large Russian city. He reviews the origins and course of the epidemic, the AP organizations' activities during the epidemic, the epidemic control measures taken, and financial aspects of the control work. The mortality rate in Vladivostok peaked during April and May, with a few fatalities continuing to occur through mid-September. Suchkov describes the circumstances in which several medical workers died of plague during the epidemic.

Suchkov also reviews three books about the 1910 Odessa plague outbreak. He summarizes the conditions in which the epidemic began, describes the course of the outbreak, and recounts the

[118] See *Interesting Stories*… 12.2 (2002), pp. 162-63.

control measures that AP workers implemented. The three books included are *Epidemics of Plague and Cholera in 1910 in Odessa*, edited by I.I. Kayantsina (1911); *Plague in Odessa in 1910*, edited by L.N. Malinovsky, D.K. Zabolotny, and P.N. Bulatov (1912); and *Plague* by D.K. Zabolotny (1907).

Bioterrorism—A Real Threat

L.A. Melnikov (pp. 220-23). Seven references.

This chapter discusses the bioterrorism threats and possible prevention measures that were under discussion in the United States. The author recommends that an effective defense system be created, one part of which would be an epidemic response unit comprised of high-risk infection specialists.

Several Considerations on the Threat of Bioterrorism

Igor Valerianovich Domaradsky (pp. 224-31)

This chapter contains the text of a memorandum, "On the threat of bioterrorism," that the author prepared upon the request of members of the United States Congress. It assesses bioterrorism risks and recommends several preventative measures that should be taken on the international level.

Domaradsky outlines the fundamentals of several topics, including the types of biological agents that pose significant security threats (bacteria, viruses, and toxins), the possibilities and limitations of using biological agents, and sources of biological agents. The memorandum then describes the methods of using biological agents in weaponized forms, considerations for diagnosing the diseases that they cause, possible effects of biological terrorist attacks, and the difficulties that terrorists seeking to effectively deploy biological weapons would face. Lastly, the author prioritizes preventive measures that governments could implement to respond to these threats.

Geographic Information Systems in Epidemiology: Possibilities of Counteracting Terrorism

B.V. Boev (pp. 232-54). One table, one figure.

This chapter considers the potential uses of geographic information systems (GIS) in predicting impacts of and responses to biological terrorist attacks. It also contains an overview of current uses of GIS in epidemiology. The author argues that anti-terrorism issues raised in the United States also are of primary importance for Russia.

Mikhail Trofimovich Titenko: Military Physician and Plague Scientist, a Person Who Served the Public

Svetlana Aleksandrovna Lebedeva (pp. 255-60). Two photographs (of the author and Titenko).

This chapter contains a biographical sketch of M.T. Titenko, a military physician and researcher.

Titenko served as a military physician during World War II and then became a researcher at the USSR Ministry of Defense Research Institute, specializing in the prevention of infectious diseases. He was deputy director for science at Rostov-on-Don AP Institute from 1967 through 1986. Titenko established an aerosol laboratory at the institute in 1967 to study treatment and prevention of high-risk aerosol infections.[119] He was active in training physicians and establishing procedures for the AP system.

N.K. Vereninova: A Leading Specialist in High-Risk Infections (100th Anniversary of Her Birth)

N.V. Uryupina and L.F. Zykin (pp. 261-67). Two photographs. List of 11 publications by Vereninova.

This chapter is a biographical sketch of Natalya Konstantinovna Vereninova, a physician and scientist of the early Soviet AP system.

Vereninova graduated from Saratov State University Faculty of Medicine in 1924, then worked as a physician in the southern Urals, Uzbekistan, and Mordovia. She joined the State Regional Institute of Microbiology and Epidemiology of Southeast Soviet Union (later Mikrob), where she held various positions, including deputy director for science. Vereninova was involved in the production of bacterial preparations; did field research and epidemic control of tularemia, malaria, and cholera; and studied bacteriophages. She was sent to Stalingrad to deal with epidemics that arose after the Battle of Stalingrad ended in February 1943. Vereninova prepared a doctoral dissertation on tularemia, but died of heart disease in 1959 before completing her defense.

Mariya Semenovna Drozhevkina (1912-92)

Yu.M. Lomov, T.A. Kudryakova (pp. 268-71)

This chapter is a biographical sketch of M.S. Drozhevkina, an AP system researcher on plague, cholera, tularemia, and brucellosis, and who held leadership positions in various laboratories.

[119] These activities coincide with the research of methods to defend the country against biological attacks, which the 2nd Directorate of the USSR MOH is known to have commissioned at the Rostov AP Institute during this period. Such projects contributed to Problem 5's research agenda. See Leitenberg and Zilinskas, *The Soviet Biological Weapons Program*, pp. 138-52.

Drozhevkina graduated from Rostov-on-Don Medical Institute in 1935 and served as laboratory chief at several AP divisions. After 1943, she occupied various positions at Rostov-on-Don AP Institute, including director of scientific work, director of the Phage Genetics Laboratory, and director of the Cholera Diagnostic Phage Laboratory. Drozhevkina published over 200 scientific works and made many important contributions to the study of plague, cholera, tularemia, and brucellosis. She defended her doctoral dissertation on "Brucellosis bacteriophage and prospects for using it" in 1958.

Continuing the Traditions of the Profession

G.I. Lyamkin and Yury Grigorevich Suchkov (pp. 272-78). Four photographs.

This chapter contains biographical sketches of Ivan Fedorovich Taran and his son Vladimir, both scientists who pursued careers in the AP system.

Ivan graduated from the Stavropol Medical Institute in 1951 and then joined the Stavropol AP Institute, where he developed a brucellosis vaccine. He was appointed chief of the brucellosis laboratory in 1973 and, in 1983, was promoted to director of the institute, a position he held until 1989. His son, Vladimir Ivanovich Taran, also joined the AP service and worked in a specialized anti-epidemic brigade. He was killed in a terrorist attack in June 2000 while conducting epidemic control work in Chechnya.

In the Beginning: Contribution of Rostov-on-Don AP Institute to the Training of High-Risk Infection Specialists

Veronika Semenovna Uraleva (pp. 279-337). Three tables, nine photographs.

This chapter details the training for AP system specialists at the Rostov-on-Don AP Institute. It describes how training evolved over time beginning in 1934, when the institute was founded. Initially, specialized courses were offered only for physicians and biologists, but eligibility requirements were expanded in 1966.

Don't Lie, People!

P.L. Burgasov (pp. 338-40)

This chapter contains an article that originally appeared in Meditsinskaya Gazeta (Medical Newspaper) on December 22, 2000. The author disputes the contents of a television program that dealt with the 1970 cholera outbreak in Astrakhan, particularly the declarations that corpses of cholera victims were lying in the streets of Odessa, Rostov-on-Don, and Astrakhan, and that the population suffered from hunger. He raises issues concerning the participation of I.V. Domaradsky in the television show.[120]

[120] As this chapter and the next demonstrate, there was serious enmity between Burgasov and Domaradsky. One reason was that Burgasov was an apologist for the Soviet offensive BW program, which was revealed to the Russian public for the first time in 1995 by Domaradsky.

General Burgasov, It's Time To Think About Your Soul!

Igor Valerianovich Domaradsky (pp. 341-42)

This chapter contains a rebuttal to the criticism of the television show on the 1970 cholera outbreak in Astrakhan included in "Don't Lie, People!" by P.L Burgasov (pp. 338-40).

Domaradsky argues Burgasov has no grounds to criticize the program on the basis that the former was more involved in the crisis than the latter.

Opinions of Other Participants in the Broadcast

Yury Grigorevich Suchkov and R.S. Zotova (pp. 343-45). One table.

This chapter contains a rebuttal to the criticism of the television show on the 1970 cholera outbreak in Astrakhan included in "Don't Lie, People!" by P.L Burgasov (pp. 338-40).

Suchkov and Zotova describe their participation in the television show and confirm their support of its content, expressing surprise at the vehemence of Burgasov's criticism.

Igor Valerianovich Domaradsky, On His 75th Birthday

Yury Grigorevich Suchkov (pp. 346-53). One photograph of Domaradsky.

This chapter contains a biographical sketch of I.V. Domaradsky, former director of two AP Institutes in Irkutsk, researcher in weaponization projects, and a one-time visitor to the United States.[121]

Domaradsky graduated from Saratov Medical Institute in 1947. After completing his graduate studies, he worked at Mikrob in Saratov, served as director of the Scientific Research AP Institute of Siberia and the Far East in Irkutsk from 1957 to 1964, served as director of the Rostov-on-Don AP Institute from 1964 to 1973, and finally moved to Moscow to join the USSR Glavmikrobioprom system. The chapter summarizes Domaradsky's talents and accomplishments. His autobiography, published in 1995, elicited a wide range of comments, mainly because it revealed for the first time details of the Soviet BW program.[122]

[121] For a more complete biography, see Part III below.

[122] Domaradsky, *Troublemaker*.

Ecology and Problems of Bioterrorism

A.V. Lipnitsky and N.G. Tikhonov (pp. 354-59)

This chapter examines the links between ecology and biological terrorism. It describes the potential effects of contemporary trends, like increased transportation and global warming, on viral epidemics.

Global warming could allow viral infections to spread northward from southern countries. Press reports of several large viral infection outbreaks (Crimea-Congo hemorrhagic fever and West Nile fever) in Russia in the 1990s raised much speculation about bioterrorism, but contained little scientific analysis that distinguished the cause of the outbreaks from the effects of other trends. Lipnitsky and Tikhonov argue that more research on infectious diseases is needed. The authors also note the importance of having access to sufficient data on the occurrence of regional disease in order to distinguish natural outbreaks from bioterrorism attacks.

Results of Contest for Best Essay and Best Scientific Article Published in Volume 10 of "Interesting Stories About the Activities and People of the AP System of Russia and the Soviet Union"

Yury Grigorevich Suchkov (pp. 360-61). One photograph.

This section honors K.B. Ilina for her article "Reminiscences of Dmitry Titovich Verzhbitsky" and V.P. Sergiev for his article "Infection and Mankind: A look at the Interspecies Battle at the Threshold of the Third Millennium, Sine Ira et Studio," both published in Volume 10.[123]

List of Scientific Works by N.F. Darskaya

(pp. 362-66)

This chapter contains a bibliography of 56 works published by N.F. Darskaya between 1940 and 1996.

Forgotten Photographs

Mikhail Iosifovich Levi and Yury Grigorevich Suchkov (pp. 367-85). 17 photographs.

This collection includes photographs (primarily group portraits) of AP system personnel from the Rostov-on-Don AP Institute and Mikrob. It includes one photograph of a laboratory in Kerch, and another of a culture medium production vessel at the Rostov-on-Don AP Institute.

[123] *Interesting Stories...* 10 (2000), pp. 41–72, 88–146.

Volume 12, Issue 1 (2002)[124]

Foreword

Renat Rashitovich Ibadulin (p. 3)

Introduction to the twelfth volume of the "Interesting Stories…" series, published after the death of original editor, M.I. Levi.

Full translation:

> Volume 12 of *Interesting Stories About the Activities and People of the AP System of Russia and the Soviet Union* is now a reality. Just a few months ago, no one could have known that it would be an issue honoring the memory of Moisey Iosifovich Levi, the originator, editor-in-chief, and scientific editor of the series.
>
> His illness came suddenly. Thursday, February 7, 2002, was his last working day, which no one would have suspected, Moisey worked at the intense pace he usually does. We discussed various things, including the publication of the next issue of the journal, Dezinfektsionnoe Delo, and the content of volume 12 of *Interesting Stories*… He was very intent on getting this volume published and had done everything to accomplish it. He died on February 11. He left life at the peak of his working ability, full of ideas and plans.
>
> Moisey's family, his colleagues, and the administration of Moscow Municipal Disinfection Center and its Testing Laboratory did everything possible to fulfill his wish. The series was completed with the publication of its 12th volume, which was the goal he had set for himself.
>
> Nadezhda Nikolaevna Basova assumed the duties of editor-in-chief and scientific editor for volume 12, part 1. Nadezhda Basova and Yury Grigorevich Suchkov were editors-in-chief for part 2. Many of Moisey's friends and colleagues responded. They sent their remembrances, scientific articles, and photographs. The volume includes some of Moisey's scientific works and other writings that Yury Suchkov found in the files in Moisey's office. Given the large number of materials that were received and the wide variety of subject matter, it was decided to publish volume 12 in two parts. Part 1 consists primarily of narratives and memoirs, while Part 2 contains works on scientific and related issues.
>
> While we have always said that the work done on these issues was a remarkable citizens' initiative by the editor-in-chief and his colleagues, the entire 12-volume work is a printed monument to Professor Moisey Iosifovich Levi, Doctor of Medical Sciences, who devoted 60 years of his life to the teaching and practice of medicine.

[124] This volume was edited by Nadezhda Nikolaevna Basova, Levi's wife.

On behalf of the editors-in-chief, we would like to thank everyone who sent in materials and produced this volume. Everyone's efforts, in one way or another, helped make this volume a reality!

R.R. Ibadulin,
First Deputy Chief Physician
Moscow Municipal Disinfection Center

Virology and High-Risk Infections

Nadezhda Nikolaevna Basova (pp. 4–64).

This chapter contains Basova's reminiscences about her career as a virologist. She provides insights into the life and work of her husband, M.I. Levi. Also included are Levi's reminiscences of hosting Albert Sabin, who visited Kharkov, Ukraine, in July 1956.

As a high school student, Basova dreamed of working at the I.I. Mechnikov Research Institute of Microbiology and Immunology in her hometown of Kharkhov, Ukraine. Despite the disruptions of war and evacuation to Central Asia, she completed her medical degree in 1947 and was hired by the Institute as a laboratory technician, and then as a junior scientist. Once the Institute opened a virology laboratory, she switched fields, from microbiology to virology. Basova spent the rest of her career as a virologist working on viruses that cause hepatitis, influenza, lymphocytic choriomeningitis, poliomyelitis, and other diseases. In 1956, she left Kharkov and established the virology department at the Stavropol AP Institute.

Basova describes a wide range of research done by her and colleagues. She includes sketches about many colleagues and about various aspects of her life and work.

Ageless Mind

Yury Grigorevich Suchkov (pp. 65-105).

This chapter describes M.I. Levi's work on hospital infection control after leaving the AP system, as well as his organization of collaborative research projects among AP institutions. It contains reproductions of several documents and correspondences pertaining to this work.

Suchkov, a colleague of Levi at the Stavropol and Rostov-on-Don AP institutes, writes that from 1968 until his death in 2002, Levi's theoretical and applied research included specializations in sterilization technology and the prevention and treatment of nosocomial infections. He organized research programs and worked vigorously to advocate and implement practical measures for improving public health.

Miscellaneous Items from 1994-2001

Moisey Iosifovich Levi (*posthumous*) (pp. 106-15). One diagram.

This chapter consists of three sections. The first contains various scientific and theoretical notes that Levi had written about the implications of canonical and contemporary research on dormant periods in epizootics. The next section summarizes the key outcomes and points of discussion at the jubilee conference held on the hundredth anniversary of the Russian AP system in Saratov in 1997. The final section reports 10 principles upon which participants in a symposium on antibiotic therapy agreed through their discussions of the papers presented at the conference.

In the notes published here, Levi discusses various hypotheses related to the culturability of different forms of sporulating and nonsporulating bacteria for the purpose of studying organisms' reactions to stress. He posits that if unculturable forms of sporulating bacteria exist, the documentation of these forms is important.[125] Levi also discusses other considerations for the formation of unculturable forms of *chauvinism*, the possible effect of phages on unculturable forms, and the role that unculturable forms may play in explaining why periods occur between epizootic outbreaks. He presents a few hypotheses about the evolution of sporulating bacteria and their ability to tolerate higher temperatures.

The second section is entitled "Historical Roots of the Anti-plague System: Theses from a Report at the Anti-plague System Anniversary Conference, Saratov, 1997." The summary of the report was produced by the Experimental Laboratory Center of the Moscow Municipal Disinfection Center. It highlights that there is a lack of literature on the historical successes of the AP system in lowering the danger of high-risk infections to the population. Further, it reports that the conference considered the publication of the *Interesting Stories*… as an important effort aimed at filling this gap.

The third section is entitled "Major Results of the Scientific Symposium on the Organization of Bacteriological Research During Controlled Antibiotic Therapy for Pyogenic Infection Patients." The findings relate to best practices with respect to the timing of isolating cultures from open wounds, the study of the efficiency of antibiotics to treat wounds, and the possible benefits of localized antibiotic infusion therapy.

Excerpt:

> 2. The risk of plague infection has decreased considerably, in no small part due to the efforts of the AP system. It is worthwhile to analyze the results and successes of these efforts. Therefore extra attention is being focused on the work from recent decades and the need to learn more.

[125] Note from the editors: By far, most of bacteria that exist on Earth have yet to be studied and identified, largely because bioscientists are unable to artificially culture them. Unculturable bacteria therefore are challenging to investigate, but yet forever entice scientists to study them.

3. As a result of recent economic problems, there have been practically no new publications on historical topics. AP establishments and their employees have become impoverished, and employees, particularly younger ones, have been laid off. During this period, we decided to begin publishing *Interesting Stories About the Activities and People of the AP System of Russia and the Soviet Union*. We have already been able to publish five volumes, an average of one every six months.

4. A distinguishing feature of the published volumes of *Interesting Stories…* is that they are devoted to practical and scientific problems in the fight against plague. The articles in *Interesting Stories…* are primarily of two types; in-depth reviews of vital topics and stories about outstanding people of the AP system. The reviews are rather high-level scientific writing for readers with a certain degree of professional training. The best of the non-scientific, anecdotal stories go beyond mere praise and positive assessments of their subjects. […]

7. Given the demands of the times through which we are living, we decided to slightly alter the profile of *Interesting Stories…* and devote more space to original articles on the fundamental problems of science, as well as expand the subject range beyond plague to include other high-risk infections, too.

Socialism or a Just Society

Moisey Iosifovich Levi (posthumous) (pp. 116-37). 15 photographs.

This chapter consists of a sociological essay that argues that societal development can and should be measured with social indicators rather than defined within the constraints of a given ideology. Levi examines Soviet history and the transition to Russian democracy, as well as draws comparisons with social development in the United States. He posits that measuring social progress is an important work of science that must be undertaken if societies are to be conscious of the reality of their state, rather than trust in the accuracy of ideology or faith.

Abridged translation:

Social scientists proceed from the entirely reasonable assumption that social structure is affected not only by changes in natural forces (population changes, migration, natural disasters, exhaustion of nonrenewable natural resources, etc.), but also by conscious activity (philosophy, ideology, propaganda, politics, management of the economy, etc.). One would like to believe that the determining factor is the conscious activity, and if it is so, then the task of outlining and formulating the goals of social progress is one of the most important areas of political philosophy. If these goals are acknowledged to be fundamentally unachievable, then they are called utopia (perpetual motion, for example), but those other [achievable] goals become the subjects of heated arguments. In exactly the same way that morality dates back to the time of Moses's tablets, the origin of the concept of social justice is lost in the depths of centuries past. It is entirely understandable why new historians strive to differentiate the concepts of social justice and social utopia. The present article is about defining the goals of social

development as they are seen by the modern generation, and about the methods of assessing society's progress toward them.

The people who make up a society are initially heterogeneous. The task of a democratic society is to provide them with approximately equal possibilities for development, though this is not sufficient to prevent subsequent economic and spiritual stratification, which is probably unavoidable in any society.

One task of society is to improve the spiritual nature of human beings. Religion, particularly Christianity, has had particular success in this regard. However, the improvement of social structure, which is the subject of this article, is a different task and cannot be reduced to the improvement of individual people.

I was driven to write these notes out of the need to formulate for myself and others a concept of the goal of social progress. […]

Without a clearly expressed goal, social development loses its direction, and even in those cases where society achieves material well-being, its future is doubtful without a concept of social development goals. Today, many people recognize that "there is no bread without freedom." However, some people define the concepts of bread and freedom too broadly.

If I may dare to do so, I would like to present my concepts of the social development goals for our country as follows:

1. A high level of productive capacities comparable to the level of developed countries, but without destructive effects on the environment. A sufficient standard of living and social protection for the vast majority of the population.

2. A high level of culture for most members of society.

3. Equal rights for citizens of different ethnic groups and people professing different religions.

4. A high level of public consciousness, sufficient to establish a government by law and ensure human rights (according to internationally recognized concepts). Respect for personal rights.

5. Democratic forms for managing the central government and local governments. Representative governing bodies and various political parties based on freedom of information.

These goals could be derided as socialism, but it is better not to use that term, because these goals do not mention forms of ownership, public structure, ideology, or religion. The concept of the goals of social development should not be dependent on any kind of ideological "ism" or any social formation. If there is a desire to make it so, then the content of the "ism" must be precisely defined. […]

For the last two centuries of human history, people in power have been vowing that their only motivation is to achieve social progress as they understand it. Such was the case in our country, especially after the October Revolution, when our leaders daily or even hourly reassured us that they were building and strengthening a socialist structure. There is no need to discuss this in detail, but it is vitally necessary that we tirelessly repeat that nothing is further from the truth than to say that socialism was being constructed in our country.

In this article, we will not discuss the methods for achieving the social development goals formulated above. Nevertheless, it does make sense to recognize all the drama and tension of our post-revolutionary life and thereby highlight the need for a sober and objective evaluation of the course of social development.

After the New Economic Policy was strangled, Stalinist totalitarianism completely broke with reason, and the development of society was characterized by an imperialistic mentality and chauvinism.[126] Millions of people were sacrificed at the altar of misrepresented goals of social development. The absence of even nascent democracy allowed the authorities to be not only cruel, but even criminal. By now, so much has been written about this that there is hardly any sense in repeating it.

During the Khrushchev era, the Eastern despotism was partially destroyed. The slavish dependence of workers on management disappeared; before that, a worker could not leave a job without the permission of the management. Collective farm workers received passports and thereby obtained freedom of movement. A large portion of the convicted political criminals, be they still alive or already dead, were rehabilitated. The pace of housing construction quickened. Some of the most odious figures of the KGB and party leadership were forced into oblivion. Culture was stimulated to some degree. Looking back, there is clearly a yawning gap between the accomplishments of the Khrushchev thaw period and the characteristics of a just society as mentioned at the beginning of this article, but nevertheless, the influence of the thaw on subsequent social development was enormous, if not crucial.[127] The seeds of the thaw fell on poorly prepared soil, but nevertheless the sprouts were very important.

During the twilight of the *zastoy*, social development appeared to slow down, but economic stagnation and the dissident movement delivered their sentence.[128] […]

[126] The New Economic Policy (NEP) was instituted by Lenin in 1921, but was terminated when Stalin ordered the adoption of the first Five-Year Plan in 1928. NEP allowed some aspects of capitalism, such as private ownership of property and small businesses. In fact, it gave a substantial boost to the Soviet economy that, at the time, was in desperate shape.

[127] The Khrushchev thaw (the Russian "*ottepel*" is commonly used) refers to the era of Soviet history defined by the reversal of many of Stalin's repressions. Many political prisoners were rehabilitated, and censorship was lifted somewhat.

[128] "*Zastoy*," or "stagnation," refers to the era of Soviet history defined by slowed economic, social, and political development under Brezhnev, which preceded the perestroika (reform) period of the 1980s.

In this sense, society is progressing especially slowly in the area of culture and therefore great efforts are required. For example, I think that the bleeding wounds of the United States—drug addiction, crime, AIDS—are largely due to shortcomings in the area of culture. In fact, the hordes of rock musicians, the avalanche of third-rate movies, and the constellation of semi-amateur theaters can't be seen as cultural progress. There is no doubt that there are at least as many art museums in New York as in Paris, but the overall level of culture in France is immeasurably higher than in the United States. This foretells serious social cataclysms in the world's richest country, even though that country has been able to construct a workable multiracial society.

For many years, it was thought that public opinion could not be measured, although it was quite possible to perceive qualitative shifts, and this was the job of politicians. However, for 20-30 years now, many countries have had institutes that study public opinion, and in most cases they present an entirely objective picture. With rare exceptions, public opinion surveys give an adequate quantitative assessment and predict the results of various elections and referendums. It seems to me that it is now time that sociologists have the opportunity to quantitatively assess the progress of society toward a more just structure of life in those five directions that were listed at the beginning of this article. It is not a simple task, but it is doable. If society were to have such a tool for the objective assessment of the rate of progress toward a more just structure of life, the waves of expert assessments, tainted with emotional outbreaks, would be replaced by more studied judgments about the activities of our government leaders. At the same time, people in power would have a social mirror that they could look at once in a while. Various countries now have research establishments that assess the quality of life, but these assessments cover mainly the economic aspect of life. For example, countries can be ranked in a series based on an indicator such as the amount of time it takes the average worker to earn 1 kilogram of meat. But this is only one indicator, and far from the most important. I think there should be a large, but finite, number of indicators, and they should have an absolute and relative "value" for obtaining a comprehensive assessment of society.

It is obvious that the goals of social progress can be formulated, and that the social progress toward these goals can be determined. Therefore, the time has come to transfer the assessment of the direction and rate of social progress from the political sphere into the hands of representatives of the natural science disciplines, because progress is a subject for science, not faith.

Thus, social progress must have clearly comprehensible goals. The movement toward a more just society can be assessed quantitatively and must not be obscured by ideology and faith, which in their own way can serve as a means, provided they do not contradict the moral and ethical norms of humanity.

Bibliography of M.I. Levi (continued)

Editor (pp. 138-40). 25 references.

This chapter contains a bibliography of M.I. Levi, continued from volume 10, pages 355-91, that features a listing of 25 works published in Selected Results in Bacteriological Diagnostics for the Program on Controlled Antibiotic Therapy of Pyogenic Patients: Sixth Russian-Italian Scientific Conference*, edited by M.I. Levi and Yu.G. Suchkov (St. Petersburg: VMA, 1999) and in* Theses Addressed in the Anniversary Collection of the Stavropol Anti-Plague Research Institute *(Oct. 2002).*

Pleasant Memories of a Wonderful Person and Patriot, Moisey Iosifovich Levi

Ivan Semyonovich Khudyakov (pp. 141-49).

This chapter explains the author's relationship with M.I. Levi, describing how the author became acquainted with Levi and his work. It also describes Levi's organization of international conferences and his attempts to find an artist to adapt the Interesting Stories… *series as a literary or cinematographic work.*

Excerpt:

> Moisey attended national forums in St. Petersburg organized by the departments of general and military epidemiology, microbiology, infectious diseases, and general and military hygiene of the Military Medical Academy and the Main Military-Medical Administration of the Russian Federation Ministry of Defense. He presented papers at these forums. He traveled to the All-Russian Conference of Surgeons organized by the academy's department of inpatient surgery, where he met surgeons from the Commonwealth of Independent States and beyond. This international conference was dedicated to the urgent problem of pyogenic infections in surgical practice. Moisey presented important and interesting information on selecting the optimum antibiotic for patients with pyogenic infection. The surgeons at this session listened very intently.
>
> In addition, immediately after the conference, Major General of the Medical Service, Professor Yevgeny Konstantinovich Gumanenko, chairman of the Department of Inpatient Surgery at the Military Medical Academy, postponed all planned activities in the department and gave Moisey the opportunity to share his experience and his laboratory's findings with the entire department, with no time limit. The information that Moisey presented at the plenary session of the conference was of great interest to the surgeons. There was an interesting conversation on the topic of "Science as Practice." I heard comments from prominent surgeons at the academy who had high praise for Moisey's paper and asked for the chance to have more in-depth discussions with this scientist from Moscow who, although not a surgeon, knew the needs of surgical practice very well.

Several members of Gumanenko's department expressed the desire to develop a plan and do work in this area, and Moisey heartily agreed.

I had a memorable time with Moisey and Nadezhda Basova at the Isaak I. Rogozin Memorial Conference on May 13, 2000, celebrating the 100th anniversary of Rogozin's birth. The conference was organized by the Main Military-Medical Administration, the Military Medical Academy, and the Military-Medical Museum, along with the Rogozin's own Department of General and Military Epidemiology at the academy, now headed by Professor Pavel Ivanovich Ogarkov. For the opening of the conference, the museum prepared an exhibition of Rogozin's scientific works and personal effects. A book was published about this outstanding scientist and practitioner in the fields of military and civilian health. The conference was interesting and insightful. Moisey's participation was very touching. He really wanted to publish some of the information in *Interesting Stories*… because it was directly related to the former director of his beloved AP system.

Moisey and Nadezhda met Rogozin's daughters Maya, who followed her father's footsteps and spent her entire career in the AP system, and Galina, a teacher, as well as Rogozin's close friends and colleagues from the Department of General and Military Epidemiology, which Rogozin headed. The Rogozin family was very glad to meet Moisey and Nadezhda after hearing stories about them from friends and colleagues.

Always wanting to preserve the memory of the AP system and its heroic figures, Moisey looked for other forms and possibilities… Moisey said to me: "Give all 10 volumes of our stories to Daniil A. Granin and ask him to look at them.[129] As a patriotic writer, he should be interested in it." I met with Daniil and, putting my entire heart into it and trying to be as convincing as possible, asked him to read *Interesting Stories*. He told me: "Tell Moisey that I'm truly impressed by his heroic and saintly activity and I approve his intentions in every way, but unfortunately I have to decline his request. I'm over 80 and God help me complete the works that I've already started and really have to finish." Granin's answer was a severe disappointment for Levi, but did not discourage him. He asked me to continue looking for a good writer in the Leningrad Writers' Organization.

On the advice of the well-known Leningrad poet Semyon Vladimirovich Botvinnik, I contacted the very popular writer Ilya Petrovich Shtemler and repeated Levi's request. He listened to me very attentively and sympathetically, but also rejected the proposal, saying that he could not switch to writing about medicine and biology, topics far from his life experience, about which he still had plenty to write. He suggested I talk with three other writers who are younger than him and who work in different genres. He gave me their addresses and told me about each one.

[129] Daniil A. Granin is a St. Petersburg author of a book on N.V. Timofeev-Resovsky, biologist and geneticist who was politically repressed during Soviet times.

I talked with each one in order. Two of them really grilled me about it, and then turned down the idea. The third was interested, and then started listing a slew of conditions that had to be fulfilled in order for him to write a literary work. Some of the conditions seemed unjustified, excessive, and not entirely ethical. Nevertheless, I relayed the results of my conversations to Moisey. I found out later than nothing constructive came of it all.

Moisey had ideas about getting filmmakers interested in this material. It seemed like something positive was taking shape. One successful documentary film director from Moscow was very interested. It turns out that his parents had spent their entire careers in the AP system and owned a set of Levi's *Interesting Stories*…But later, for some reason, he cooled on the idea and lost interest, declining any further contacts. This was another severe blow for Moisey, but he never gave up. He felt that our country must have thousands of sincere and truly creative writers, poets, filmmakers, and other professionals outside of the creative arts unions, which have so much dead wood. It just could not be that not one of them would be interested in our subject. We simply were not doing a good enough job of showing the significance and urgent dynamism of this exciting subject, showing them our lode of dramatic material, "opening up" their souls, giving them a guilty conscience, or striking a patriotic chord that would inspire them to a burst of creativity and spiritual awakening.

Plague Monoclones[130]

Yu. Yu. Vengerov (pp. 150-61). Six references.

This chapter narrates the scientific work the author undertook with M.I. Levi between 1983 and 1990 to produce monoclonal antibody against the plague microbe Fraction 1 antigen for application in an enzyme immunoassay test-system for clinical use in the AP system. The author describes his and his colleagues' working relationship with Levi, as well as the technical and bureaucratic challenges that they encountered during the project.

Vengerov describes M.I. Levi as a distinguished scientist and highly effective organizer, able to inspire enthusiasm for the study of the plague microbe among biologists of all types. Despite the author's and his colleagues' lack of familiarity with the study of plague, the research project that Levi proposed at the Institute of Molecular Biology of the USSR Academy of Sciences was well received. The article includes anecdotal accounts of the project's presentation at a conference of AP scientists and of its introduction to the Alma-Ata AP Institute.

Excerpt:

At that time, we started having frequent and regular contacts with Moisey Levi. As in all his activities, Moisey displayed an amazing combination of talents as a scientist and organizer. He

[130] The term "monoclones" is a contraction of "monoclonal antibodies." Monoclonal antibodies is the name for antibodies derived from a single source or clone of cells that recognize only one kind of antigen.

had astounding abilities to pose and solve scientific problems with inspiration and insight, as well as find alternative ways of getting the results implemented within the extremely complex administrative system of the USSR MOH at the time. I saw that Levi's undertakings were always firmly supported by the Ministry, which is almost unthinkable in our present "democratic" times, when it is impossible to imagine getting any useful or necessary work done without promising money to specific bureaucrats.

Over time, I came to understand that Levi's authority was in no way based on his occupying some chair, as was the case with many academicians/institute directors. The secret was that the people who occupied high administrative posts at the time, such as V.P. Sergiev, director of the Main Administration of Quarantine Infections [a subunit of the MOH], and his deputy K.A. Kuznetsova, were convinced that Levi's proposals were always truly promising. He always thought through and constructed every last detail for the practical realization of each project. On the other hand, both Sergiev and Kuznetsova had fairly extensive knowledge of the subject, and both wanted to ensure that the people in the AP system had the latest methods in hand. Yu.M. Fedorov, who was then deputy director of the Main Administration of Quarantine Infections, handled the specific administrative tasks for our project.

The development of monoclones for detecting the plague microbe and the practical implementation of enzyme-linked immunosorbent assay (ELISA) systems based on these antibodies were acknowledged to be necessary and important tasks, and the development of this field was supported by our administrators and by MOH officials. As I now understand, the success of our work allowed Yevgeny S. Severin to access new funding sources for his scientific teams.[131] Based on Severin's capabilities and resources, Levi, with his inherent energy and enthusiasm, used his authority and support within the MOH to move the project ahead quickly.

There was intense organizational activity going on at the same time [as the laboratory work to develop the ELISA and monoclonal antibody detection systems proceeded]. One of the important stages in the project was the holding of a large seminar at Moscow State University in the Biochemistry Department, chaired by Academician Yevgeny Severin. Personnel from AP stations throughout the Soviet Union attended the seminar, the purpose of which was to provide training on using monoclonal ELISA test systems for detecting the plague F1 antigen. There were about 60 practitioners from the Russian Republic, Kazakhstan, Uzbekistan, Azerbaijan, and other republics. I heard the names of many geographic places that I had not a clue even existed. The plan was to conduct full-scale practical exercises using our test systems in order to prepare the AP station personnel to use independently the test systems at their locations.

We were not at all used to the appearance and style of the attendees at the seminar. I remember the weathered, sunburned faces and the rather informal style of dress and demeanor. Most of

[131] Yevgeny S. Severin was founder and, at this time, chairman of the Biochemistry Department, Moscow State University.

them knew each other well, and Levi knew them all. Each one wanted to talk with Moisey, get advice from him, or just talk about themselves. He addressed them all by name, asked about their families, and, as it turned out, had played an important role in the life of almost every one of them. At least this was the impression that I had during the seminar. He suggested a dissertation topic to one person, found a job for another, helped the third get a promotion, helped a fourth, who had a newborn child, get transferred within the system to a place with a better climate, and so on for practically all of them. For all these people he was a true patriarch—caring, respected, and beloved.

The AP system personnel startled us with their skills and their attitude toward their work. They were truly interested in what we said, and most of them really wanted to work with ELISA and monoclones. We were nervous about preparing the practice sessions, which were the first public full-scale test of our new product. The Biochemistry Department had acquired several ELISA readers, automatic pipettes, and reagents for the practice sessions.[132] Because of this flurry of activity, I do not remember much about the rather pompous administrative portion of the seminar, which included speeches by Yevgeny Severin, V.P. Sergiev, and other prominent representatives of the MOH and the USSR Academy of Medical Sciences.

When we finally got down to the two days of practice sessions, we received one more lesson in organization. Levi divided the attendees into groups of four to five people. After a single demonstration on the second day of the practice sessions, each group was told to work independently and conduct all the procedures using an ELISA plate to detect F1 in over 20 coded samples. One of the groups performed the analysis on two plates [containing wells]; on one plate the reagents were applied using an automatic pipette, which was very scarce equipment at the time, and on the other plate by applying droplets using a simple 5 mm glass pipette. All the plates responded perfectly, including the one that was prepared without using the rare automatic pipette. In addition, visual evaluation, without any instrumentation, was shown to be perfectly effective. Thus one of the results of the seminar was to demonstrate that ELISA could be performed without a reader or an automatic pipette. On the other hand, the results were not all that startling, because these were people who had a wonderful mastery of immunoanalysis using passive hemagglutination, where the results are always evaluated visually.

The success of visual evaluation of the ELISA results gave Levi the idea that the system could be specially designed for use without instrumentation, and for this the visual evaluation would have to be made as unambiguous as possible. He proposed using beta-lactamase as the enzyme marker instead of the traditional horseradish peroxidase. Good results were obtained in laboratory versions, and several test systems were developed. These results were reported in several publications.

[132] An ELISA reader consists of a light source that illuminates a sample located in a well using a specific wavelength and a light detector located on the other side of the well that measures how much of the initial light is transmitted through the sample; the amount of transmitted light is related to the concentration of the molecule of interest.

Thus during the seminar, all the practical problems of implementation were resolved, and within a short time we delivered the planned number of test systems for the AP stations. The plans were in fact accomplished, and the pilot series of ELISA test kits began to be used in the AP system.

This seemed to be the successful conclusion of my group's work to develop the F1 detection systems, but Levi made a proposal to start production of monoclonal antibodies within the AP system itself.

The site chosen for setting up this operation was the Alma-Ata AP Research Institute, the director of which was M.A. Aykimbaev. Hybridoma cells that S.N. Kurochkin obtained for producing monoclonal antibodies for F1 were sent to the laboratory there. Gulya, the institute director's daughter, had to learn how to generate monoclonal antibodies by injecting ascites into mice. This charming woman mastered everything rather quickly, and the process of registering the monoclonal antibody preparation with the MOH soon began.

I had the opportunity to visit Alma-Ata with Moisey Levi and Yu.M. Fedorov to demonstrate the use of the ELISA test systems and conduct initial training of personnel at Alma-Ata AP Research Institute. By that time, I had a fair amount of experience working under all kinds of conditions and at various places ranging from greenhouses to horse stables, so the demonstration went well and the test systems gave the required sensitivity. However, during the training I was surprised by the somewhat negative, detached attitude and the fairly strange and skeptical behavior of the institute personnel. Gulya, who was in the center of the event, looked distressed and preoccupied.

Being in a good mood after the successful demonstration and tests, Levi, Fedorov, and I spent a wonderful evening out on the town. I was not particularly inclined to give too much importance to the unusual atmosphere surrounding our test system. However, the next day once again confirmed the truth of the saying that there is no smoke without fire.

In the morning, I intended to give some additional materials to the personnel who had trained to work with our test systems, but there was no one in the laboratory except the thoroughly distraught Gulya. The center of the event shifted to the director's office. It turned out that in the absence of the director, who, as I recall, was traveling abroad, the institute was temporarily under the direction of his deputy who, as usually happens in the East, was in opposition to his superior's support of our project, so the deputy decided that this was a convenient moment to organize a "group event."

At the meeting in the director's office, the group, which consisted of several scientists at various levels, said that the institute in no way should be getting into such a premature, and possibly adventuristic, undertaking as monoclonal antibodies or ELISA. It would be better to direct its efforts toward something else, and, generally, it would be best of all to be rid of the

prospect of the unnecessary additional and incomprehensible work, particularly since there was no increase in pay.

Alas, I was already very familiar with this attitude on the part of some scientists and practitioners toward new methods. This attitude was a mixture of fear that encountering a new method would reveal successfully hidden incompetence, fear that replacing the old method with a new method would leave them without work, and finally simply the lack of desire to do anything. What happened next was a classic demonstration of the impeccable workings of the bureaucratic command–administrative system.

At the meeting, the usually paternally beneficent Fedorov sat with a gloomy impenetrable face, vaguely nodding during the speeches made by the "group," while Levi was absolutely quiet and silently smiling about some kind of thoughts he was having. I followed the events, not being familiar with the playing field of this conflict, the aims of which were unknown to me. When the representatives of the "group" were finished, Fedorov, not hurrying, began to speak. His words appeared to have no relation to the subject of the conversation.

He began by saying that the deputy director (who was sitting boldly in the chair at the head of the table) in only three months was facing either an evaluation or a recertification before the Main Committee in Moscow, but this upcoming procedure apparently had run into some kind of problems. The deputy director suddenly stiffened up. Next, Fedorov talked about one of the recalcitrant laboratory directors, who apparently had something amiss with his education, so that he can only be an interim director, and the only way he could ever get over that hurdle and go from interim director to permanent laboratory director would be with the approval of that same Main Committee. The third person was another laboratory director who wanted a promotion to the next category, for which it was necessary to have the permission of—well, you can guess. Fedorov had unpleasant words for practically everyone.

What happened next was interesting. Although Fedorov was sharp, it was more like punishing a child. He spoke evenly, as if there were no doubt, and ended by saying that he was certain that despite the heavy work load, the other very important matters, etc., most of the institute's personnel would support the Ministry's initiative. Therefore, surely the lion's share of the group, rolling up its sleeves, would take up the work of implementing ELISA and starting up monoclone production.

No one wanted to be cut off from the main part of the group, so everyone voted "aye." This unanimous enthusiasm even began to interfere with the work. At the next session of the seminar, which was supposed to involve only brief practical comments, some people showed up who had not been there previously. They expressed considerable, but alas, uninformed, interest and asked all kinds of questions that had nothing to do with the subject.

It was always the custom in the East at that time to hold a closing banquet, and it was here that we witnessed the apotheosis of expressions of enthusiasm. There were 30–40 people at the

banquet, including the entire administrative staff of the institute and all the staff involved in our project. Everything about the table in every way emphasized the deputy director's homage to the Main Committee. The people who had been at the collective opposition meeting offered toast after toast, where one after the other offered more or less flowery remarks about their full support for the project and the undertakings by the Main Committee in Moscow. The one who went further than all others was the laboratory director who was awaiting a promotion to the next category—he proposed his toast as a poem. In general, the people at the table demonstrated that the staff was completely and unanimously supportive of the project and that the Main Committee was fully in control of the situation.

The next day, we flew off to Moscow. My part of the work on this project was finished. After that, on several occasions, I prepared and sent out batches of monoclonal ELISA test kits for detecting F1. The AP institute successfully started production of the monoclones. The AP stations began actively using ELISA for various scientific tasks of monitoring plague, as evidenced by the methodological recommendations that were issued. Moisey Levi was the driving force and the brainpower behind these accomplishments. As for myself and my colleagues, the F1 work was a starting point in our understanding of ELISA as a methodology for developing immunoassay systems.

The organizational, scientific, and life experiences that I obtained during this work with Moisey Levi were very important to me in the future. After the F1 detection system, my group developed detection systems for HBs [hepatitis B surface] antigen, rotavirus, HIV, and many others. The work on each system required dealing with specialists from various establishments, which meant making contacts within different structures and encountering different styles of work and administration. The experience of working with the AP system was simply invaluable in overcoming these problems. Most of the test systems we developed were produced first in large batches and then went into mass production, and all went through the same stages of implementation as we did with Moisey Levi for F1.

Naturally, after the project was finished, I had direct scientific contact with Moisey more rarely, but we remained friends and I always remember seeing him as an older comrade from whom I was able to obtain sound advice on any scientific problem or simply talk about the events swirling around in our country.

Reflecting on my long career, I look through my old laboratory notebooks under the heading of "Plague Monoclones" and gratefully remember my friendship with this extraordinary person and the several years of intense work we spent together.

Living Classic

V.G. Zhukhovitsky (pp. 162-64).

This short article commemorates M.I. Levi as a scientist and teacher, offering high praise for his knowledge and leadership. The author concludes with the opinion, shared by many of his students and colleagues, that Levi was a worthy scholar in the Greek classic sense of the word.

Knowing and Working with Moisey Iosifovich Levi

V.P. Ipatov (pp. 165-70).

This chapter contains the correspondence of M.I. Levi and V.A. Serebryakov, which was published in the journal Medical Parasitology and Parasitic Illnesses. *Using the correspondence as evidence of Levi's attention to detail and passion for the subjects in which he was engaged, the author also includes his praises of Levi as a colleague.*

Valentin Anatolievich Serebryakov, a colleague of the author's at the Uzbek Scientific Research Institute, published an article, "Statistical analysis of familial distribution of subjects ill with cutaneous leishmaniasis in rural areas," (*Medical Parasitology and Parasitic Illnesses* issue 4 1969:440-43) containing references to work by M.I. Levi. In the article, Ipatov reproduces the letter written by Levi to the editor and the response written by Serebyakov, both of which were published in the same journal in 1970 (issue 2, pp. 252-53). Levi draws attention to several instances where Serebryakov and his coauthors incorrectly cited data related to the incidence of illness around a given epidemiological focal point for leishmaniasis. Given Levi's recalculations, the response from Serebryakov validates Levi's criticisms, but concludes that the correction in no way affects the basis or conclusions of the original article.

The author also briefly describes the nature of the working relationship he had with Levi between 1988 and 2001 while working in the biological division of the Central Research Control Laboratory of the Moscow Municipal Disinfection Center.

Excerpt:

> As head of the bacteriology department at TsKIL (Central Testing and Research Laboratory of the Moscow Disinfection Station), I took part in introducing the use of bacteria test kits for steam and air sterilizers. These tests were developed under the direction of M.I. Levi. I also organized the commercial production and distribution of these kits from 1989 through 1992. An updated version of this commercial process is still in production. At the same time, I worked with Levi to develop improved long-shelf-life bacteria test kits for disinfection chambers. These kits are also still in production.
>
> Having been part of a working group brought together by Moisey Levi, I can judge his professional and human qualities. Over many years of work in the Central Testing and Research Laboratory, Moisey was able to find and train a group of assistants who were highly professional, even artistic in their work. The laboratory technicians did not simply have "golden hands," but always understood

the essence of the scientific work that Moisey was directing. He often included them as co-authors in scientific articles, which can be a questionable decision. I think it would be more correct to express gratitude to them for their technical assistance in the work.

The atmosphere at work was more like a family, without official formalities. Moisey kept up with the personal affairs of his coworkers, but discipline was strictly observed, although without nit-picking. He regularly walked around all the workplaces and knew them at least as well as the people who were working there. He spent more time going around the laboratory than he did sitting in his office. Generally, he kept up with everything that was going on in the laboratory. If necessary, he called working meetings to discuss scientific problems. These meetings were often brainstorming sessions; each person spoke freely, then Moisey summarized the discussion by saying: "So what is our dry matter from this?" This "dry matter" soon became reality.

Admiral (Remembrance of M.I. Levi)

Leonid Fedorovich Zykin (pp. 171-75).

This chapter contains an essay highlighting the significant contributions that M.I. Levi made to the AP system, despite his relatively short tenure as an official AP system employee, as well as to the study of biology and epidemiology, given his extensive and prolific career dealing with both fields.

Zykin writes that although he never worked alongside Levi, his knowledge of Levi's contributions to the study of plague enabled him to assess that Levi was a major scholar and a person with a far from ordinary character. The article places special emphasis on the speed with which Levi gained renown within the AP system during his service to the system from 1956 to 1965 and on the impact that his work from outside the system continued to make after that period.

Zykin describes several specific contributions to the work of the AP system that emerged from Levi's work on enzyme immune analysis, monoclonal antibodies, diagnostic preparations, and latent periods between epizootics. Perhaps most significantly, Zykin notes, Levi's development of serum diagnostics enabled an increase in the efficiency of certain AP system activities by a factor of 10 or 20. The author suggests that part of Levi's success in contributing to the field may have derived from the "fresh views and unorthodox thinking" he brought with him as a result of his coming to the field of plague study "from the side" (that is, with degrees both in biology and medicine and a great capacity for mathematical analysis).

Excerpt:

It also must be noted that because neither the scientific editor/editor-in-chief [of *Interesting Stories*…] nor his assistants were subordinates of any official of any AP organization, they were able to publish many objective materials that sometimes shed completely new light on the events described. […]

Moisey Iosifovich Levi can rightly be called the "Admiral of the AP Service." He stood on the captain's bridge of a great ship that sailed through the waves of epizootics, epidemics, and outbreaks. He had a long view from the captain's bridge out to the horizons of science. He lived through shipwrecks and other disasters, but never wavered from the true course.

Moisey Iosifovich Levi: Teacher and Leader

S.U. Kreyngold (pp. 176-78).

This short chapter describes several accomplishments of M.I. Levi, including his ability to attract many scientists to the field of plague study, his efficiency in gaining relevant experimental results despite often limited laboratory resources, and his dedication to improving the plight of Soviet science during periods in which it suffered.

Director of the Center for Scientific Ideas and Developments

M.M. Avrutsky (p. 179).

This chapter contains a brief remembrance of M.I. Levi as a highly competent manager at the Experimental Laboratory of the Moscow Municipal Disinfection Center who maintained a highly experienced, motivated staff.

"Interesting Stories About the Activities and People of the AP System of Russia and the Soviet Union" and "Informational Principles of Life"

Renat Rashitovich Ibadulin (pp. 180-93).

This chapter narrates the author's experience of preparing two volumes of his book, Informational Principles of Life, and it describes the assistance that M.I. Levi rendered to the project. It also includes references to concepts addressed in previous articles that the author wrote, contained in previous volumes of the Interesting Stories…[133]

[133] R.R. Ibadulin, "Life and the Cell," *Interesting Stories*… 10 (2000), pp. 197-279 and "Multicellular Organisms as Information-Computer Systems," *Interesting Stories*… 11 (2001), pp. 73-137.

VOLUME 12, ISSUE 2 (2002)[134]

Northwest Caspian Plague Focus and Several Aspects of Activities There

Boris Georgievich Valkov (pp. 4–39). One photograph (portrait of author), 20 references

This chapter describes the author's research projects at the Elista AP Station, the Dagestan AP Station, and the Volgograd AP Institute between 1953 and 1990. The short essays included in the chapter describe high-risk infections in the northwest Caspian region, the role that the AP system plays in the region, and the theoretical and practical contributions that AP system personnel made to an increased understanding of high-risk infection control in general.

Extended excerpt:

> This excerpt describes several research programs undertaken at Volgograd, including the defensive aspects of the Soviet BW program.
>
> In January 1958, the Volgograd AP Station became a branch of the Rostov AP Institute (USSR MOH Order No. 392 of October 31, 1957). The production of bacterial preparations, including live plague vaccine, was established at the branch. As director of the station (and later the branch) beginning in 1954, candidate of medical sciences Zinaida Semenovna Pavlenko was an excellent organizer and a wonderful, responsive person.
>
> Igor Valerianovich Domaradsky, who at the time was director of Rostov AP Institute, had a large role in establishing and developing the research at the Volgograd branch and its successor institute, the Volgograd AP Institute (established by USSR MOH Order No. 8 of January 15, 1970). The following people played a very active role in organizing and developing the institute:
>
> • Petr Nikolaevich Burgasov, Deputy Minister of Health, Chief Sanitary Physician of the Soviet Union;
>
> • Aleksandr Varlamovich Pavlov, director of the Main Sanitary-Epidemiological Administration, USSR MOH;
>
> • Ivan Danilovich Ladny, director of the Main Administration of Quarantine Infections, and his successor Vladimir Petrovich Sergiev;
>
> • Nikolay Nikolaevich Zhukov-Verezhnikov, academician of the Academy of Medical Sciences;
>
> • Georgy Pavlovich Rudnev;

[134] Levi died before this volume was completed, so his close colleague Yuri Grigorevich Suchkov edited it.

- Zinaida Vissarionovna Yermolyeva;
- Vitaly Dmitrievich Belyakov; and
- personnel of local administrative organizations in Volgograd.

The first director of the institute, colonel of the medical service, candidate of medical sciences, and senior scientist Vasily Sergeevich Suvorov contributed great effort and knowledge to the organization of the institute. He was admired and respected by the staff not only for his knowledge, but also for his good nature. Unfortunately, his sudden death in 1983 prevented him from realizing all of his dreams. The author of this article also was present at the establishment and startup of the institute. S.L. Borodko, scientific secretary and secretary of the institute's party organization, also contributed much effort and knowledge.

The leadership of the institute changed twice; Suvorov was succeeded by V.P. Borodin and I.I. Chernenko, they were succeeded by I.G. Tikhonov and G.M. Larionov, and they were succeeded by A.V. Lipnitsky.

It is not my task to analyze the activity of the institute during this period, but I think that this will be done later on. But certainly I should note the further growth of the institute, the achievements of our researchers, and the difficulties they encountered.

Several circumstances at the time fostered the establishment of Volgograd AP Institute as the lead institute for protecting the public against biological weapons:

- the lack of any such institute in our country;
- the presence of biological weapons in many countries, primarily the United States;
- the real possibility that these weapons would be used, as confirmed by historical examples;
- the improved health situation in the natural plague focus in the territory previously served by the Stalingrad AP Station;
- the lack of information on the possibility of using deep mycosis pathogens and several viruses as biological weapons;
- the low sensitivity of rapid analysis methods of detecting biological weapon agents in nature;
- the need for more effective methods of decontaminating sites seeded with various pathogens;

- the need for better methods of rapid diagnosis, prevention, and treatment;

- existing AP institutes in Saratov, Rostov, Stavropol, Alma-Ata, and Irkutsk were already fully occupied with scientific tasks.

All the above items determined the direction of research at the institute. This research concentrated on developing rapid methods of detection, decontamination, and diagnosis of pathogens; studying the variability and viability of microorganisms; developing preparations for prevention and treatment; and many other areas. Particular attention was given to infections such as deep mycoses, glanders, and melioidosis. The necessary organizational measures to be taken during field expeditions in infection foci were developed.

Scientific research began in 1963 with the establishment of two laboratories at what was still the Rostov AP Institute branch; a disinfection laboratory headed by B.G. Valkov and a special laboratory headed by the institute's director, S.L. Borodko. Beginning in 1966, the pace of scientific research quickened considerably, because the branch began studying deep mycoses. Professor Pavel Nikolaevich Kashkin became its scientific director. He was a leading mycologist, chairman of the microbiology department and director of the mycology laboratory at Leningrad Institute of Physician Continuing Education. Others from Leningrad who actively participated in training the staff and conducting research were professors Kirill Pavlovich Kashkin, Nikolay Petrovich Blinov, and Tatyana Nikolaevna Kokushina, and docent Andrey Iosifovich Drozdov.

At that time, the medical community in our country had only a vague concept of deep mycoses, while this subject had been studied fairly extensively in the United States. There was a reason for this. High-risk fungi, especially *Coccidioides immitis* (the cause of coccidioidomycosis), had long been in the sphere of usable biological weapon agents, as Rosebury described in P*eace or Pestilence*.[135] During World War II, the United States was prepared to use aerial bombs filled with this pathogen.[136] This book also provided information on developments carried out at the Camp Detrick laboratories to increase the virulence of this fungus. In addition to *C. immitis*, other high-risk deep mycosis pathogens are the fungi *Histoplasma capsulatum*, which causes histoplasmosis, and the pathogens of two blastomycoses: *Blastomyces dermatitidis* and *Paracoccidioides brasilensis* (South American paracoccidioidomycosis).

As both laboratory director and deputy scientific director of the institute, it was easier for Valkov to assemble the various groups that would comprise the nuclei of the future laboratories.

[135] The full citation is: *Theodore Rosebury, Peace or Pestilence: Biological Warfare and How to Avoid It*, (New York: Whittlesey House, 1949).

[136] In fact, the United States never weaponized *C. immitis*. Further, Rosebury, who worked for the US BW program during World War II, does not claim it was weaponized; this pathogen is just listed in his book with many other pathogens as a possible BW agent.

During the early years of the institute, the disinfection laboratory grew and gave rise to separate laboratories for biochemistry, epidemiology, detection, and immunology, as well as a serological group. Merging with the special laboratory, they formed the deep mycosis laboratory. The laboratory of culture media and microorganism cultivation was developed based on the culture media group. Finally, the aerosol laboratory was spun off from the disinfection laboratory.

In order to staff the laboratories, there was a need not only for experienced staff, but also promising young staff, of which there were clearly not enough at the institute. Searches were begun which ended successfully. Leonid Fedorovich Zykin became director of the detection and immunology laboratory. Senior scientists were V.N. Metlin, L.S. Petrova, and V.M. Svistunov (transferred from Mikrob). Director of the glanders and melioidosis laboratory was Leonid Abramovich Ryapis. Director of the biophysics laboratory was Nikolay Nikolaevich Piven, and senior scientists were I.V. Ryapis, V.I. Ilyukhin, K.V. Durikhin, and A.I. Shelokhovich (Rostov-on-Don). Other laboratory directors were: Nikolay Mikhaylovich Cherepanov (Irkutsk), biochemistry; Vasily Sergeevich Suvorov, epidemiology; Anatoly Vasilevich Lipnitsky, deep mycoses; Nina Semenovna Surnina, live cultures museum; Elena Mikhaylovna Beburishvili (Volgograd), culture media and microorganism culturing, succeeded by Viktor Mikhaylovich Samygin; and Viktor Yakovlevich Kurilov, electron microscopy.

When the detection and immunology laboratory was split into two, one of the laboratories (detection) was headed by L.F. Zykin and the other (immunology) was headed by Viktor Nikolaevich Metlin, a wonderful methodologist and very knowledgeable specialist on high-risk infections. The information laboratory was headed by doctor of medical sciences Nikolay Fedorovich Neklyaev, succeeded by Valery Nikolaevich Andrus. The laboratory directors made noteworthy achievements, in some cases being forced to start from scratch. This was the case for N.M. Cherepanov in the biochemistry laboratory, L.A. Ryapis in the glanders and melioidosis laboratory, N.N. Piven in the biophysics laboratory, and V.Ya. Kurilov in the electron microscopy laboratory. Starting with a small library, N.F. Neklyaev created the information department. Vitaly Ivanovich Yefremenko infused much energy and youthful enthusiasm into the work of the biochemistry laboratory when he succeeded N.M. Cherepanov there. His scientific worth was confirmed by his defense of candidate's and doctoral dissertations and his development of an entire field of making choleragen.[137] Professor Yefremenko currently heads the Stavropol AP Institute [at the time of publication in 2001 or 2002].

[…]

By the end of 1972, most of the work had been completed for organizing all the departments of the institute, equipping them, and building a new building. The pace of scientific research therefore quickened at this time.

[…]

[137] Chloragen is a toxin produced by the cholera vibrio.

Under the supervision of senior scientists, much work was done to study the viability of high-risk infection pathogens in different geographic regions of the country (Volgograd, Rostov-on-Don, Stavropol, Simferopol, Riga, Chärjew, Irkutsk). Later this work was carried out with a more sophisticated methodology using the aerosol method of infecting sites. A dissertation for candidate of medical sciences degree was defended (L.K. Merinova), and instructions on the time periods for natural decontamination of environmental sites seeded with high-risk pathogens were issued and are still in effect. G.G. Malysheva defended her candidate's dissertation on the viability of cholera vibrios in the Volga River and Volgograd Reservoir. Lyudmila Konstantinovna Merinova, one of the most capable scientists at the institute, later defended her doctoral dissertation and became director of one of the laboratories.

A.V. Agafonov, S.L. Borodko, and V.I. Yastrebov conducted research to find new bactericides. Hundreds of bactericides were synthesized by various establishments in our country, including Volgograd Institute of Organic Chemistry, Volgograd Polytechnical Institute, Leningrad Chemical-Pharmaceutical Institute, Leningrad Institute of Plant Protection, and All-Union Institute of Fats, but it was the task of our institute to critically study the bactericidal activity of each of these preparations.

[…]

This was the first time that industrial wastes from chemical production were widely used in disinfection practice. The economic effect from this innovation (the disinfectants metafor, aldofor, isometafor, and isofor) was 460,000 rubles. The disinfectants were demonstrated at the All-Union Exhibition of National Economic Achievements. The developers, B.G. Valkov and V.N. Andrus, were awarded the exhibition's bronze medals and engraved watches. Disinfection procedures were developed for using the industrial waste disinfectants calcium hypochlorite and milk of lime [calcium hydroxide] by V.I. Yastrebov, V.A. Saleeva, and B.G. Valkov.

A dry diagnostic differential medium for the plague microbe was developed by K.V. Durikhin, A.Ye. Popova, and B.G. Valkov in collaboration with colleagues at the Mikrob Institute). There is no need for me here to write about M.I. Levi's pupil Konstantin Vasilevich Durikhin, because Levi himself has given a wonderful description of Durikhin (M.I. Levi, 1994). I would only note that you do not often meet such a kind-hearted and talented, yet modest person. All who knew Durikhin were very grieved at his loss.

Alla Yevgenyevna Popova was a capable scientist always looking for the new, useful, and outstanding. She took her discoveries and developed them into practical applications. She thought along the same lines as Durikhin and helped him overcome difficulties in life. Her death was a severe blow to us.

A dry yeast medium for *Coccidioides* fungus was developed by B.G. Valkov and L.A. Lisitsyna in collaboration with colleagues from the Rostov AP Institute. A group consisting of V.M. Svistunov,

Yu.V. Gurov, and V.I. Yastrebov completed a large volume of work to develop and implement into medical practice a needle-free intracutaneous method of plague vaccination. The role of biologically active points in vaccination was studied. Based on the experimental results, significant changes and additions were made to the existing specifications for plague vaccination.

A series of work on mild inactivation methods made it possible to develop recommendations for processing materials to obtain diagnostic and vaccine preparations. This work was done by G.I. Kostina, I.S. Kovmir, V.I. Yastrebov, T.V. Pleshakova, V.Ya. Kurilov, V.I. Kapliev, S.R. Sayamov, V.N. Khodakovskaya, B.G. Valkov, and others. The results from this research were defended by Galina Ilinichna Kostina for her dissertation. Kostina, a talented scientist, after successfully defending the dissertation, moved to Moscow to the Institute of Immunology of the Russian Federation Academy of Medical Sciences.

Work by T.V. Pleshakova, V.P. Kukhtin, and L.A. Yershova on the resistance of high-risk infection pathogens to various physical factors is noteworthy. Also, L.N. Petrov made an important contribution to the development of normative documents for civil defense.

V.N. Khodakovskaya showed the influence of various chemicals on serological reactions and proposed reliable methods of eliminating this influence and detecting high-risk infection pathogens. She defended a dissertation on this subject. The feasibility of using water electrolysis products as a disinfectant was demonstrated by B.G. Valkov, V.P. Kukhtin, and V.I. Yastrebov.

[...]

In the 1970s and 1980s, while I was working in the field of disinfection, I again came into close contact with Moisey Iosifovich Levi, who headed the Central Testing-Research Laboratory of the Disinfection Station of the Moscow Municipal Executive Committee Main Administration of Healthcare. As members of the USSR MOH commission charged with establishing rules for the use of disinfectants, we met often and solved problems of using new chemicals as disinfectants and insecticides. Levi had much influence on the research in the field of disinfection and insect eradication, on the theoretical basis of this research, and on the practical testing of new chemicals. Levi's idea that not only the chemical affects the microbe cell, but also that the microbe cell affects the chemical, is worthy of attention. Unfortunately, I do not know if this idea was investigated, although at one time, we discussed it with Konstantin Vasilevich Durikhin and even attempted to work out methodological approaches to resolve the issue.

The deep mycosis laboratory was formed from the special laboratory, which had worked on culturing microbial masses for subsequent study of infection pathogens, and from the serological group of the disinfection laboratory. It was initially headed by Sima Lvovna Borodko, succeeded by Anatoly Vasilevich Lipnitsky, who completed graduate studies and defended a dissertation under Moisey Iosifovich Levi at the Rostov-on-Don AP Institute.

Lipnitsky is one of Levi's talented pupils. His developments in immunology and diagnostics are widely acknowledged by specialists. He defended a doctor of medical sciences dissertation. For many years, now Professor Lipnitsky has been deputy scientific director and is an honored scientist of the Russian Federation.

The laboratory staff began working on immunology and the development of diagnostic preparations and soon obtained positive results. For example, diagnostic erythrocyte antigens for deep mycoses are highly sensitive when used in passive hemagglutination for detecting antibodies in experimentally infected animals, and the antibody neutralization reaction can be used for specific detection of fungi. The results of this research were generalized by Yevgeniya Romanovna Valkova in her candidate's dissertation, which she successfully defended. She headed the laboratory of experimental animals. Later, Natalya Petrovna Khrapova was able to use fractionation to obtain different classes of immunoglobulins of hyperimmune IgM sera, which were adsorbed onto formalinized sheep erythrocytes. The resulting *Coccidioides* immunoglobulin as a component of a new diagnostic preparation is highly specific. Khrapova defended her candidate's dissertation and later, after expanding and deepening this research, her doctoral dissertation. She became director of one of the institute's laboratories.

Fluorescent antibodies constructed by N.S. Surnina and N.N. Vysochinskaya and an enzyme immunoassay test system invented by N.P. Khrapova and S.F. Zharkova were developed for diagnosing deep mycoses. This research was generalized in the candidate's dissertations of N.S. Surnina and S.F. Zharkova. N.S. Surnina headed the live cultures museum and did much to build the rich collections of deep mycosis, glanders, and melioidosis pathogens and to expand the collections of plague, cholera, anthrax, and other pathogens.

In the late 1960s and in the 1970s, attempts were made by S.L. Borodko, E.M. Beburishvili, and E.I. Prokofyeva to develop vaccines; so, new antibiotics were evaluated experimentally by L.N. Zelenskaya. One of the institute's successes was the development of a live vaccine based on a mutant of *C. immitis* with greatly reduced virulence and deficient in *p*-aminobenzoic acid. Research conducted by E.I. Prokofyeva and V.S. Lesovoy showed that mice acquired a high degree of resistance to virulent strains of this fungus.

[…]

The detection laboratory, headed by Professor Leonid Fedorovich Zykin, made an important contribution to the institute's work. Much could be said here about this laboratory, but Zykin has already done this in the wonderful article "Volgograd AP Institute: From Sunrise to Sunset" (L.F. Zykin, 1998). It should be noted here that Zykin generated the ideas and organized the work, and personally made an important contribution to the development of scientific research and also to the training of skilled scientists. His students A.T. Yakovlev, V.S. Rybkin, and V.V. Alekseev defended doctoral dissertations and two of them were promoted to the positions of deputy director (Rybkin and Alekseev) and one became a laboratory director

(Dunaev). Anatoly Trofimovich Yakovlev heads the clinical-diagnostic laboratory of Volgograd Cardiology Center, which serves the population of the lower Volga region. After meeting the administration of the center and visiting the laboratories, Valkov was convinced that Yakovlev enjoys well-deserved recognition and authority. V.V. Alekseev headed the aerosol laboratory and did much to develop the scientific content on this topic.

To be fair, it must be said that Vladislav Mikhaylovich Svistunov, working in the disinfection laboratory, did more than anyone to establish the aerosol laboratory. His designs were used to build the aerosol chambers and to develop the methods and procedures that were subsequently used to carry out methodologically sophisticated scientific research.

The staff members working with glanders and melioidosis were pioneers in various fields of scientific research. The glanders and melioidosis laboratory in the USSR MOH Main Administration of Quarantine Infections system was established in 1960 at Rostov AP Institute, where the first collection of typical strains of glanders and melioidosis pathogens (nine and 18 cultures, respectively) was established, and where the methodological procedures for experimental research were developed. The results of these experiments were generalized in 1970 in the monograph "Melioidosis" edited by V.T. Shiryaev and in the laboratory manual for diagnosing high-risk infections written by L.B. Adimov.

In late 1971, it was decided to transfer the glanders and melioidosis laboratory from the Rostov AP Institute to Volgograd. The initial laboratory staff consisted of the standard minimum: six scientists (including the director), six laboratory workers, and two service staff. Laboratory director L.Ya. Ryapis and senior scientist V.I. Ilyukhin were transferred from the Rostov AP Institute in 1972. The other staff members were selected mainly on a competitive basis from graduates of the local medical institute and employees of the AP stations and included N.S. Sycheva, A.M. Barkov, V.P. Batmanov, N.N. Piven, and others.

The subject matter during those years was "inherited" from Rostov AP Institute: treatment (antibiotic therapy) and laboratory diagnosis (erythrocyte diagnostic preparations). During the first two to three years, the laboratory operated jointly with three Rostov personnel, G.M. Orlova, L.B. Adimov, and I.I. Polyakov, who periodically came to Volgograd for extended stays to set up joint experiments. Eventually, the research work naturally separated from the Rostov AP Institute, and also expanded considerably in its range of topics as a result of contract work. In the mid-1970s, the staff size was increased, and many of these personnel were immediately sent to Pushchino for eight-month courses on molecular biology. The enhanced training of scientific staff was accompanied by an improvement of the equipment and supplies (for example, new equipment and reagents for ultracentrifuging, electrophoresis, gel filtration, etc.).

In 1979, L.Ya. Ryapis transferred to Moscow (he currently is working at the Sechenov Medical Academy), after having prepared sufficient materials at Rostov and Volgograd for his doctoral dissertation. After his departure, V.I. Ilyukhin was named director. During these years, the

laboratory continued to grow, both in number of staff and in space occupied. Particular attention was given to genetics and molecular biology. This direction in the laboratory was fostered by senior scientist D.K. Merinova. By the mid-1980s, the laboratory reached its maximum number of staff: the director (doctor of medical sciences), five senior scientists, and 16 scientists. By that time most of the staff had completed candidate's dissertations based on research results at the laboratory.

During this time, the laboratory achieved its greatest successes. Practically all the instructional-methodological documentation approved by the USSR MOH on the treatment, diagnosis, and prevention of glanders and melioidosis was prepared by laboratory staff members V.I. Ilyukhin, V.S. Zamaraev, N.N. Piven, and others and was published as separate brochures or as chapters and sections in manuals on the laboratory diagnosis of high-risk infections. The monograph "Pseudomonads and Pseudomonoses" authored by V.D. Belyakov, L.Ya. Ryapis, and V.I. Ilyukhin was published by Medgiz in 1990, and the "Melioidosis" bibliographic index was published. In the course of genetic research, L.Ya. Ryapis, L.K. Merinova, I.P. Ageeva, and others established a collection of mutants needed for investigating gene exchange systems and decoding pathogenicity factors of the glanders and melioidosis pathogens. The plasmids of *P. pseudomallei* were identified by M.I. Petere and V.A. Antonov. Advanced research methodology developed by M.A. Anishchenko, L.K. Merinova, and V.S. Zamaraev made it possible to begin experiments on genetic engineering in order to obtain a recombinant vaccine and identify the role of individual antigens and enzymes in the manifestation of pathogenicity. Extensive research on immunity by V.I. Ilyukhin and S.M. Farber showed the promise of using *F. tularensis 15* as a potential factor for making recombinant vaccines against glanders and melioidosis.

However, in 1988, on the initiative of the administration and the party bureau, the laboratory was divided into three independent subdivisions (separate laboratories for glanders and melioidosis, as well as a molecular biology and genetics laboratory).

At various times, laboratory staff traveled to conduct research and participate in scientific conferences in Vietnam, Mongolia, Thailand, England, and Netherlands. Reports of the isolation of glanders and melioidosis pathogens in Mongolia and Iran served as the basis for repeated expeditionary trips to border areas. A number of Mongolian horses delivered to the Ulan-Ude meatpacking plant were tested for diagnostic titers of antibodies in passive hemagglutination, and a culture of *B. mallei* was isolated from one of them. Cultures of so-called *B. pseudomallei*-like spp. were found in Lenkoran district. Interactions and correspondence with foreign colleagues resulted in a great increase in the volume and representativeness of the collection of *Burkholderia* strains, the total number of which has reached hundreds of cultures from different regions of Asia, Australia, and Africa.

[…]

Much more could be written about the people, the scientific achievements, and the difficult years

that our science and our country are undergoing, but I hope this will be the subject of studies by other researchers who worked during later years. Here it should be noted that within five years of its founding, the institute was a solid scientific establishment that solved many problems and is capable of solving even more difficult tasks in the future, especially in the areas of deep mycoses, glanders and melioidosis, and disinfection and detection of high-risk infections.

Reminiscences and Thoughts About a Teacher, Colleagues, and Work in the AP System

Yury Vladimirovich Kanatov (pp. 40-60). One photograph (portrait of author).

This chapter recalls episodes from the author's collaboration with M.I. Levi and others to develop a serological test for detecting plague. It describes people that facilitated the successful development, commercialization, and implementation of the technique. It also discusses implications for several practical and research applications.

Biotechnological Improvements in EV Plague Vaccine Preparation at the Stavropol AP Institute

Aleksandr Iosifovich Tinker (pp. 61-102). Seven figures, 12 tables, 42 references.

This scientific chapter describes the development and production of plague vaccines at AP facilities, activities that were significantly increased in the second half of the twentieth century. It specifies the scientific and technical accomplishments at Stavropol, which contributed to the development, production, and further improvement of the vaccine.[138]

Although vaccine production at the Stavropol AP Institute was smaller than at the Central Asian Institute, Mikrob, and Irkutsk Institute, at least one quarter of the Stavropol staff was involved in production and improvement of the EV vaccine for plague. 20 percent of the dissertations by Stavropol staff and 400 other publications from Stavropol focused on EV plague vaccine.

Excerpt:

> EV vaccine production began in 1958 using manual techniques. Modern production equipment was installed from 1960 to 1964 when the entire first floor of the Institute's new building

[138] Antibiotic-resistant strains of *Y. pestis* EV were developed at the Rostov-on-Don AP Institute in the early 1960s. The development of live vaccines constituted by antibiotic-resistant *Y. pestis* EV strains was a research priority in the Soviet Union because this vaccine was administered to persons who had been exposed to virulent *Y. pestis*. If the live EV vaccine was not antibiotic resistant, antibiotics administered to exposed persons would kill both the pathogen and the EV vaccine strain. See Anthony Rimmington, "The Soviet Union's Offensive Program: The Implications for Contemporary Arms Control," in Susan Wright, ed., *Biological Warfare and Disarmament: New Problems/New Perspectives*, edited by Susan Wright, (Lanham: Rowman and Littlefield Publishers, 2002), pp. 103-50.

became devoted to manufacturing. Various technological improvements have been made since then. Annual production of the EV vaccine is now 22 million doses per year, much of which is exported to many countries.[139]

Т.М. Дробышева (н.с.), **З.П. Глушкова** (лаборант), **Т.И. Анисимова** (зав. лаб.).

T.M. Drobysheva (scientist), Z.P. Glushkova (laboratory assistant), T.I. Anisimova (laboratory head).

Reminiscences About Plagueologists

Tamara Ivanovna Anisimova (pp. 103-10)

This chapter contains biographical sketches of several of the author's colleagues from her career in the AP system, which began in 1953. It includes biosketches of Klavdiya Aleksandrovna Kuznetsova, Vladimir Ivanovich Gorokhov, Vladimir Nikolaevich Fedorov, Moisey Fishelevich Shmutter, Vladimir Stepanovich Petrov, Rakhim Kuandynovich Tleugabylov, and Galina Nikolaevna Lenskaya.

Reminiscences About Boris Mikhaylovich Kasatkin

Mark Andreevich Dubyansky (pp. 111-31)

This chapter is a biographical sketch of B.M. Kasatkin, a mentor to the author for over 10 years. It describes Kasatkin's significant contributions to methods of environmental plague elimination and to mathematical techniques in epizootiology.

Kasatkin was a talented ecologist, epizootiologist, inventor, builder, and hands-on technician, but also a theoretician, practitioner, and strategist. He foresaw useful approaches using statistical methods and modeling, though he did not publish these ideas. Dubyansky describes his professional experiences with Kasatkin, including an incident when Dubyansky left a remote field camp alone to go hiking without authorization. Kasatkin could have fired him for this, but he was transferred to a more suitable position, instead.

Dubyansky also recounts a violent encounter with an itinerant construction worker at a remote field station. The editor notes that it was not unusual that AP field staff had to deal with unruly or violent seasonal workers during operations in remote areas.

[139] To this day, the EV plague vaccine has never found favor in any Western industrialized nation.

Susceptibility of Animals to Plague Infection: Methodological Recommendations for Determining Differences Among Animal Individuals, Populations, and Species in their Susceptibility to Plague Infection

A.I. Dyatlov (pp. 132-42)

This scientific chapter describes an experimental methodology for determining the median lethal dose (LD_{50}) of plague pathogen in comparative studies of animal populations. It describes a method of mapping the population of a study area in order to identify isolated sub-populations. The author specifies experimental variables considered in the methodology, including time animal subjects spend in captivity, the standard dose of the pathogen administered, and accepted levels of statistical significance for distinguishing between populations.

In the 'Kitchen' for Development of a Screening Test To Identify Opiate Users by Detecting Antibodies to Morphine Using a Solid-Phase Enzyme Immunoassay with β-Lactamase

Natalya Borisovna Gamaleya (pp. 143-52)

This scientific chapter explains the development of an opiate user screening test. It describes M.I. Levi's suggestion to use β-lactamase to identify relevant antibodies as a crucial contribution to the successful development of the materials and procedures for the new screening test, which was approved for clinical use in Russia in 1992.

Brief Sketch of the Crimea AP Station

Aleksandr Borisovich Khaytovich and Valery Antonovich Shikulov (pp. 153-56)

This chapter recounts the history of the Crimea AP Station. It describes the evolution of the station's organizational structure, the station's personnel, and its contributions to research on plague.

The Crimea AP Station was established in 1970 in response to a cholera outbreak in Ukraine. It is located at Maryino, on the outskirts of Simferopol, and was initially staffed by local personnel from regional and municipal sanitary-epidemiological stations in Crimea. Its activities have included control of quarantine and viral infections, surveillance of ports, and mapping of natural foci of various diseases. As of 2001, the station was the only institution of its type in Ukraine.[140]

[140] Today, Ukraine's relatively small AP infrastructure consists of one AP institute in Odessa and the Crimean AP Station. Although small, it is an important part of the public health sector in the country. "The Crimean AP Station

Full translation:

> The Crimea AP Station was founded in late 1970 in response to cholera epidemics in Ukraine. The station's mission was to provide advice, develop standard procedures, and carry out specialized work on reportable diseases.
>
> The first director of the Crimea AP Station was Galina Fedorovna Mitsevich, the long-time director of the Crimea Region Sanitary-Epidemiological Station. As an experienced leader of sanitary services, Ms. Mitsevich was well respected by specialists from the USSR MOH Main Administration of Quarantine Infections, the Ukraine MOH Main Sanitary-Epidemiological Administration, and the leadership of the Rostov-on-Don AP Institute. In the 30 years since then, the Crimea AP Station has been a respected organization within the state AP system.
>
> Three sites were considered for the station. Sevastopol and Lozovoe, five kilometers from Simferopol, were passed over in favor of Maryino, a suburb of Simferopol. In addition to the existing one-story stone building on the site, the staff built a new laboratory wing, an infectious material facility, and other working areas.
>
> A top priority was to assemble a skilled, capable staff. The station hired a number of young employees from the regional and municipal sanitary-epidemiological stations in Crimea. They included physicians T.F. Zakharova, Z.I. Shabanova, G.A. Smirnova, I.S. Shestialtynova, A.A. Gurov, L.N. Alyanaki, P.O. Katsyuk, and Yu.I. Podkorytov. They represented a variety of professions, including epidemiologist, bacteriologist, and sanitary physician, but none of them had experience with high-risk infections, although they all eventually were certified in that specialty. The staff also included experienced specialists. Gedaly Moiseevich Golkovsky was a prominent plague specialist and director of the bacteriology laboratory at Guryev AP Station and Larisa Yuryevna Ziskind came from the Belarus Republic Sanitary-Epidemiological Station. Epidemiologist Valery Antonovich Shikulov had long experience working in tularemia, anthrax, and brucellosis foci and was an expert in sanitary field work. Zoologists Pavel Grigorevich Korchevsky and Valentina Alekseevna Korchevskaya had been at Aralsk AP Station. Later additions to the staff included Svetlana Georgievna Sedina and Viktor Ivanovich Sedin (zoologist) from the Dagestan AP Station, Aleksandr Borisovich Khaytovich from the Borzya Division of Chita AP Station, and Lyudmila Mikhaylovna Bogatyreva from the Taldy-Kurgan AP Station.

currently provides health-care institutions with advisory, methodological, and practical assistance concerning border controls, prevention, and control of quarantine and other high-risk infectious diseases. Furthermore, it appears that the Crimean AP Station simultaneously serves as the Republic AP Station for the Autonomous Republic of Crimea." See Sonia Ben Ouagrham-Gormley, Alexander Melikishvili, and Raymond A. Zilinskas, "The Anti-Plague System of Ukraine," in Sonia Ben Ouagrham-Gormley, Alexander Melikishvili, and Raymond A. Zilinskas, *The AP System in the Newly Independent States, 1992 and Onwards: Assessing Proliferation Risks and Potential for Enhanced Public Health in Central Asia and the Caucasus*, James Martin Center for Nonproliferation Studies 2008, <http://cns.miis.edu/antiplague / pdfs/080103_part2_ch09.pdf>.

By 1976, the station was working in eight regions of eastern Ukraine and in the seaports of Berdyansk, Mariupol, and Kherson. A new branch of preventive medicine at that time was border sanitation to prevent the importation and spread of quarantine diseases. This work, which included developing plans for epidemiological surveillance and helping medical institutions prepare for epidemics, became the major occupation of the AP station. By the 1980s, the station had begun monitoring natural focal bacterial infections such as tularemia, anthrax, leptospirosis, brucellosis, and yersiniosis. In 1986, the station opened a virology laboratory to study natural focal infections such as tick-borne encephalitis, Crimean-Congo hemorrhagic fever, hemorrhagic fever with renal syndrome, and West Nile fever.

Physicians from the AP station have inspected municipal and district medical facilities in nearly every region of Ukraine to verify preparedness for quarantine infections. Top specialists from the station were invited by the USSR MOH to help develop informational materials for all-union and republic emergency anti-epidemic commissions, medical colleges, and sanitary-epidemiological councils. In this work, they collaborated with specialists from many cities in Russia, including Nizhny Novgorod, Kaliningrad, Lipetsk, Murmansk, Rostov-on-Don, Chita, Krasnodar, and Elista, as well as cities in former Soviet republics that are now independent states, including Baku (Azerbaijan), Yerevan and Spitak (Armenia), Tbilisi (Georgia), Almaty, Aralsk, and Kyzyl-Orda (Kazakhstan), Tashkent, Andizhan, and Termez (Uzbekistan), Minsk (Belarus), Vilnius (Lithuania), and Riga (Latvia).

The Crimea AP Station has become an important center for methodology work. The staff developed procedures for laboratory diagnosis, epidemiology, and prevention of high-risk infectious diseases of concern to the nation and the Ukraine republic.

Research at the station has resulted in a number of innovations. Researchers discovered five phages that lyse cholera non-01 serogroup vibrios. Staff members were the first in Crimea to isolate halophilic and other rare vibrio species, *Yersinia enterocolitica*, and the pseudotuberculosis pathogen from humans and the environment. They discovered and mapped natural foci of tularemia, leptospirosis, intestinal yersiniosis, and the viral infections of tick-borne encephalitis, Crimean-Congo hemorrhagic fever, and hemorrhagic fever with renal syndrome.

Staff members have presented over 300 reports to international, all-union, and republic congresses, symposia, and conferences, published over 230 scientific papers in various journals, and defended one doctoral dissertation and four candidate dissertations.

The station was reorganized as an AP division on two occasions, and was even shut down for a time.

Since 1991, the Crimea AP Station has been a part of the Ukraine MOH. As a result of Ukraine's serious economic difficulties, the station has been downsized. The virology laboratory was

closed and some experienced senior staff departed. In 1997, Aleksandr Khaytovich, a doctor of medical sciences and professor at Crimea State Medical University, became director of the station and reasserted its reputation in Ukraine.

In 2001, the station celebrated its 30th anniversary. Attending the ceremonies were the chairman of the Presidium of the Supreme Council of Crimea Autonomous Republic, representatives of the Ukraine President in Crimea Autonomous Republic, representatives of the Ukraine and Crimea Ministries of Health, the Chief State Sanitary Physician of Crimea, and directors of various government agencies. The program honored the important achievements made by the station. Twenty staff members received recognition and awards from the Supreme Assembly of Crimea Autonomous Republic, the Council of Ministers of Crimea Autonomous Republic, and the Ukraine and Crimea Ministries of Health. The Presidium of the Supreme Council of Crimea Autonomous Republic awarded the title of "Honored Physician of Crimea Autonomous Republic" to station director Doctor Khaytovich, physician-virologist V. A. Shikulov, and bacteriology laboratory director Yu. A. Ilich. The title of "Honored Medical Worker of Crimea Autonomous Republic" was awarded to bacteriology laboratory worker T. F. Pekker.

The Crimea AP Station is currently the only practicing institution of its kind in the Crimea. The station's specialists provide health-care institutions with advisory, methodological, and practical assistance concerning border controls, prevention, and control of quarantine and other high-risk infectious diseases.

Reminiscences of Georgy Petrovich Gamleshko

G.I. Vasilyeva (pp. 157-61)

This chapter contains a biographical sketch of G.P. Gamleshko, a plague expert who worked in both the AP system and in the USSR Ministry of Defense Military Medical Institute.

Professor Gamleshko is remembered as a versatile scientist, an excellent mentor, and an insightful colleague. Orphaned at an early age, he graduated from Kuban Medical Institute in 1954 and then began graduate studies in microbiology. He entered the AP system at Rostov AP Institute in 1965 as senior scientist, and then was appointed director of the department of immunology and nonspecific prevention of plague. He has authored seven patents and 150 scientific publications.

For many years, Gamleshko worked on a new live plague vaccine with a special property useful for twenty-first-century bioterrorism threats. He conducted joint research with the USSR Ministry of Defense Military Medical Institute, the aim of which was to protect troops from epidemic diseases.

Results of Contest for Best Essay and Best Scientific Article Published in Volume 11 of "Interesting Stories About the Activities and People of the AP System of Russia and the Soviet Union"

Yury Grigorevich Suchkov (pp. 162-63)

This section honors M.I. Levi (posthumous) for his article "Progress Toward Controlled Antibiotic Therapy of Patients with Purulent Septic Infections" in Volume 11.[141] *It includes a congratulatory letter from Irkutsk AP Institute of Siberia and the Far East, noting that the institute has published two historical monographs and has established a museum that has exhibits on the history of the Irkutsk Institute.*

List of Scientific and Methodological Works of Anatoly Ivanovich Goncharov

(pp. 164-99)

This chapter contains a bibliography of A.I. Goncharov that features a listing of 204 works published between 1963 and 2001.

Forgotten Photographs

Yury Grigorevich Suchkov (pp. 200-50)

This section contains 46 photographs that depict groups, individual portraits, and scenes of laboratory and field work.

[141] *Interesting Stories...* 11 (2001), pp. 44-72.

Part II: The Anti-Plague System in Russian and Western Media

The Plague

Taisiya Belousova
Sovershenno Sekretno (1998, 10), (pp.18-19)

Just as they did decades ago, they are hiding the sources of this frightening disease. The plague continues to threaten the Russian people.

Plague epizootics, 1951-1952, in Dagestan Autonomous Soviet Socialist Republic, indicated by black triangles

Background Information: "A natural source of plague" is defined as an area where plague-infected rodents are found. Plague is transferred from rodents to humans and camels through flea vectors. In the Commonwealth of Independent States (CIS),[142] there are natural sources of plague located in Central Asia, Kazakhstan, and Transcaucasus. In Russia, these areas include Transbaikalia, Altai, Dagestan, Chechnya, Kabardino-Balkaria, Kalmykia, the eastern regions of Stavropol Territory, Astrakhan Oblast, and along the borders of Kazakhstan, Mongolia, and China. All together, they [natural plague foci] make up some two million square kilometers.

Two clinical manifestations of plague exist: bubonic and pneumonic. The first can be caught from a flea bite. The

[142] CIS was a regional organization comprised of nations that once constituted the states of the Soviet Union.

second is a complication of bubonic plague. Pneumonic plague is passed on like the flu and is lethal in all cases. If, during the two days following the initial infection, the patient is correctly diagnosed as suffering from bubonic plague, there is hope for a recovery. If the diagnosis comes later, the patient will die from high toxin levels. When active antibiotics are administered, the toxic microbes die, secreting the toxins into the patient's body. Pneumonic plague can be fatal on the second day after infection. More often than not, patients die because most local doctors cannot accurately diagnose plague and tend to pass it off as the flu, meningitis, or pneumonia.

"Until the twentieth Congress of the CPSU [Communist Party of the Soviet Union]," G.D. Ostrovsky, the former chief of the Highly Infectious Diseases Division of *Minzdrav* [Soviet MOH], recalls, "information about endemic infectious diseases was not reported and never found its way into the scientific press, which gave no opportunities to assess the true extent of illness. The totalitarian state was concerned about its respectable image. After 1956, it permitted the publication of information on the infection of rodents and fleas with plague, but, however, the reports were stamped: 'for internal use only.' Meanwhile, *Minzdrav* informed the World Health Organization (WHO) that there were no reported cases of humans being infected with plague... By so doing, it created a feeling that plague had been eradicated (in the Soviet Union]."

While the CPSU was pulling the wool over the WHO's eyes, doctors battled with several plague epidemics. Let us name just a few: Moscow, 1939; the Southern Volga-Ural Region 1945, Central Asia 1945; Caspian Sea Region-Turkmenia 1946; Astrakhan Oblast in Kazakhstan, 1947-48; Turkmenia, 1949; Central Asia, 1953, 1955, and 1958; Mount Elbrus region, 1970; Kalmykiya, 1972; Dagestan, 1975; Kalmykiya, 1979; Caspian Sea Region, 1980; Uzbekistan and Kazakhstan, 1981.

Between 1920 and 1989, 3,639 people contracted plague, of whom 2,060 died. Although hundreds died before World War II, beginning in the mid-1940s, when patients began to be treated with sulfa drugs, anti-plague serum, and methylene blue, the number of deaths was reduced to the dozens. Then in 1950, with the advent of streptomycin, plague casualties were numbered in single digits. The casualties from the plague epidemics would have been much higher if it had not been for the work of the members of the AP service, the activities of which were always classified. The plague doctors were prohibited from speaking about their work even with their relatives. In the 1960s and 1970s, any violation of the nondisclosure order was punished by immediate dismissal. Frequently, the specialists only discovered their destination and purpose for travel once they reached the airport.

[Begin article text]

> L.A. Melnikov, a former staff member at Mikrob in Saratov, recalls the working conditions during an epidemic in Turkmenistan: "Kyzyl-Arbat was surrounded by soldiers. The troops were armed with rifles and patrolled all around in groups of two or three, cutting off all roads and trails. Many of them wore cotton and gauze surgical masks covering their mouth and nose. We would drive along completely deserted streets past small houses with their doors and shutters closed tight. The administrative offices, stores, post office, and police station were all

closed. With difficulty, we were able to find a few scared members of the local city council and communist party workers. They told us that the plague had practically paralyzed the small town. No one dared leave his home for fear of being infected with the plague.

"The day after our epidemiological team arrived, we received word that some people were dead and others dying from plague in one mountain village. About a kilometer from the village, soldiers had cordoned off the area. Two solitary black yurts stood amidst the steppe. Two military doctors—officers —walked up to us. They told us that, according to their information, six people had died in the village. A few women and children had fled and were still unaccounted for. No one had any doubt—it was the plague. However, the diagnosis had to be backed up with bacteriological tests and autopsies.

"Armed with surgical instruments, canisters full of disinfectant, and other necessary tools, we slowly worked our way across the burning-hot soil to the infected village. Our clothes included overalls, two lab coats worn one over the other, a white kerchief, a surgical cap, a thick cotton and gauze surgical mask, protective goggles that were similar to what a motorcyclist would use, rubber boots, oilskin apron, and two pairs of rubber gloves. With all that gear on, we looked more like cosmonauts than doctors, clumsily working our way across the moon's surface. The sun beat down on us unforgivingly and the sweat poured off us, pooling in our rubber boots.

"We pulled the door curtain away from the yurt and looked inside. What lay before our eyes was a horrible sight. Corpses of men and women lay strewn across their felt bedding and the dirt floor. Their faces had been deformed by the plague, and their skin looked black. The smell of rotting flesh penetrated even our thick surgical masks. We made a superficial assessment and description of the dead. Then we dragged the bodies out of the yurt and performed autopsies... After we doused the yurt and clothing in Lysol, we sprinkled insecticide on the bedding and carpets to kill the fleas and then covered the bodies in lime. When we returned to the camp, I couldn't resist the temptation to immediately look under the microscope at the smears taken on site. I was amazed. It looked as if all of the tissue of the victim was made up of plague bacilli.

"The next morning, half of our team was busy with the unenviable but necessary task of burning the plague victims' bodies. In the middle of a treeless desert, that task was far from easy. Several trucks from the army division brought firewood from some far-off place, others brought saksaul wood collected in the area. The huge bonfires burned all day. When we ran out of firewood, we discovered that the bodies had not been completely incinerated. As evening approached, a tanker truck loaded with oil arrived. The soldiers pointed the thick hoses at the smoldering fires, and the flames lit up again with renewed intensity.

"The suffering and frightened relatives and neighbors of the plague victims scattered in a panic from the source of the infection. They knew that people would be looking for them and consequently used every trick in the book to escape being put in quarantine. The search for those who had come in contact with the victims at times was similar to a detective story complete with high-speed chases and arrests.

"I was given infected camels as patients. One time, we were successful in isolating the plague bacterium. We had trudged along for hours in deep sand to where the camel had fallen. By that time, the animal's putrefied body had bloated and looked like a sphere. When we opened the body to start the autopsy, we were literally bathed from head to toe in a horrid-smelling liquid that came from the camel's belly. My entire AP suit was soaked and I almost fainted. Somehow we were able to extract the internal organs to perform a biopsy. After that, we spent quite some time bathing and disinfecting ourselves. The risk of contracting plague was huge. Those events took place in 1949, but the plague remains just as ugly today as it was back then."

"If the plague doctor had even the slightest doubt, right then and there effective measures were taken," professor Yu.G. Suchkov explained, "We often received information about the plague from state security channels. The KGB was also on the lookout for people who had come in contact with the bacteria throughout the country. Of course, the KGB agents had one question on their mind: 'is this some sort of sabotage?' But no one imported the plague in test tubes, our own was more than enough."

The state security agencies were especially concerned when the plague found its way to Moscow. It happened in December 1939. The deputy director of science of Mikrob in Saratov, A.L. Berlin, had accidentally been infected with plague while testing a new AP vaccine. Berlin, unaware of his illness, arrived at the capital to present a paper at Narkomzrav [renamed *Minzdrav* or Ministry of Public Health] in 1946 and checked into the Metropol Hotel. He collapsed the next day. Three days later, Berlin, a barber who had given him a shave, and two doctors who had treated him at the Infectious Diseases Hospital on Sokol Hill were dead. The news about the plague found its way to the Central Committee. A great commotion ensued: a few steps from the Kremlin, from dear Comrade Stalin, from the Soviet Government, the "Black Death" loomed. The best specialists arrived by airplane from Rostov-on-Don. A plague hospital was hastily established, where everyone who had come in contact with Berlin as well as anyone suffering from pneumonia was quarantined. The coroners performed autopsies on the victims' bodies. Meanwhile, the hotel and the offices of *Narkomzdrav* were disinfected. Those in power were so worried that foreigners would discover the news about the plague that all of the work was done under the careful control of the NKVD, in strict secrecy at night. The epidemic was isolated and stopped. After that incident, any work on the plague [bacillus] was prohibited in Moscow.

Since the 1920s, Soviet specialists have repeatedly battled the plague in Mongolia, China, Korea, Afghanistan, and Vietnam. In spite of the security at the Soviet scientific research institutes that worked with highly virulent infectious agents, in the West they knew of our scientists' work and held it in high regard.

During World War II, the arrival of Soviet plague researchers on different fronts at times led to unexpected consequences. In the summer of 1942, I.I. Rogozin, the head of the Anti-epidemic Directorate of Narkomzdrav, arrived in Astrakhan to coordinate the efforts to stop a tularemia

outbreak among the troops. His driver, who up until the war had worked at the Stavropol AP Institute, requested that he be granted leave to return to Stavropol to evacuate his family. However, he was unable to escape Stavropol because the Germans had overrun the city. The Germans took a quick interest in the automobile with Moscow plates and interrogated the driver. The driver told them that he had taken Rogozin to Astrakhan. The information quickly found its way to a group of high-ranking fascist physicians. They were aghast. Rogozin was known for his work in the field of plague prophylaxis and therefore it was quite possible that a plague epidemic was raging in southern Russia. Immediately, all of the personnel from the

Tent hospital for plague patients, Mongolian People's Republic, 1948.

German formations headed toward southern Russia were vaccinated for plague, which caused a panic among the fascists. Our secret agents, who obtained documents on the immunization, passed them on to military command. Then, Soviet doctors, who feared that the Germans might be using biological weapons, ordered the vaccination of the Red Army.

In the history of the Soviet AP system, incidents abound that were once inappropriate to discuss. Professor M.I. Levi recalls how during the War on Cosmopolitanism, Soviet security agencies "ethnically cleansed" the AP system.[143] Many talented Jewish specialists were fired, including I.I. Rogozin.

[143] The "War on Cosmopolitanism" started approximately 1948 and aimed to eliminate persons with foreign connections and Jewish heritage.

One other incident: in the 1960s, the Central Asian republics repeatedly tried to pull a fast one on Moscow. As former chief of the Plague Prophylaxis Division of the Soviet MOH, K.A. Kuznetsova recalls, "the local administrative and party organizations and even local ministries of health tried to hide cases of illness for a number of reasons. First, they didn't understand the seriousness of the possible consequences. Second, they held the skewed idea that the republics would 'look' worse than the others, where 'unpleasant' diseases didn't exist."

"From 1966 to 1969, the Uzbek MOH did everything in its power to keep me from informing Moscow of some cases of cholera in Tashkent and other areas, something I was required to do," plague specialist A.I. Dyatlov recalls. "They called me in to the Council of Ministers, pleaded with me, and then threatened me. The issue went all the way to Sh.R. Rashidov [the First Secretary of the Uzbek SSR], whom I spoke with by telephone from some minister's office, where I was admonishingly told that this was our internal affair. I agreed, but the information was sent to Moscow immediately anyway." This kind of obstinance [sic] led to the promotion to the leading positions at the AP stations of local yokels who had connections within the AP system, under the pretext that "local personnel should be promoted to the positions they deserve." It didn't matter that these "specialists" knew absolutely nothing about the plague; at least they were obedient.

The desire to "look good" was still alive and well among the Uzbek leadership 20 years later. In 1981, the plague brought Kyzyl Kum to its knees. And in the town of Uchkuduk, made famous by a well-known song about three wells, children were dying from plague.[144] While the Government of the Uzbek SSR was busy thinking of a way to punish the doctor's assistant who brought them the horrible news about the plague (right out of the dark ages is it not?), and looking for "those responsible" for causing the epidemic, the AP services of the Uzbek SSR and the Kazakh SSR were busy flushing out and destroying the infected rodents, establishing a safety perimeter around living quarters, vaccinating the population, and teaching the people how to protect themselves. Even so, it took Kuznetsova a long time to convince the local authorities not to punish "those responsible."

"Although the [AP] service had been formed to fight the plague, it was forced to battle other highly virulent infections like cholera, anthrax, brucellosis, and tularemia," professor Suchkov explains. "If you believe the official statistics, until 1965, cholera didn't exist in the Soviet Union. (Information about an outbreak of cholera in Stalingrad in 1942 and 1943 was classified. Back then, the cholera outbreak was blamed on the Germans. Granted, experienced physicians knew that was nonsense, since there were no cholera victims among the Germans.) In 1965, cholera epidemics simultaneously began in Afghanistan and the Uzbek SSR—560 people fell ill in Kara Kalpakiya alone. When the local doctors were asked to lend a hand in battling the cholera outbreak, they told the plague specialists: you are the specialists, so get to work, we

[144] Yalla, a pop group from the Uzbek SSR during the Soviet era, became famous after its song *Uch Kuduk* proved to be a bestseller.

were never taught how to treat it and we don't want to be infected. The local coroners flat-out refused to perform autopsies on the corpses of the cholera victims. So, the plague doctors were forced to fight the cholera outbreak on their own. It was a good thing the AP service had trained specialists that were versed in several fields. They could isolate the source of the epidemic, carry out laboratory tests, treat patients, and vaccinate. The republic's authorities sent 9,000 soldiers, police, and militiamen to guard the quarantined area. The epidemic was kept from spreading to the central regions of the republic. However, the epidemic was spread to Khorezma and other areas in Turkmeniya near Kara Kalpakiya by drug smugglers.

"At the onset of the epidemic, D.V. Zheglova, a doctor at the AP station in Turkmenistan, extracted El Tor cholera vibrios from the Kushki River. The cholera outbreak was proved to be from a local source. However, the Turkmen Sanitary Epidemiological Station was not about to accept this infamous discovery. The station's staff fabricated a number of reports on Zheglova, saying she had supposedly taken the cholera vibrio from a collection of live cultures from the AP station and contaminated the water of the Kushki River. Doctors accused her of sabotage and a criminal investigation was opened. A special commission studied the issues for over a month, but Zheglova was finally vindicated. Even so, the cholera outbreak in Kara Kalpakiya was declared to have originated in Afghanistan.

"In 1970, cholera epidemics simultaneously began in several areas—Odessa, Astrakhan, Volgograd, and Rostov-on-Don. In all of these areas, the El Tor strain of *Vibrio cholerae* had been isolated two to three years earlier and should have been reported to cholera experts. However, since no one had fallen ill with cholera, the vibrio was classified as 'cholera-like.' By 1971, the epidemic had reached dangerous proportions. *Minzdrav* was compelled to create a General Directorate for Infections Requiring Quarantine. The cholera outbreak in Dagestan in 1994-95 was said to have been caused by tourists who had been in Pakistan and pilgrims who had been in Saudi Arabia. Many of the researchers do not share the opinion that the disease was imported to Russia. I personally think that the cholera outbreak was caused by the El Tor strain that had been found time and again in Central Asia, Azerbaijan, Dagestan, Rostov, Donetsk, and even in the Moscow River. But if the El Tor strain is ruled the culprit, then you necessarily have to disinfect the reservoirs and irrigation canals and prohibit swimming, irrigation, and fishing. That is why it was more advantageous to declare that the cholera outbreak came from abroad. I will just add that today cholera, which is fatal in 40 percent of all cases, is no less a problem [in Russia] than the plague."

By 1991, a large AP system operated under the jurisdiction of the Main Quarantine Directorate of *Minzdrav*. Within the AP system, there were six sizeable centers (Saratov, Rostov-on-Don, Stavropol, Irkutsk, Volgograd, Alma-Ata), 21 AP stations, 52 divisions, and more than 200 epidemiological teams staffed with well educated, specially trained people. All of the AP divisions and epidemiological teams monitored the situation in areas where plague occurred naturally.

"In one government structure alone there were 10,000 smart, self-sacrificing, patriotic people," Levi recalls, "they were all directed by just three people, who knew all of their specialists

by name. Pastukhov, Ostrovsky, Kuznetsova didn't sit on their duffs in their offices, they traveled to each epidemic. It was a unique caste system with some elements of a democracy. And our group of specialists was very successful. We were even recognized by the United Nations. Sadly enough, because of the classified nature of our work, no one knows anything. Only recently have we begun to publish their memoirs in a compilation called 'Entertaining Essays About the Exploits and Experts of the AP System of Russia and the Soviet Union' [an alternate translation of the Interesting Stories… included in this publication; *Zanimatelnye ocherki o deyatelnosti i deyatelyakh protivochumnoy sistemy Rossii i Sovetskogo Soyuza*].

"As I read the memoirs of the veterans of the AP system, I did not cease to be amazed. Every day these people were working with some infection or another in the laboratory. A significant portion of their life was dedicated to catching plague-carrying fleas, mice, and marmots. For months at a time, they would work in areas affected by epidemics under horrible conditions. In Gadrut (Karabakh), for example, they had to guard the local cemetery and confiscate the plague-victims' bodies from the locals. Thinking that it would make them immune to the disease, the natives tried to eat the internal organs of the plague victims. In Bakanas (Kazakh SSR), the doctors went from door to door collecting the dead (a total of 250) and piled them up along the road. They performed the autopsies right there. And how about spending days in hospital wards that reeked of Lysol, where the floor and walls were covered with bloody sputum, where writhing patients could tear your mask or goggles off at any moment, infecting you with the plague. But in spite of all these horrors, difficulties, and burdens, most of the plague doctors love their profession and are proud of what they do. And thank God, these kinds of fanatics still exist. However, as the years go by, their number becomes smaller and smaller.

"After the disintegration of the Soviet Union, the AP system also began to fall apart. In the former Soviet republics, due to a lack of funding and transportation, the monitoring of disease and epidemics could not continue on the same scale as it once did. That means that, at any moment, people living in the areas where plague is endemic could become the next victims of a violent outbreak of pneumonic plague. In an automobile or on a train, the 'Black Death' could make it to Russia so fast it would make your head spin. In Russia, the AP system isn't in much better shape. Due to a lack of funding, there have been personnel cutbacks in several centers. They don't have the money to pay salaries, and employees have been sent on leave with no exact date to report back for work, which obviously has led to mass layoffs. The older generation is now retiring, and there is practically no young blood in the AP system.

"In 1995, the WHO warned us of a pneumonic plague outbreak in India. Back then in Moscow, quarantine wards were set up where anyone arriving from India was checked. And just what do you think is going to happen if there is an outbreak of pneumonic plague (God forbid!) in Chechnya, where there is neither an AP system or any doctors (or those that do exist can be counted on one hand). Only those who have been dedicated to fighting the plague for decades really understand what kind of a nightmare awaits us all.

"Two years ago in a letter sent to presidential aide A.Ya. Lifshits, several AP veterans explained in layman's terms what the lack of funding for the AP system would lead to. The situation did improve for a time, but then the money dried up once again. In 1997, the plague doctors could take it no longer so they wrote an open letter to *Minzdrav*. If the government cannot, as it once did, finance the AP service, then let us go through a sensible reorganization. Here is the plan to do it, where everything has been taken into account. The new service will be able to aid in disease control and protection in Russia and will do it on a budget no greater than in 1996. The letter was signed by the well-known scientist and academician, I.V. Domaradsky, professors M.I. Levi and Yu.G. Suchkov, Doctors of Science N.N. Basova, L.A. Ryapis, E.V. Rotshild, former directors of the Main Directorate of Quarantine Work and the Highly Infectious Diseases Division L.M. Marchuk, K.A. Kuznetsova, and G.D. Ostrovsky, long-time AP personnel R.S. Zotova, I.V. Khudyakov, and others. No one bothered to answer the letter."

(Letter reproduced as follows.)

Bureaucrats of every rank and file upon whom depends the future of the AP service! The control over the plague and other infectious diseases is being lost, not on a daily but an hourly basis. We do not know where or when the next epidemic will occur. In the areas where the plague is endemic, where AP centers are still open, specialists are constantly isolating the plague bacillus. AP vaccinations are carried out under the strict directions of those, and only those people who work in the dangerous areas. Moreover, the vaccine does not stop one from becoming infected, but rather only eases the disease. So, if the people catch the plague...it will be all over! By taking a look at the general conditions of the country's health care system, one can predict our future. If the AP service does not receive renewed support in the near future, the plague's revenge will be great. And it is altogether possible that, by 2000, Russians will begin to die off like wooly mammoths.

Bioterror: Who Will Protect Russia?

Taisiya Belousova
Sovershenno Sekretno (1999, 11), (pp. 16-17).

"The West is currently concerned with the problem of bioterrorism. The Americans believe that stolen, anthrax-filled weapons could be used by terrorists. During the Sverdlovsk accident in 1979, stricken residents of the military compound were saved by a 'vaccine for elites,' while ordinary citizens perished. The Soviet Union was preparing for bacteriological war. Scientists were probably trying to invent some kind of antidote for the general population, but no information about this has come out. Can you tell us what kind of help our people could count on in the event of a terrorist attack?"

N.S. Voropaev, Vyatka, Russia

No information about our scientists' work on the "fifth problem"—protecting troops and civilians against bacteriological and other weapons of mass destruction—has been published because this research is still classified. During the 1930s and 1940s, this research was done by military personnel in order to protect the people who were developing bacteriological weapons (BW). In the early 1950s, this work was re-assigned to civilians.

Naturally, the AP and virology institutes were given the leading role, since the main types of weapons being developed abroad were based on "native" pathogens of high-risk infections. This work was monitored by a special department of the 2nd Directorate, USSR MOH, which coordinated and organized the "fifth problem" program. The Directorate received assignments from the Ministry of Defense (for purposes of secrecy, all documents list the Civil Defense Staff as the ordering agency) and transmitted them to the institutes. The proposals were of a "voluntary-mandatory" nature. The military controlled the scientists through this Administration.

Members of Specialized Anti-Epidemic Brigade in training

Initially, this "fifth problem" work caused a lot of difficulties for the institutes. The deadlines were tight, and the work was done at the expense of basic research. In addition, the work was poorly funded. Another problem was that these ["fifth problem"] researchers were not allowed to travel abroad, so some "brave soldiers" began going to conferences in their place. Finally, S.G. Drozdov, director of the Institute of Poliomyelitis and Encephalitis, refused to work with the military, saying that his people had had enough of these restrictions (the institute produced vaccine in addition to conducting research). The institute refused to cooperate until the Ministry of Defense agreed that it would be better for the scientists to know about preventive efforts being undertaken abroad. Many "acquired" tighter security clearances. Before every trip abroad, academician V.M. Zhdanov, director of the Virology Institute [and former deputy minister of health], was exasperated by the minute scrutiny and endless instructions from KGB agents and 2nd Directorate bureaucrats. However, at one point Zhdanov decided to play a joke on his "handlers" and wrote in his report that capitalist countries were preparing for bacteriological warfare by infecting fleas with the flu virus. Since this document is still in the MOH archives, it was apparently taken seriously.

The AP institutes developed not only medicines, but also diagnostic procedures and methods for rapid detection of pathogens in the environment. They also tested new antibiotics and chemotherapy agents for the treatment and emergency prophylaxis of plague, anthrax, and tularemia. In 1970, the military thought that fungal infections and glanders might be used as BW agents. They were particularly

concerned about melioidosis, an exotic infection that had never been reported in the Soviet Union. The causative microbe lives and multiplies in soil, primarily in Southeast Asia. The disease is chronic, often fatal, and difficult to diagnose and treat, so it was thought that special precautions had to be taken when working with this microbe. The Volgograd AP Station was converted into an institute especially for this work. Eventually it was determined that melioidosis infection is much easier to achieve in the laboratory, and is not transmitted by human contact.

Academician I.V. Domaradsky wrote that: "The main task in developing bacteriological weapons and vaccines against them is to produce new strains and new cultures based on knowledge of the virulence and pathogenicity of bacteria, etc. The amount of such work done abroad, by the Americans, was always incredibly large. They were ahead of us. They spent huge amounts of money studying the factors that contribute to and control the pathogenicity of microbes and viruses, as well as developing methods for genetic engineering, artificial modification of bacterial characteristics, etc. Unlike us, the Americans didn't need to do any further specialized research. If they needed to, they could have made BW and vaccine strains very quickly. We had Lysenko, who set the country back many years in the field of genetics. In the late 1950s and early 1960s, when the boom in molecular biology and genetics began, in the Soviet Union we were completely unprepared. We were starting from zero. The first genetics courses were taught in Moscow in 1964, and some of the students were from the AP institutes. From this moment on, we began to catch up with the Americans.

"In that same year of 1964, the Saratov and Rostov AP institutes set up departments of microorganism genetics. The scientists hoped that genetic research on the plague pathogen would show them how to control the variability of bacterial characteristics, which is necessary for developing new, more effective plague vaccines. The plague specialists were not entirely satisfied with the existing vaccine, and here's why. Suppose someone dropped a bacteriological bomb on us and the medics determined that it was filled with the plague pathogen. That would call for emergency measures, which means treating everyone with antibiotics. At the same time, we would need to start vaccinating people. But since the plague vaccine is a live vaccine, it can't be used at the same time as antibiotics, because the antibiotics will kill the vaccine microbe and no immunity will develop. Researchers at the Rostov AP Institute were able to develop the EV vaccine strain, which is resistant to several drugs used for emergency prophylaxis, including streptomycin and penicillin. To this day, no one else anywhere has achieved this.

"The author of a recent article on BW accused the AP institutes of complicity with the developers of bacteriological weapons. Let me explain what's behind this. In order to test their newly developed vaccine strains, the plague specialists needed a virulent (pathogenic) strain. That same kind of strain could be used in BW. Some of the virulent strains were kept in the institutes' live culture museums, and scientists were able to model some of them by manipulating the bacteria. The MOH transmitted all research reports to the Ministry of Defense. The BW developers shamelessly borrowed other researchers' methods of obtaining virulent strains, issued them under their own names, and received lots of money for each 'invention.' Can you really call that complicity? The accuser should have known that it's a huge leap from test tube to bomb, and without these virulent strain models, it would have been impossible to develop the treatments that are still in use to this day. It would have been simpler

for the AP institutes to obtain virulent strains from the Ministry of Defense, rather than 'inventing' their own. But the military didn't have such strains. They got into genetics much later than the civilians did. That's why the *Glavmikrobioprom* [Main Board of Biotechnology Industry] system was set up to develop biological weapons in parallel with the military system.

According to academician S.Ya. Gaydamovich: "The virology institutes did the same work as the AP institutes on the 'fifth problem.'[145] Our customers recognized that Venezuelan encephalomyelitis and yellow fever viruses were ideal BW agents against the Soviet Union. These viruses were new to the Soviet Union. They can easily be produced in large quantities in the laboratory, they infect via the respiratory pathway, and they are not transmitted [from one human] to other humans; i.e., the infected patient is a dead end for the infection. Since there was already a vaccine for yellow fever, we worked mainly on issues of rapid detection. But in order to detect a bacteriological bomb, we had to know what viruses we have and where they are. For 20 years, scientists searched the entire Soviet Union. They discovered 20 viruses and made special maps.

"There was a lot that our customers didn't know. In all seriousness, they often posed this scenario: 'Suppose the enemy drops a bacteriological bomb on us. We need for you to go out into the field and find the virus in five minutes.' But people are going to get sick before I find the virus! We tried to explain in plain language that there is no detection method that can be faster than the physical reaction of an organism. We also use biological systems for detection – we can take samples and apply them to mice or chicken embryos, but the human body is still the most sensitive to any virus. Over time, the customer came to understand that we knew more about our field than they did.

"Concerning Venezuelan encephalomyelitis, the virologists not only worked on detection, but also on developing a vaccine. Virologists received a Russian government prize in 1997 for the vaccine. But vaccines are used for prevention. Of course, we worked on therapeutic drugs, and, with colleagues from Riga, we developed ribamidil, which is particularly effective for treating hemorrhagic fevers, but in fact, the viral infections are still not under control.[146] Our customers wrote special requests for artificial alterations of viruses. But when we explained to them how horrific it would be if we took 'pieces' of one, a second, or a third virus, they despaired and never brought it up with us again.

"It's been claimed that our intelligence agents obtained the Marburg virus in Germany by secretly exhuming corpses of the victims. Actually, in 1969, the Yugoslavians sent organs from diseased monkeys to the Institute of Poliomyelitis and Virology for research purposes, and the virus was extracted from these organs. However, the civilian institutes had nothing to do with either the Marburg or Ebola viruses, since special safety precautions were required for this work such as maintaining a negative air pressure in the laboratory, keeping the animals in a closed system with separate ventilation, collecting all waters in a cistern for decontamination, and other measures. These conditions were achieved only

[145] In Soviet times, many academy research institutes had closed laboratories dedicated to Problem 5 R&D. The scientific workers in closed laboratories were not allowed to reveal anything about their work to workers of open laboratories.

[146] Ribamidil is an anti-viral drug with claimed effectiveness against both DNA and RNA viruses.

in the 1980s, when a new building was constructed for the closed institute [presumably Vector] at Koltsovo (Novosibirsk). It's not known if there were any attempts to make biological weapons using Marburg or Ebola viruses, but they are still working on the vaccines for these viruses at Koltsovo."[147]

In the late 1950s, the MOH began training specialists to respond to bacteriological warfare. Departments of high-risk infections were established at the regional sanitary-epidemiological stations. These departments certified the detection and diagnostic methods developed by the "fifth problem" program and taught these methods to bacteriologists. From 1950 through 1991, the AP Institute of the Caucasus and Transcaucasia in Stavropol trained 100 specialists in BW defense every year. The students included internists, surgeons, zoologists, and parasitologists. The Rostov and Mikrob institutes worked with military physicians. The virology institutes offered annual courses and seminars for sanitary-epidemiological station personnel and military medics. In the 1960s, the Rostov AP Institute established specialized mobile anti-epidemic brigades (SPEBs). In the event of a bacteriological attack, these rapid-response teams of highly capable specialists were able to travel anywhere and within hours set up a laboratory, detect the biological agent, determine the boundary of the contaminated area, and work to eliminate the outbreak. These brigades proved highly effective, and by the early 1970s, had been set up at all major AP stations. All new methods were field tested at the national training courses for SPEBs at Rostov. Subsequently, these brigades had a major role in suppressing cholera epidemics in 1965, 1970, 1971, and 1995-96. Brigades successfully operated in Chechnya in 1995.

The persons most responsible for the Soviet Union's bacteriological shield were academicians V.M. Zhdanov, I.V. Domaradsky, S.Ya. Gaydamovich, S.G. Drozdov, M.P. Chumakov, D.K. Lvov, and Z.V. Yermolyeva, professors L.N. Makarovskaya, P.I. Anisimov, N.P. Buravtseva, Yu.G. Suchkov, G.M. Medinsky, and Ya.Ya. Tsilinsky, as well as dozens of other staff members of the civilian institutes. By the 1970s, scientists and medics were ready to offer real assistance to people exposed to BW. But none of them were called to the Sverdlovsk accident [which occurred in April 1979].

Academician Domaradsky wrote: "What happened at Sverdlovsk remains hidden behind seven seals. It's hard to imagine that altered strains of the anthrax pathogen were used there. Perhaps the military people were simply selecting the most virulent strains—by then they had gotten very good at that. Therefore, there wouldn't have been any sense in developing a special anthrax vaccine to protect the personnel of Sverdlovsk-19 [the military facility that was the origin of the 1979 outbreak]. There are some really stupid rumors about this tragedy, such as: 'the virus selectively killed men and children' and 'during the Iraq crisis, the Americans asked us for a wonder vaccine that would protect soldiers!' There was no special vaccine there! The West long ago learned the true cause of the outbreak, and Burgasov (Chief Sanitary Physician of the Soviet Union), who was in Sverdlovsk at the time, is still telling us the line about some mythical meat that caused the disease. Why don't they honestly say that the release occurred in the morning, when men were going to work and children were going to school?

[147] In actuality, Marburg virus was weaponized at both the military biological institute at Zagorsk and at Vector. Ebolavirus was investigated for its weapons properties at Vector (and probably at Zagorsk), but in the end was not weaponized. See Leitenberg and Zilinskas, *The Soviet Biological Weapons Program*, pp. 216-21.

Why are generals Urakov, Pautov, and Vorobyev silent? We gave our oaths to a government that no longer exists. What are they worried about? That the communists will come back to power?

"But if the military admits that virulent strains were released [in Sverdlovsk], the victims' relatives are going to ask: why was all the work done by local physicians, most of whom didn't understand what they were up against? Why didn't they send specialists to Sverdlovsk who were trained to deal with anthrax? There's only one answer; the military didn't want to be found out. Certainly the specialized brigades would have determined the real source of the Sverdlovsk outbreak. The generals would have had to pay for their criminal negligence with their stars."

B.L. Cherkassky, corresponding member of the Academy of Medical Sciences, has answered the question of whether the military had its own vaccine: "In April 1979, I and three colleagues from the Central Institute of Epidemiology organized the mass needleless vaccination of residents of the Chkalov District of Sverdlovsk. We used the STI-1 vaccine, developed back in 1942 by N.N. Ginsburg. I can tell you that the Ministry of Defense did not and does not have any special vaccine. The following fact proves this. Until 1991, the anthrax vaccine was produced by Tbilisi Institute of Vaccine Sera. After the breakup of the Soviet Union, production of the vaccine was started at the former secret plant in Kirov. If the military had their own, more effective vaccine, they would be making money with it today. But Kirov produces the ordinary STI-1 vaccine." In 1979-83 plague specialists at the AP Institute of the Caucasus and Transcaucasia in Stavropol obtained a vaccine strain that has multiple drug resistance and is more effective than STI-1. But it exists only in a laboratory form and has never been industrialized, reportedly because of intrigues by the military.

AP doctors with plague patient.

In 1989, one of the leading figures of *Glavmikrobioprom*, the director of the All-Union Scientific-Research Institute of Highly Pure Biopreparations, Vladimir Pasechnik, took refuge in England. Wanting to enhance his renown, he not only talked about what we were doing in BW development, but also scared the western public with all kinds of untruths. As a result, our Ministry of Foreign Affairs received inquiries from Margaret Thatcher and George [H.W.] Bush: was the Soviet Union still developing bacteriological weapons? We obviously couldn't allow the West to find something here. Under orders from Gorbachev, measures were taken over the course of a year to limit, and in some cases stop or conceal work on BW development and on the "fifth problem." International inspections of the facilities named by Pasechnik didn't catch anyone red-handed. In 1991, Kanatjan Alibekov, deputy director of the Biopreparat production association, which included all the *Glavmikrobioprom* institutes, fled abroad and also described the horrors of our weapons. Again, all kinds of commissions came to Russia. In April 1992, [Russian

Federation President Boris] Yeltsin signed a decree to halt all offensive BW programs. Research on defensive aspects was "frozen." There began a massive destruction of [Ministry of Defense and Biopreparat] documents on BW development and the "fifth problem."

Academician Domaradsky: "Only the Committee on State Security could give orders to destroy documents. But the KGB itself did not know which documents to burn and which to save. They probably called in specialists from the General Staff, who could have cared less about priorities or about the future of science. At best, they saved documents that were of interest to them at the time. The result is that young scientists today can't look at our research, they can only refer to similar research done in the West. Imagine all the work that was done in this area: all the AP and virology institutes and the huge institutes of *Glavmikrobioprom*, with all their outstanding specialists. Some of these developments could have been useful today, because no one has that kind of funding or working conditions any more.

"There was a big embarrassment in 1952, during the Korean War. Our side raised an uproar that the Americans were scattering virus-infected toys [sic] in the Far East. Professor N.N. Zhukov-Verezhnikov wrote about it as if it were an absolute fact. The toys were investigated, but no viruses were found. However, diversions like that could happen in principle."

Academician S.Ya. Gaydamovich: "In 1956, employees were transferring cultures from one laboratory room to another in our institute. A laboratory technician, in violation of regulations, was carrying vials in a jar. She tripped in the hall and broke two vials containing several micrograms of dried viruses. Air currents carried the viruses about 50 meters, and everyone in the hall at that time got sick the next day with a severe headache, fever, and terrible fatigue. The vials contained the Venezuelan encephalomyelitis pathogen. This disease is rarely fatal, but the virus is capable of disabling massive numbers of people. There is no specific treatment for it. Imagine what would happen if this virus were sprayed around under pressure? In 1968, all the participants at a tropical medicine congress in Iran came down with the flu and carried it back to their home countries. The virus was spread through the ventilation system. The same thing happened in the United States with a bacterial infection that became known as "legionnaires' disease." The attendees at a war veterans' convention began dying of severe pneumonia. After the microbe had been isolated, it was found in large quantities in dust that had accumulated in the ventilation system, and it had been spread via that system. The same thing happened in Tallinn [capital of Estonia]. After that, during Communist Party congresses, the military monitored the air quality in the Kremlin's Palace of Congresses, with virologists standing by at the institute in a state of highest combat alert. A couple of times, the military's instruments started beeping, and they rushed air samples over to us, but we never found anything serious.

"Although you can't make BW in a kitchen—you need a special laboratory for that—there is still the threat of diversions of this sort. There's been a lot of talk about bioterrorism in the United States in the last few years. They're not only talking, they've armed themselves with all the developments in BW defense. In Russia, all work on the "fifth problem" ceased long ago. Today, we have practicing physicians who might encounter high-risk infections for the first time without knowing much what to

expect. If we don't teach them how to handle high-risk infections, then if any diversion should take place, we'll have all the same problems all over again."

Plague scientists believe that a [deliberate] bacteriological dispersion would not be particularly effective. However, they confirm that the SPEBs, despite the general decline of public health in this country, are still capable of dealing with the aftermath of a dispersion or accident. If only the military doesn't try of [sic] cover it up the next time.

Soviet Germ Factories Pose New Threat: Once Mined for Pathogens in Bioweapons Program, Labs Lack Security

Joby Warrick
Washington Post, Saturday, August 20, 2005, pp. A1, A14

ODESSA, Ukraine — For 50 years under Soviet rule, nearly everything about the Odessa Anti-plague Station was a state secret, down to the names of the deadly microbes its white-coated workers collected and stored in a pair of ordinary freezers. Cloistered in a squat, gray building at the tip of a rusting shipping dock, the station's biologists churned out reports on grave illnesses that were mentioned only in code. Anthrax was Disease No. 123, and plague, which killed thousands here in the 19th century, was No. 127. Each year, researchers added new specimens to their frozen collection and shared test results with sister institutes along a network controlled by Moscow.

Today, the Soviets are gone but the lab is still here, in this Black Sea port notorious for its criminal gangs and black markets. It is just one of more than 80 similar "anti-plague" labs scattered across the former Soviet Union, from the turbulent Caucasus to Central Asian republics that share borders with Iran and Afghanistan. Each is a repository of knowledge, equipment and lethal pathogens that weapons experts have said could be useful to bioterrorists.

After decades of operating in the shadows, the labs are beginning to shed light on another secret: How the Soviet military co-opted obscure civilian institutes into a powerful BW program that built weapons for spreading plague [bacteria] and anthrax [bacterial] spores. As they ramped up preparations for germ warfare in the 1970s and 1980s, Soviet generals mined the labs for raw materials, including highly lethal strains of viruses and bacteria that were intended for use in bombs and missiles.

The facilities' hidden role is described in a draft report of a major investigation by scholars from the Center for Nonproliferation Studies at the Monterey Institute of International Studies. The main conclusions of the report, which was provided to the *Washington Post*, were echoed in interviews with current and former U.S. officials familiar with the labs. Most scientists who worked in anti-

plague stations in Soviet times knew nothing of their contributions to the weapons program, the report says. The labs today are seeking to fill a critical role in preventing epidemics in regions where medical services and sanitation have deteriorated since Soviet times. But an equally pressing challenge is security: How to prevent the germ collections and biological know-how from being sold or stolen. "They often have culture collections of pathogens that lack biosecurity, and they employ people who are well-versed in investigating and handling deadly pathogens," said Raymond A. Zilinskas, a bioweapons expert and coauthor of the draft report on the anti-plague system. "Some are located at sites accessible to terrorist groups and criminal groups. The potential is that terrorists and criminals would have little problem acquiring the resources that reside in these facilities."

Managers of the old anti-plague stations are aware of their vulnerabilities but lack the most basic resources for dealing with them, according to the Monterey authors and U.S. officials. Since the collapse of the Soviet Union in 1991, budgets at the institutes have fallen so steeply that even the simplest security upgrades are out of reach. One facility in a Central Asian capital could not even afford a telephone and had no way of contacting police in the event of a break-in. At least two anti-plague centers outside Russia have acknowledged burglaries or break-ins within the past three years, though there are no confirmed reports of stolen pathogens or missing lab equipment, Monterey officials said.

The lack of modern biosafety equipment is also raising concern among U.S. officials about the potential for an accidental release of deadly bacteria and viruses. In Odessa, where 44 scientists and about 140 support staff carry out research in the I.I. Mechnikov Anti-plague Scientific and Research Institute, scientists wearing cotton smocks and surgical masks work with lethal microbes that in the West would be locked away in high-containment laboratories and handled only by scientists in spacesuits. The lab's scientists said their training in handling dangerous materials allowed them to work safely with pathogens without Western-style safety equipment—which they viewed as unnecessary and which in any case they cannot afford. "Many of the institutes are located in downtown areas, and some work with pathogens with windows wide open," said Sonia Ben Ouagrham, who coauthored the Monterey study with Zilinskas and Alexander Melikishvili.

The obscurity of the anti-plague stations is hampering their ability to fix the problems, the researchers said. The institutes were not officially part of the Soviet bioweapons complex, so they have been deemed ineligible for the tens of millions of dollars in aid given each year by U.S. and Western governments to keep former weapons scientists from selling their expertise. Western governments are just beginning to look for ways to help the institutes, and not only because of the bioterrorism threat. In a two-year study of Russia's biotech industry, a panel of the U.S. National Academy of Sciences recently urged former Soviet republics to modernize the anti-plague labs and integrate them with other global networks that seek to prevent outbreaks of diseases from becoming pandemics. "The Russian Anti-plague System, regardless of any involvement it might have had in the former offensive program, serves an important public health need," said David Franz, panel chairman and director of Kansas State University's National Agricultural Biosecurity Center.

Any weakening of the anti-plague network has consequences for the control of infectious diseases throughout the world, and especially in Europe, said Monterey's Zilinskas. "These institutes have served to prevent diseases such as plague, tularemia and Crimean-Congo hemorrhagic fever from spilling over," he said, referring to a flulike fever sometimes referred to as "rabbit flu" and a hemorrhagic viral fever. "Some Europeans are unaware of this biological threat on their southeastern flank. Others are aware, but so far, are choosing not to be engaged."

Growth of a Secret Soviet System

The name "anti-plague" reflects a grim reality of the Czarist and early Soviet periods, when the first anti-plague stations were created: Plague, or black death, was a frequent visitor to Russia and neighboring countries well into the 20th Century. Plague is caused by a bacterium, *Yersinia pestis*, and it is most commonly transmitted to people by animal or insect carriers, such as rats. It is the same illness that killed an estimated one-third of the population of Europe in the 14th century. Today, plague is easily treated with antibiotics, although a rare form of the disease—pneumonic plague, caused by breathing the bacteria into the lungs—is highly lethal and is considered a weapon of choice for germ warfare or bioterrorism. In Odessa alone, a sea port of just over 1 million people, tourists can visit eight different cemeteries for plague victims, including Plague Mountain, a grassy mound that served as a mass grave for victims of an 1812 outbreak that killed more than 2,600 people.

The first anti-plague stations were established to help contain such outbreaks. A dozen of them already were operating by the end of the reign of the last czar. The start of the Soviet era in 1917 brought many new institutes, new priorities and an expanded list of diseases, including tularemia, cholera and anthrax. The Monterey Institute's report studies how the institutes evolved under Soviet leadership, and draws on scores of interviews and visits to more than 40 anti-plague institutes and field stations. Some details emerged previously from the writings and testimony of Soviet weapons scientists.

By all accounts, the anti-plague network grew dramatically under the Soviets, both in size and sophistication. By the end of the Soviet period it boasted 14,000 employees and 88 permanent facilities, including six major anti-plague institutes, 26 regional stations and 53 smaller field stations. Odessa's Mechnikov Institute was a regional station, first opened in 1937 to battle recurring outbreaks of plague linked to infected rats that were arriving by ship. The original building on a municipal dock was later exchanged for a walled compound of three-story buildings painted pale blue. Inside, scientists dissected infected rats and birds in separate virology and bacteriology labs, using equipment that would be considered outmoded in many U.S. high schools today. For years, until the lab purchased autoclaves for cremating contaminated materials, the bodies of the diseased animals were simply buried in the lab's courtyard.

Beginning in the 1950s, the Soviet military began to exert influence over research priorities in the facilities. At first, the Monterey report says, anti-plague institutes were asked to help bolster the nation's defenses against a possible foreign biological attack. The assignment was code-named "Problem Five," and it required scientists to expand on their already-proven ability to respond to a sudden outbreak.

Researchers refined techniques for detecting and identifying pathogens, established rapid-response teams and aided the investigation of new drugs.

A growing international consensus against BW prompted the Soviets to shift to a new direction. In 1969, President Richard M. Nixon unilaterally halted U.S. production of biological weapons. Three years later, the Soviet Union joined the United States and other nations in signing the Biological Weapons Convention, outlawing biological weapons. Within the next two years, the Soviets secretly began to build a massive offensive weapons program. Much of it was hidden inside a sprawling civilian-run enterprise called Biopreparat, which put tens of thousands of scientists to work on bioweapons projects disguised as pharmaceutical research. The ruse worked. Western governments did not become fully aware of true of purpose of Biopreparat until a leading Soviet scientist, Vladimir Pasechnik, defected to Great Britain in 1989.

A Steady Supply of Virulent Strains

When Soviet generals began their expanded buildup of bioweapons in the 1970s, they looked to the anti-plague network for help, the Monterey authors said. The largest anti-plague institutions were enlisted into a new program, code-named "Problem F," or simply "Ferment." According to Zilinskas and others, the anti-plague institutes were a goldmine for the military because they provided "ready-to-use information, biomaterial and expertise."

Precise details of the anti-plague institutes' work remain unclear. The Russian government still refuses to officially acknowledge the existence of the Soviet Union's offensive weapons program. Russia also has outlawed any disclosures of classified information from the pre-1992, Soviet era. But scientists now living outside Russia have brought many key facts to light, the researchers said. It is now known, for example, that key anti-plague institutes during this period came under the command of Soviet military officers, some of whom once worked at military biological facilities. It is also clear, they said, that Soviet bioweapon engineers relied on the anti-plague institutes for basic research and identification of pathogen strains that were exceptionally lethal. "There was a secret law that enjoined all anti-plague institutes to send the government any kind of virulent strain that might be used for defensive purposes," said Zilinskas. Soviet bioweapons that most likely originated in anti-plague centers include bacterial strains that cause plague, anthrax and tularemia, the report concludes. In addition, it is believed that one of the anti-plague facilities, in Volgograd, helped Biopreparat scientists develop weaponized versions of the bacteria that cause glanders and melioidosis, two livestock diseases that also attack humans. "This collaboration probably went beyond the mere supplying of strains," the authors write. "It included efforts to weaponize wild bacterial strains."

The bioweapons program was so secret that many researchers didn't know about it. Lev Mogilevsky, deputy director of the Mechnikov Institute and a 36-year veteran of the anti-plague system, said he believed it was impossible that his institute could have contributed to the creation of offensive biological weapons. But he did remember working on joint projects with military medical units in the 1970s and 1980s, during which the exchange of information was decidedly one-way. "We would hold

meetings to discuss Problem Five, and there would be many institutes participating, including military ones," Mogilevsky recalled. "Our contributions would be open, but the military's never were. They revealed nothing."[148]

Under-funded, Under-staffed and Unsecured

Today, the Mechnikov anti-plague research institute and others like it throughout the former Soviet Union face a new generation of difficulties. Even the simple task of gathering field specimens can be a challenge, because it requires travel. That means using the institute's aging van, which is often in need of repairs, and purchasing gasoline, which the lab cannot afford. To grow bacteria for testing, the scientists need a sterile nutrient broth, or growth medium, common to biological labs all over the world. But again, the Mechnikov Institute has no money for such supplies. Workers improvise by collecting meat scraps, boiling them down in their labs and skimming off the fat. The list goes on: Glassware. Lab chemicals. Fax paper. Microscope parts. Testing kits.

"Our budget has been very much decreased. The equipment that we have is old," said Mogilevsky. "Basically what we have is enough to sustain the institute at a very low level of activity." Other shortages, unrelated to lab work, trouble the institute's deputy director. He worries about broken alarm sensors, ancient locks that need replacing and walls that should be built higher and stronger to keep out intruders. He wonders whether a single guard is enough, and if not, how he could possibly afford another.

When the Monterey Institute and the Nuclear Threat Initiative, a nonprofit group, brought scores of anti-plague scientists together two years ago for their first post-Soviet-era meeting, complaints about inadequate supplies and plummeting budgets were a common refrain. In fact, Mechnikov Institute's plight was nowhere near the worst. "All were in poor shape," said Zilinskas, who has helped launch a program that brings anti-plague scientists to the United States for training. "Some of the facilities received literally no money from their governments, at all." Many of the anti-plague institutes and stations in the ex-Soviet republics continue to maintain high professional standards, the researchers said, thanks in part to a core of older scientists who were trained under the Soviet system in classic laboratory techniques. But today, training is harder to come by, even for the few young scientists who are willing to accept starting salaries of less than $25 a week. Over time, continued cost-cutting inevitably will undermine the institutes' ability to function at all. And that, the researchers said, has a cost of its own. "If the system shuts down because of lack of equipment and funding, there's a risk of an epizootic outbreak among animals that becomes an outbreak among humans," said Monterey's Ben Ouagrham. "And humans travel."

[148] Each of the five "problems" had an AP institute that headed it, with the exception of Problem 5 that was headed by the Gamaleya Institute. "…every year or every other year, the Problem 5 Commission members, including representatives from the MOH's 2nd Directorate and from MOD, would visit all of the institutes involved in Problem 5 tasks to review their work and accomplishments." Leitenberg and Zilinskas, *The Soviet Biological Weapons Program*, 144.

Part III: Biographies of P.N. Burgasov and I.V. Domaradsky

Petr Nikolaevich Burgasov (On the occasion of his 85th birthday)

Vestnik Rossiyskoy Akademii Meditsinskikh Nauk (Russian Academy of Medical Sciences Newsletter) no. 2, 2000, p. 53.

January 29, 2000 marked the 85th birthday of Petr Nikolaevich Burgasov, academician of the Russian Academy of Medical Sciences and a prominent Russian epidemiologist, scientist, and founder of the anti-epidemic service.

Petr Burgasov graduated from Moscow Medical Institute II in 1938 and completed graduate studies in high-risk infections at the M. Gorky All-Union Institute of Epidemiology and Microbiology in 1941.

After graduation, his work involved military epidemiology and anti-epidemic protection of troops. He led a regimental sanitary service during the Soviet-Finnish armed conflict (1939-40) and served as army epidemiologist during World War II. After the war, he conducted scientific and organizational work in various medical establishments of the Soviet Army.

In 1962, he became a full professor and taught epidemiology in the Military-Medical Training Department of the Central Institute of Physician Continuing Education. In 1969, he became a professor in the Medical Pathology Department.

From 1965 through 1986, as USSR Deputy Minister of Health and Chief Sanitary Physician of the Soviet Union, he was the leader in establishing and organizing the country's sanitary-epidemiological service.

Professor Burgasov is a versatile scientist. His many years of research work have been devoted to crucial issues of theoretical and applied immunology. In 1951, based on a cycle of research on immunity and immunoprophylaxis of tularemia, he among other things refuted Sergent and Donatien's concept of nonsterile post-infection immunity, proved the superiority of subcutaneous vaccination, and demonstrated the possibility of obtaining specific resistance using killed tularemia vaccines. He directed research to develop effective new vaccines, improve vaccination methods and schedules, and study the level of post-vaccination immunity by modeling various experimental conditions.

He produced a series of research publications (1967-72) on the evolution of botulism and the principles of an efficient serotherapy system to treat botulism poisoning. These findings were published in a monograph entitled "*Evolyutsiya klostridiozov*" (*Evolution of Clostridioses*), which he coauthored with S. N. Rumyantsev.

As USSR Deputy Minister of Health and Chief Sanitary Physician of the Soviet Union, he led several campaigns to eradicate foci of high-risk infections, including the Astrakhan cholera outbreak of 1970 and the Sverdlovsk anthrax outbreak of 1979.

Professor Burgasov has always been characterized by a willingness to set aside traditional routine regulations and is an exceptionally bold decision maker when it comes to organizing and carrying out anti-epidemic measures. In this regard, we need only recall the enormous responsibility he took on during the Astrakhan cholera outbreak of 1970, when he single-handedly gave permission to export agricultural products from the focal area. Subsequent events showed that this, as well as other decisions that went against traditional concepts and regulations, were absolutely correct, from an epidemiological as well as an economic standpoint.

He has long been interested in the eradication and prevention of high-risk infections. His findings in this area have been published in several fundamental monographs, including *Sibirskaya yazva* (*Anthrax*), 1970; *Sibireyazvennaya infektsiya* (*Anthrax Infection*), 1984; *Kholera El-Tor* 1971; *Naturalnaya ospa* (*Smallpox*), 1972; and *Sanitarny shchit strany* (*The Country's Sanitary Shield*), 1973.

In conjunction with his scientific and organizational work, Professor Burgasov has always had an active role in public life. For many years, he was chairman and member of scientific councils for a number of institutes, chairman of commissions and committees on various infectious diseases, and a World Health Organization expert on quarantine diseases. He was a member of the editorial board for the third edition of the *Bolshaya Meditsinskaya Entsiklopediya* (*Great Medical Encyclopedia*), senior editor for the section on "Epidemiology, Infectious and Parasitic Diseases," editor-in-chief of the journal *Molekulyarnaya genetika, mikrobiologiya, i virusologiya*, and an editorial board member of other medical periodicals.

His contributions to the scientific and organizational aspects of preventing and containing infectious diseases have been highly esteemed at the national level. He has been awarded the Order of Lenin, Order of Labor's Red Banner, Order of the Red Star, Order of the Fatherland War, and numerous medals.

The Presidium and the Department of the Preventive Medicine of the Russian Academy of Medical Sciences, along with the editorial board of the journal *Vestnik Rossiyskoy AMN* (*Bulletin of the Russian Academy of Medical Sciences*) congratulate Professor Burgasov on his birthday and wish him good health and continued creative activity.

Igor Valerianovich Domaradsky (On the occasion of his 75th birthday)

Vestnik Rossiyskoy Akademii Meditsinskikh Nauk (Russian Academy of Medical Sciences Newsletter) no. 12, 2000, pp. 54-55.

Professor Igor Valerianovich Domaradsky, academician of the Russian Academy of Medical Sciences and doctor of medical sciences, recently celebrated his 75th birthday.

Professor Domaradsky was born on December 22, 1925 in Moscow. He graduated with honors from Saratov Medical Institute in 1947 and completed his graduate studies in 1958 [sic], after which he worked at Mikrob. In 1956, after defending his doctoral dissertation, he became chairman of the Department of Biochemistry and Biophysics at the institute. In 1957, he was named director of the Anti-Plague Research Institute of Siberia and the Far East in Irkutsk, where he worked until 1964. The contacts he established with public health agencies in Mongolia, China, and Vietnam helped strengthen sanitary border controls. He directed successful programs of traditional research on the microbiology of several high-risk infection pathogens, as well as research on the biochemistry and pathogenesis of plague in a new biochemistry laboratory. These findings were published in the institute's serials *Trudy* (*Works*) and *Izvestiya* (*News*). He also directed research that scientifically confirmed the role of weakly virulent *Yersinia pestis* strains in plague epizootics.

From 1964 to 1973, Professor Domaradsky headed the Rostov-on-Don Anti-Plague Research Institute. New findings were obtained on the genetics and metabolism of the plague and cholera pathogens. A crucial contribution to the problem of protecting the public and troops from mass bacteriological attack was the use of genetic methods to develop a new variety of the *Y. pestis* EV vaccine strain resistant to the most widely used antibiotics. This made it possible to use these antibiotics for emergency prevention and treatment in conjunction with simultaneous vaccination. A new ideology for sanitary border controls was developed for the USSR MOH. As one element of this successful new ideology, the institute organized fully equipped specialized mobile anti-epidemic brigades. These and similar brigades organized at other anti-plague institutes proved their worth during the cholera epidemics that struck the Soviet Union in 1965, 1970, and later years. Since the early 1970s, the Rostov-on-Don AP Institute has been the country's lead institute for cholera.

From 1973 to 1976, Professor Domaradsky worked in Moscow in the Soviet *Glavmikrobioprom* [Main Administration of Microbiology Industry] system. In addition to administrative duties, he conducted research in the country's first extra-chromosomal heredity laboratory, which he had founded. At the same time, for 14 years he directed the Plasmid all-union scientific program, which had a major role in establishing many aspects of the molecular genetics of microbes. The innovation of this research was formally recognized with a prize awarded in 1983 for the "Plasma" discovery; however, the discovery actually was made already in 1977, three years before any similar foreign publication. Another achievement was proving that plasmids can be transferred from *E. coli* to gram-positive bacteria (1976). This discovery greatly expanded the possibilities for artificially directed variability of microbes.

Professor Domaradsky is a founder and active member of the Russian Academy of Natural Sciences.

Professor Domaradsky has mentored 58 candidates of sciences and 14 doctors of sciences. Lately he has been working as chief scientist at the G.N. Gabrichevsky Research Institute of Epidemiology and Microbiology of the Russian Federation MOH, directing a number of scientific programs, and lecturing at the Peoples' Friendship University of Russia.

Igor Domaradsky has authored approximately 400 scientific works, including 10 monographs, such as *Ocherki patogeneza chumy* (*Plague Pathogenesis*), 1964; *Biokhimiya i genetika vozbuditelya chumy* (*Biochemistry and Genetics of Plague Pathogen*), 1974; *Chuma* (*Plague*), 1998; and *Vvedenie v ekologiyu bakteriy* (Introduction to Ecology of Bacteria), 1998. He has 46 inventions and a discovery to his credit.

The scientist has been awarded the Order of Lenin, Order of Peoples' Friendship, Excellence in Public Health Badge, Excellence in Microbiology Industry Badge, and other honors.

The Presidium of the Russian Academy of Medical Sciences and the editorial board of the journal *Vestnik Rossiyskoy AMN* (*Bulletin of the Russian Academy of Medical Sciences*) heartily congratulate Professor Domaradsky and wish him good health, further creative successes, and many more years of active life.

Part IV: Concluding Remarks by the Editors

Up to this point, scholarship on the biosecurity challenges facing the former Soviet Union (FSU) focuses on the threats posed by inadequate material protection, poor personnel management and brain drain, and weaponized bacterial and viral pathogens stored in military and AP research facilities. A related literature assesses the initiatives undertaken by governments to mitigate these risks. The *Interesting Stories*… and the other publications included in this paper are important in that they add empirical depth to this knowledge.

In this section, we examine several critical issues implied in the materials contained in this Occasional Paper to suggest the value that they may add to further study of related issues. First, we analyze the significance of the *Interesting Stories*… as a text that records the personal and organizational histories of the AP system as a political statement. Second, we identify the ways in which these texts supplement the existing literature on biosecurity in the FSU.

A history written as a political statement

The *Interesting Stories*… present a history of the AP organization, of its component institutions, and of many of the scientists who staffed them. The text serves to publicly validate the often-unrecognized work that these institutions and its veterans undertook. Its editors and authors offer their history as justification for the continued support of the AP system by the Russian government, and they appeal directly to Russian society to support this petition. Published between 1996 and 2002, M.I. Levi's editions both reflect and respond to the socio-economic and security contexts of post-Soviet Russia, our analysis of which points to the ways in which the *Interesting Stories*… are relevant to assessments of present challenges to biosecurity in the region.

Recording and validating the AP system's past

The contributors to Levi's publications indisputably shared the common objective of transcribing and sharing their organizational and personal histories. By producing the 3,500 pages of the *Interesting Stories*… to describe never-before published research and its accomplishments, the authors demonstrate an intent desire for recognition of their scientific work and that of their colleagues of the AP system.

In particular, the authors refer to the AP system, or "AP *service*," as a symbol of their collective undertaking to utilize science for the public interest. A common thread connects most of the *Interesting Stories*…, namely, the tacit and explicit insistence that the contributions of many—indeed, the AP system of the 1970s employed 14,000 staff members—served beneficent public health goals. Detailed descriptions of fieldwork and laboratory procedures represent the first public attribution of many discoveries, methodological developments, and ideas to their proper progenitors. Levi includes complete bibliographies of the most prolific AP scientists toward this aim of publically documenting the facts of the past.

The publication also served as a forum for not only exposing, but also debating these "facts" of history, since claims on new scientific developments were not always undisputed. The volumes include

animated back-and-forth exchanges of former AP workers debating the facts of their own history, writing letters and articles with titles such as, "How It Really Was," "What Do You Mean, 'How It Really Was?" "Don't Lie, People!" and "General Burgasov, It's Time To Think About Your Soul!" Several articles in the *Interesting Stories…* reference the conflict between B.Y. Elbert and N.A. Gaysky who initially collaborated on developing a tularemia vaccine, but then parted ways to conduct individual work, with each claiming their joint accomplishments to be his own.[149] Despite the personal politics among the AP specialists, which color the pages of Levi's collection, the effort to collaboratively chronicle the AP system's past demonstrates that these writers sought a tangible reflection and validation, first, of the public service to which they had dedicated their lives and, second, of their personal accomplishments in this regard.

Intended audiences of this effort included young scientists, as well as the scientific and public health communities in and outside of Russia. First, Levi meant in particular for the younger generation to take note of the history of the organization and of its individuals. He explains, "I wanted to instill respect for the older generation of AP workers."[150] Advances in microbiology and genetics from the 1970s onward may have rendered some of the techniques used in the 1930s and 1950s obsolete, but the AP "old guard" who wrote the *Interesting Stories…* maintained confidence, and correctly so, in the value of their generation's contribution. Indeed, the depth of these scientists' study of natural plague foci, their development of field research techniques, and their safe pathogen management procedures represented the essential foundations of the Soviet Union's capability to quickly respond to and suppress outbreaks of dangerous epidemic disease.

Second, the volumes also seem aimed at validating the AP system as a world-class institution. Levi lays claim to the institution's plague and high-risk infection expertise being unrivaled worldwide for much of the existence of the Soviet AP system. Yet, in fact, very little was known about this work outside the Soviet Union, such that claims to international renown do not reflect reality. Illusions of world fame aside, the *Interesting Stories…* allude to how the generation of specialists that directed the AP system institutions at its height in the 1960s and 1970s commanded due respect from Soviet citizens and scientists abroad. Referring to the acclamations of the special anti-epidemic brigades sent to Chechnya in the 1990s, Shelokhovich recalls "gratuitous reviews from the local administration in Gudermes and from the simple Chechen medics, and even… kind words of the French doctors from Doctors Without Borders."[151] Although the acknowledgment that the authors of the *Interesting Stories…* demand may carry a degree of self-importance or even narcissism, in fact, the history they present justifies the merit of the public health work of the AP institution.

Identifying audiences for a political message

In addition to merely documenting the importance of the AP system to the Soviet Union and its

[149] See Yu.A. Myasnikov, "My Encounters with Nikolay Grigorevich Olsufyev," *Interesting Stories…* 3 (1994), pp. 12-31, and I. M. Gabrilovich, "Concerning the History of the Development of the Tularemia Vaccine," *Interesting Stories…* 5 (1997), pp. 176-81.

[150] M.I. Levi, "About the Founding of "*Interesting Stories…*" *Interesting Stories…* 9 (1999), pp. 114-19.

[151] A.I. Shelokhovich, "The Road Home (Reminiscences)," *Interesting Stories…* 9 (1999), p. 193.

citizens, the *Interesting Stories*… also convey an explicit "political" message. This message suggests that both the general public and the Russian Federation government must take action to preserve the institution. Convinced that decreased funding of AP activity in Russia in the 1990s represented an incorrect and dangerous path, by publishing the series, Levi performs an act of civic engagement advocating for the future of the AP system.

The forewords of volumes 1, 3, and 4 emphasize that Levi initially aimed but to share "scientific literature" with a general audience by publishing the series. But, beginning with the fifth volume of the series in 1997, it is clear that letters to the editor sent by readers and prospective contributors convinced Levi to "open an appropriate dialogue with people in power," since "the very existence of the AP system [was] in question." He explains how the publication of this history was linked to gaining political and financial support for the system, writing, "The idea is to shine light on the activity and people of the AP system so that it does not suffer the same fate as legendary Atlantis, which is now known only from the tales of ancient Greek historians."[152]

Accordingly, volume 5 reproduces letters that former leaders of the AP institutes exchanged with the Russian government to request funding for the reorganization of the system, and articles in following editions echo the same urgency with which their authors believed that action to maintain AP work in Russia should be taken. Ultimately, such petitions produced negligible, if any results, an outcome with which Levi expresses his disappointment in volumes 10 and 11, released in 2000 and 2001, respectively. Seeming resigned to the decline of the AP system of the Soviet Union as an inevitable fact of post-Soviet history and fiscal crisis, the editor realizes that the series' last hope is to convince society at large of the value of the AP system: "The issues have taken on a life of their own, and everything now depends on whether the public will make use of them."[153]

Historiographical perspective

The publication of any history cannot be separated from the historical milieu in which it was written. The content of the *Interesting Stories*…, published from 1994 through 2002, must be considered as it relates to at least three important contexts of this period: the opening of the press in Russia, the growing knowledge of the Soviet BW program, and the availability of foreign assistance to former weapons scientists in the FSU.

First, the dissolution of the Soviet Union in 1991 made possible the publication of previous state secrets, including information about the AP system's history, nature, work program, and work force. Before the press was liberalized, due to this secrecy, it would have been impossible—or rather, illegal—for the AP scientists to receive public validation of their work and of its benefits to Soviet public health, as described above. On the tail of Soviet society's "opening" through the *perestroika* of the late 1980s, Levi and his colleagues displayed an initiative reminiscent of the self-publishing, or *samizdat*,

[152] M.I. Levi, "Foreword," *Interesting Stories*… 5 (1997), p. 3. Indeed, previous CNS reports and the media articles by Belousova and Warrick contained in this occasional paper demonstrate the suffering quality of some AP facilities due to lack of attention and funding.

[153] M.I. Levi, "Foreword," *Interesting Stories*… 11 (2001), p. 3.

by writers of the last years of Communist censorship. The disintegration of government restrictions on the press facilitated and encouraged the transparency in which AP scientists and doctors had long seen great value:

> Our publication continues to develop the theme of the "openness" of the AP system as a problem of utmost importance. It seems to us that someone had set out to hamper scientific research, disrupt established practices, diminish the importance of scientists in society, subjugate them to the will of others, and, in the final analysis, harm the country. The easiest way of accomplishing these things is to classify everything as secret.[154]

Several accounts contained in the *Interesting Stories...* reveal the extent to which AP scientists resented and were skeptical of the secrecy in which they were forced to work. With restrictions dropped and the information floodgates opened to the post-Cold War world, the writers took this opportunity to share their memoirs as an act of reengagement with the wider Russian scientific, epidemiological, and microbiological communities as well as, they hoped, the international scientific community. In its own way, this publication is a virtual manifestation of the brain drain characteristic of the period.

The revelation of the Soviet BW program was the second occurrence contemporaneous with the historical context of the *Interesting Stories…* Starting with Vladimir Pasechnik in 1989, and Ken Alibek in 1992, defectors from USSR's BW program began to reveal to British and US intelligence the extent of its huge size, details of its work program, and the legends developed and used by the KGB to hide it from both Russians and foreigners. The classified visitations by US and British experts to Russian non-military sites that conducted weapons-related research and development began in 1993 under the Trilateral Agreement concluded by the three countries, which served to inform their governments that the defectors had been truthful; however, the process ended in 1996 when the Russian government would not allow foreigners to visit military sites. In 1995 a seminal event occurred — Igor Domaradsky, an AP scientist who in the early 1970s was transferred to Moscow, there to help establish the civilian BW institution, Biopreparat, published a memoir, *Troublemaker, or The Story of an "Inconvenient" Man* (in Russian), in limited print in Moscow that not only revealed to the public for the first time the existence of the illegal Soviet BW program but also implicated the involvement of the AP system in it.[155] Still, it is likely these revelations did spread rather quickly after Domaradsky published his memoir in 1995, since AP veterans maintained their networks, which the publication of the *Interesting Stories…* even helped to facilitate. Domaradsky continued publishing articles about the Soviet BW program and, in 2003, an expanded and updated version in English of his 1995 self-published autobiography called *Biowarrior* was published in the United States.

As Soviet BW activities were revealed piece by piece, Levi's authors continued publishing the history of the AP system in the *Interesting Stories…* The articles gradually addressed more political issues and

[154] M.I. Levi, "Foreword," *Interesting Stories…* 5 (1997), p. 3.

[155] In the same year, 1995, Domaradsky contributed his first article, "Proscriptions," to the *Interesting Stories…* 3 (1994), which consisted primarily of a list of the names and biographical information of AP employees who suffered as a result of the Stalin repressions.

voiced increased criticisms of the AP system and certain personnel, and a wider range of authors contributed to Levi's compendium. A great deal of this criticism was directed against the AP system's shift of focus in the 1970s to non-plague-related microbiological research. Several articles discuss the transfer of personnel to different AP institutes to do less appealing work than that to which they were accustomed. These changes, in fact, supported the AP system's work on the Soviet BW defense program (codenamed Problem 5) and pathogen weaponization research (notably at the Volgograd AP Institute, Mikrob, and the Rostov AP Institute).[156] As such, it is reasonable to assume that the *Interesting Stories*… also came to some extent be the AP veterans' response to the new revelations about the illegal activities that their institution had been co-opted to support. Having served the AP system for public health purposes, it is probable that some AP scientific workers felt betrayed by revelations of its complicity in BW efforts. In this regard, readers should know that outside a few institute directors, AP workers, from the lowest level to the highest, would have been unaware of the Soviet offensive BW program and only a comparative few would have known about Problem 5.[157]

It is also important to note that common knowledge of the AP system, let alone its role in the BW program, would have been quite limited in Russian society. One of the editors had a personal experience that demonstrated this fact. In 2003, Zilinskas had the opportunity to visit the AP institute in Odessa, Ukraine (it Soviet times, it had been an AP station). While being driven to his hotel after the visit, the taxi driver who had spent his whole life in Odessa said: "I have driven by this building hundreds of times and until now never knew what its purpose was." As a result of this general ignorance of the AP system, it would be wrong to overemphasize that the intent of Levi's volumes was to "defend the good name" of the AP system. Setting straight the record on the history and activities of the AP system was certainly an aim, but the majority of the articles of the compendium suggest that chronicling this history was done on its own merit.

The growth of foreign assistance programs is the third and final development necessary to address in considering the context of the *Interesting Stories*…. These programs sought to secure threats of weapons of mass destruction-related materials and technologies in the FSU, not excluding those related to biosecurity. Numerous AP facilities outside of Russia benefited from the US Department of Defense's Cooperative Threat Reduction (CTR) program, the biotechnology program of the International Science and Technology Center (ISTC), and the EU Framework Programs in healthcare.[158] However, as Russia AP institutes remained closed to foreigners, their scientists only received limited assistance from these programs if they collaborated with an open institute such as Biopreparat's Vector or SRCAM. Aware of the absence of such external assistance, and recognizing the need to secure and

[156] Citing both original interviews and L.F. Zykin, *Interesting Stories*… 8 (1998), pp. 37-52, Zilinskas and Leitenberg, pp. 147-48, affirm that the Volgograd AP Institute, established in 1970, was dedicated to performing R&D to weaponize bacterial strains, particularly Burkholderia pseudomallei and Burkholderia mallei, which cause melioidosis and glanders, respectively.

[157] As a rule, scientists in the know about the offensive Soviet BW program would be knowledgeable about Problem 5, but Problem 5 scientists would not know details about the offensive BW program.

[158] Alevtina Izvekova, "International Assistance for Anti-plague Facilities in the Former Soviet Union to Prevent Proliferation of Biological Weapons," Nuclear Threat Initiative, June 1, 2005, <www.nti.org/analysis/articles/anti-plague-facilities-soviet-union/>.

maintain the AP system in the face of threats posed by new diseases and bioterrorism, several authors of the *Interesting Stories…* present cogent arguments for prioritizing tasks aiming to defend against these threats on the Russian security agenda. The following section presents specific ways in which their publications can inform this agenda.

New support for biosecurity policies

The insights gained from reading the *Interesting Stories…* could add knowledge valuable to the formulation of biosecurity policy in the future. We make three points in this regard.

First, Levi's compendium illustrates the challenges inherent in the interface between science and policy, specifically in biological security and scientific engagement efforts. The *Interesting Stories…* offer evidence that the Soviet government believed that its ability to regulate Soviet society po planu, or "according to plan," extended to science. For instance, much as Lysenkoism gave Joseph Stalin fantastical hopes of creating better and newer crop species within a very short time, several articles in *Interesting Stories…* suggest that Soviet ideology allowed, or simply required, the country's leaders to refuse to believe that diseases of the "undeveloped world" like cholera were naturally present in the Communist utopia.[159] The *Interesting Stories…* make clear the extent to which many of these bureaucrats were ignorant of, or misunderstood, the fundamental issues of biology as they relate to security. S.Ya. Gadamovich describes one request from the government that was simply technically unfeasible to fulfill:

> In all seriousness, they often posed this scenario: "Suppose the enemy drops a bacteriological bomb on us. We need for you to go out into the field and find the virus in five minutes." But people are going to get sick before I find the virus! We tried to explain in plain language that there is no detection method that can be faster than the physical reaction of an organism.[160]

Fundamental misunderstandings by government officials of environmental microbiology led to them making decisions that not only did not solve the problem but also led to disaster. The destructive approach by "vigorous epidemiologists," was recounted by L.F. Zykin:

> For example, when the El Tor [cholera] vibrio was discovered in a lake near Krasnoyarsk, tons of disinfectants were put into the lake, and in addition, dynamite charges were set off to produce better mixing of the water. You can imagine the damage this caused; the entire surface of the lake was covered with dead fish. Interestingly, two weeks after this barbaric measure, cholera vibrios were again isolated from the water.[161]

[159] Lysenko was an agronomist who repudiated Mendelian genetics and instead followed the Lamarckian notion that structural changes in animals and plants brought about by environmental or agricultural forces are transmitted to offspring. This notion fitted Stalin's concepts on how society can be changed, so "Lysenkoism" became state dogma avowed by him and his successor, Nikita Khrushchev.

[160] Taisiya Belousova, "Bioterror: Who Will Protect Russia?" *Sovershenno Sekretno* 11 (1999), pp. 16-17; see Part II of this report.

[161] L.F. Zykin, "How It Really Was," *Interesting Stories…* 7 (1998), pp. 217–25.

In several of the *Interesting Stories*… the authors convey their astonishment that KGB operatives were unable to comprehend the fact of science that natural foci of disease, such as plague, spawned epidemics because they naturally existed on the territory of the Soviet Union itself. For them it made more sense to assume that epidemic outbreaks were caused by saboteurs importing pathogens from abroad. The *Interesting Stories*… demonstrate that those who understood the science of plague best, that is, the AP specialists or "plagueologists," were much less likely to believe that the etiology of an outbreak was foreign saboteurs than the ostensibly better "informed" intelligence and defense agents. As such, Levi's stories provide an illustration of the science-policy nexus as it relates to biosecurity in the FSU. Understanding these attributes of the *Interesting Stories*… would be invaluable to those considering the role of scientific discourse in policy—and the role of political discourse in science—as they relate to security and proliferation.

Second, these sources add to the knowledge of organizational culture of the Soviet government. The necessity of secrecy to the development of Cold War weapons is an understandable phenomenon, and the *Interesting Stories*… offer further evidence of how secrecy unavoidably decreased the efficiency of scientific institutes. Notwithstanding, these publications make it clear that the scientists recognized the value of openness and global cooperation for achieving public health and, in many cases, resented the compulsory restrictions under which they worked. There already are many primary sources and analyses that deal with the intricacies and paradoxes of bureaucratic politics of the Soviet Union; the *Interesting Stories*… contribute several new anecdotes that illustrate how competiveness among government agencies and the bureaucrats that led them generated unproductive useless results and outcomes.

Last, the personal narratives included in the *Interesting Stories*… provide a unique glimpse into the psychology of the personnel that proliferation threat reduction programs often target. For instance, many of these programs give priority to providing incentives to scientists who have specialized knowledge that could be applied to the development of weaponizable biological agents, to instead apply their skills for peacefully directed purposes. The *Interesting Stories*… suggest the nuance, however, that a great number of the former AP scientists pursued the development of the Soviet public health system with a resolve that, at times, transcended material compensation. Most memorable in this regard is the story by M.I. Levi, I.V. Khudyakov, and Yu.G. Suchkov, "Citizen's Initiative in Scientific Research," in which the trio vividly describe a self-funded expedition that departed from Moscow to gather environmental samples from natural plague foci near Atyrau, Kazakhstan. If many scientists with knowledge relevant to national security are devoted to upholding trans-boundary public health irrespective of personal gain like some former AP workers, then scientist engagement programs seeking to reduce the threat of brain drain might be advised, for instance, to direct these programs to offer less support to such less threatening scientists and instead concentrate on dissuading true weapons scientists from being enticed to restart such work on behest of a future aggressive national leader.

At the same time, contrary to the suggestion that the biological threat from the FSU is smaller than it seems, authors of *Interesting Stories*… chapters reiterate that it is of international "interest" that policymakers, public health organizations, and even industry leaders should act to strengthen biosecurity measures worldwide. The support of the collection's authors for such a focus perhaps derives most from the sheer volume of new information about the AP institutions; institutions possessing significant proliferation potential in a region of well-known biorisks, and information which was previously mostly undiscovered, uncatalogued, and unavailable until now. Though the release of the *Interesting Stories...* serves the goal of revealing the history of the AP system, it also provides an opportunity to look forward. Failing to examine these stories with the goal of gaining perspective on current approaches to securing the biological risks posed by some of the new states that once belonged to the FSU, their successes as well as their shortcomings, would be to lose that opportunity to heed the warnings of history to decrease biological threats of the future.

The editors thank Rhianna Tyson Kreger and Stephen Schwartz for their excellent editing of the paper and Rhianna Tyson Kreger for its design and production. We also thank Dr. Yury Grigorevich Suchkov for having sent us one of the volumes that we had been unable to procure.

Appendix 1: Understanding Natural Disease Foci

Raymond A. Zilinskas, PhD

Throughout this report, terms such as "natural disease focus," "natural disease foci," and "natural plague foci" are used. The notion of natural disease focus or foci stems from the work begun in the late 1930s in the Soviet Union by Academician Evgeni N. Pavlovskiy (1884-1965), who developed the theory of natural focality of human disease agents.[162] In other words, some pathogens, such as *Yersinia pestis* and *Francisella tularensis* (which cause respectively plague and tularemia), tend to exist naturally in certain definable regions (natural foci) where they live a saprophytic existence in the soil and/or as parasites that colonize preferred hosts (carriers) and vectors. According to Pavlovskiy, natural foci diseases affecting humans include plague, tularemia, tick-borne and Japanese encephalitis, rabies, various leptospiroses, dermal leishmaniasis, tick-borne relapsing fever, and some helminthiases such as opisthorchiasis and trichinosis.

Scientific investigations based on Pavlovskiy's theory have since then evolved through three stages. At the first stage, the emphasis was on exploring the interactions between the pathogen, its vector, and its preferred host. For example, a natural plague focus would be a region where *Y. pestis* on a dependable basis can be recovered from certain warm-blooded animals, and their ectoparasites, that live in that region and, possibly, the region's soil, plants, and/or soil protozoa.[163]

During the second stage, field investigations made clear that the vector is not necessarily a structural component of every natural disease focus, especially in regards to non-transmissible diseases. For example, a natural anthrax focus would be a region where Bacillus anthracis, on a dependable basis, can be recovered from the soil and, at times, warm-blooded animals inhabiting it.

And during the third stage, field investigators gained the understanding that the presence of a warm-blooded host in the natural disease focus might be unnecessary for pathogen survival; i.e., a natural focus can consist of only soil and aquatic ecosystems. For example, B. anthracis spores can survive in a natural anthrax focus's soil for decades or longer without ever coming into contact with warm-blooded animals. In the final analysis, the one vital component of all natural disease foci thus is the pathogen population.

Research by Russian scientists has demonstrated that natural plague foci have been in existence for many millions of years over extensive areas of the Earth's surface, including millions of square kilometers that are nearly untouched by human activity.[164] Natural disease foci are dynamic entities, in continuous process of shrinking or expanding, depending mainly on natural forces, such as weather

[162] Evgeni N. Pavlovskiy, *Natural Focality of Transmissive Diseases in Connection with Landscape Epidemiology of Zooanthroponoses* (in Russian), (Moscow, 1964). The author of this book was awarded the Lenin Prize in 1965.

[163] Kenneth L. Gage and Michael Y. Kosoy, "Natural history of plague: Perspectives from more than a century of research," *Annual Review of Entomology* 50 (Unknown, 2005), pp. 505-28.

[164] V.Yu. Litvin and E.I. Korenberg, "Natural focality of diseases: development of the concept by the end of the century" (in Russian), *Parazitologiya* 33 (1999), pp. 179-91.

patterns, but also by human activities. Thus, natural malaria foci tend to expand in years of high heat and rainfall, and decrease in years of drought and coolness. As for human activities being an important determinant on natural disease foci, a good example of how human intervention influenced a natural focus involves tularemia, which is a zoonotic bacterial disease caused by *F. tularensis*.

The warm-blooded animal reservoirs of this pathogen are mammals of the genera *Lagomorpha* and *Rodentia*, while its vectors are ixodic ticks and other blood-sucking insects. Tularemia is predominantly a disease of the northern hemisphere, and large regions of Russia are natural tularemia foci. Despite the prevalence of *F. tularensis* in many Russian *oblasts*, the number of human cases annually usually is low, in the tens of thousands. However, during the early days of World War II, in 1942, the morbidity rate suddenly shot up into the hundreds of thousands, affecting both German and Russian soldiers.[165] The most likely reason for this increase was that the natural tularemia focus in the region near Stalingrad (now Volgograd) expanded. This occurred because the war prevented farmers from harvesting their grain, leaving plants to rot in the fields. With this over-abundance of food, the population of field mice, which are carriers of *Francisella tularensis*, exploded, leading to an enormously increased number of interactions between the mice and humans. It is said that mice were everywhere; in the trenches and cellars where soldiers took refuge, crawling into unattended beds and sleeping bags, defecating and urinating in huts and tents, and so forth. The ingestion and inhalation of large numbers of *Francisella tularensis* bacteria by soldiers therefore was unavoidable, leading to a greatly increased tularemia morbidity rate.

Under certain circumstance, natural disease foci might also become dangerous sources of pathogens that cause disease outbreaks affecting nearby human populations. In this case, humans become accidental hosts to the pathogen (see Figure 4). An especially threatening situation has developed over the last few decades in Central Asia as an ever-growing number of people have moved into regions hosting a variety of natural disease foci, mainly because the extraction industry in this region has been expanding rapidly. Initially, no one was in a position to determine whether this population increase in formerly uninhabited or sparsely inhabited regions would lead to more people being exposed to dangerous pathogens or if the effects would be negligible. The early recognition of the problem in the 1960s and 1970s by Soviet AP scientists led the government to support the undertaking of many large-scale projects for the purpose of eliminating or shrinking natural plague foci.[166] Some of these projects focused on exterminating rodents that were carriers of plague bacteria; others on killing the ectoparasites populating rodents in order to prevent the transmission of pathogens among rodents. These attempts appear to have had no, or at the most a limited, effect on plague demographics of the region.

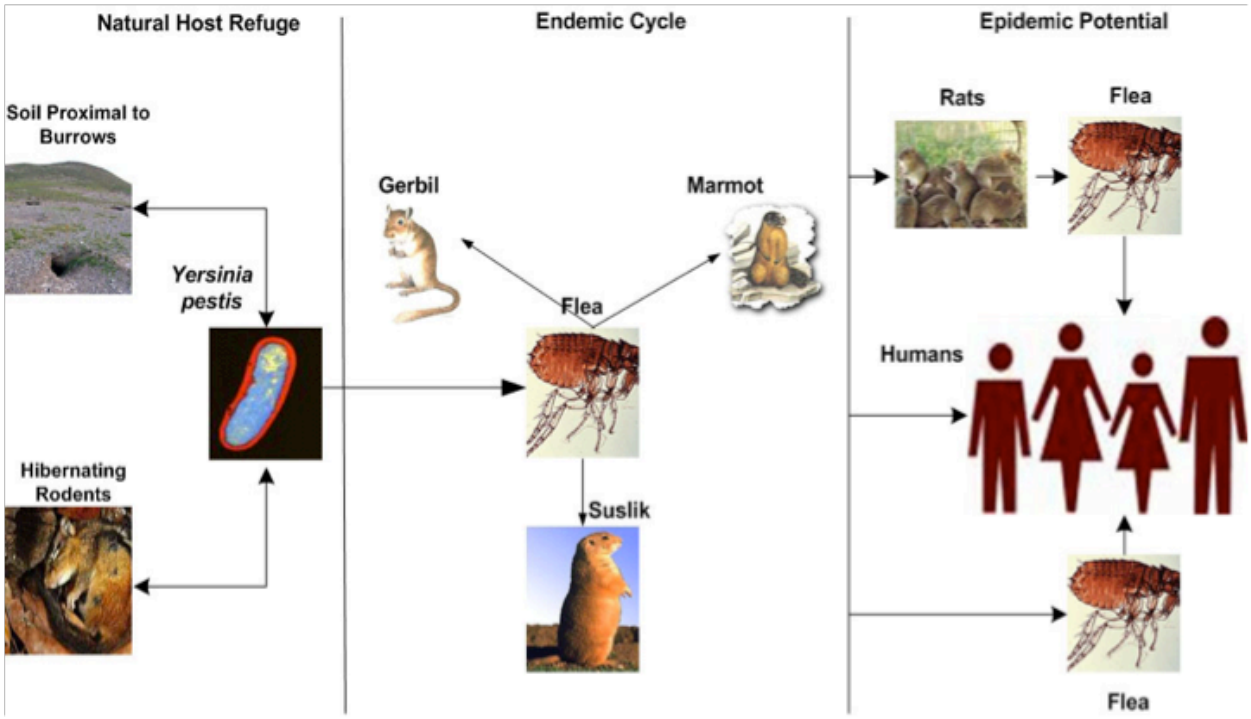
After December 1991, when the dissolution of the Soviet Union also led to a splintering of its AP system, a new, unfavorable situation has arisen; due to limited resources, AP scientists are no longer able to conduct adequate field studies of natural disease foci. As a result, no one has accurate information

[165] Leitenberg and Zilinskas, *The Soviet Biological Weapons Program*, pp. 29-32.

[166] A.I. Dyatlov, "The Enzootic of Plague: New Approaches and Hypothesis" (in Russian), *Zhurnal mikrobiologii, epidemiologii, i immunobiologii* 6 (1999), p. 113-15.

as to the activity levels of many of the region's natural disease foci. This situation and its implications are considered in detail in a report published by the CNS in 2008.[167]

Figure 4



[167] Sonia Ben Ouagrham-Gormley, Alexander Melikishvili, and Raymond A. Zilinskas, *The Anti-plague System in the Newly Independent States, 1992 and Onwards: Assessing Proliferation Risks and Potential for Enhanced Public Health in Central Asia and the Caucasus*, Monterey, CA: Center for Nonproliferation Studies, January 3, 2008, <http://cns.miis.edu/antiplague/index.htm>.

Appendix 2: Acronyms

AMN – *Akademiia Meditsinskikh Nauk SSSR* (USSR Academy of Medical Sciences)

AN – *Akademiia Nauk SSSR* (USSR Academy of Sciences)

AP – anti-plague

BWC – 1972 Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction

CIS – Commonwealth of Independent States

CNS – James Martin Center for Nonproliferation Studies at the Monterey Institute of International Studies, Monterey, California

CPSU – *Kommunisticheskaya Partiya Sovetskogo Soyuza* (Communist Party of the Soviet Union)

FSB – *Federalnaya Sluzhba Bezopasnosti* (Russian Federal Security Service)

FSU – former Soviet Union

KGB – *Komitet gosudarstvennoy bezopasnosti* (Committee on State Security)

MEDGIZ – State Publishing House of Medical Literature

MOD – *Ministerstvo Oborony* (USSR Ministry of Defense)

MOH – *Ministerstvo Zdravookhraneniya* (USSR Ministry of Health)

NII – *nauchno-issledovatelsky institut* (scientific research institute)

NKVD – *Narodny Komissariat Vnutrennikh Del* (People's Commissariat of Internal Affairs)

NTI – Nuclear Threat Initiative, Washington, DC

OGPU – *Obyedinennoe Gosudarstvennoe Politicheskoe Upravlenie* (Unified State Political Administration) – one of the several forerunners of the KGB

PCR – polymerase chain reaction

RAN – *Rossiyskaya Akademiia Nauk* (Russian Academy of Sciences)

RF – *Rossiyskaya Federatsiya* (Russian Federation)

RKKA – *Raboche-Krestyanskaya Krasnaya Armiya* (Worker's and Peasant's Red Army)

SRCAM – State Research Center for Applied Microbiology of Biopreparat in Obolensk

SSR – *Sovetskaya Sotsialisticheskaya Respublika* (Soviet Socialist Republic)

US – United States

USSR – Union of the Soviet Socialist Republics

VEEV – Venezuelan Equine Encephalitis virus

VNII – All-Union Research Institute… (of something)

VUZ – (higher educational institution)

ZhMEI – Zhurnal mikrobiologii, epidemiologii i immunobiologii (Journal of Microbiology, Epidemiology and Immunology)

Appendix 3: Glossary of Biotechnical and Russian Terms and Names

Aerosol—a colloidal suspension of liquid droplets or solid particles in air. For the purposes of this book, all aerosols we discuss are "bioaerosols," which are aerosols with components containing formulated bacteria, viruses, or toxins.

All-union (*vsesoyuzny*)—national; an agency, enterprise, institute, or unit that existed throughout the Soviet Union.

Amino acid—any of a group of 20 organic compounds that are linked together in various combinations to form peptides or proteins.

Antibody—a specific protein molecule produced by an organism's immunological defense system when it is challenged by a foreign substance (the antigen). The antibody neutralized the antigen by binding to it.

Antigen—a substance that, when introduced into an organism, elicits from it an immunological defensive response. Many living microorganism or chemical agents can, under appropriate circumstances, become antigens.

Antiserum—a serum containing antibodies.

Applied research—experimental or theoretical work directed toward the application of scientific knowledge for the development, production, or utilization of some useful product or capability.

Bacteria—one-celled organisms lacking a nucleus and having a plasma membrane cell wall. Bacteria can be aerobes or anaerobes; only a small percentage of bacteria are pathogenic. They store most of their DNA in one long, looping molecule (chromosome), but can also contain plasmids, which are small, circular, double-stranded DNA molecules that replicate independently from their host (see Plasmid, below).

Basic research—experimental or theoretical work that is undertaken to acquire knowledge of fundamental principles of phenomena and observable facts and that may not be directed toward a specific application.

Bioinformatics—the application of information technologies to analyze and manage large data sets resulting from such activities as gene sequencing of the human and non-human genomes.

Biomodulators—a general term for biological or synthetic agents that are capable of eliciting specific and/or non-specific effects on immunological or neurological response systems for either positive or negative purposes. Thus immunomodulators can, on the one hand, enhance the immune response that defends a person against pathogens or, on the other, can depress a host's immunological defense

system, thereby making the host more susceptible to infection. Similarly, neuromodulators can improve a person's mood or, conversely, can cause a person to suffer hallucinations and other irrational behavior.

Biosafety—in activities involving life forms or their parts, the observance of precautions and preventive procedures that reduce the risk of adverse effects.

Biosecurity—activities designed to secure for humans, animals, and plants freedom from possible hazards attending biological activities, such as research, development, testing, and applications; measures taken by governments to guard against damage that may be brought about by accidental or intentional exposure to biological agents or toxins.

Biotechnology—a collection of processes and techniques that involve the use of living organisms, or substances from those organisms, to make or modify products from raw materials for agricultural, industrial, or medical purposes.

Capability—the ability to produce or apply a particular set of scientific techniques or technologies.

Catalyst—a substance that affects the rate of a chemical reaction but remains itself unaltered in form or amount.

Cell culture—the propagation of cells removed from a plant or animal in culture.

Cell fusion—combining nuclei and cytoplasm from two or more different cells to form a single hybrid cell.

Central Committee—Central Committee of the Communist Party of the Soviet Union.

Clone—a group of genetically identical cells or organisms asexually descended from a common ancestor. In case of a cloned organism, all cells making up that organism have the same genetic material and are exact copies of the original.

Cloning—the use of genetic engineering to produce multiple copies of a single gene or a segment of DNA.

Contagion—the transmission of a pathogen from an infected person to an uninfected person by direct or indirect contact. For BW purposes, the major contagious pathogens are smallpox virus and *Y. pestis*.

Culture—the growth of cells or microorganisms in a controlled artificial environment.

Culture, batch—a fermentation process that takes place within a fermenter, which is a closed culture system that contains an initial, limited amount of nutrients. After seeding the culture with a few

microorganism of choice, they are allowed to propagate until a vital nutrient is used up or waste products accumulate to such an extent that they negatively affect the growing microorganisms. After the fermentation ceases, the culture is removed from the fermenter and the microorganisms (biomass) are separated from the liquid culture medium. If the biomass is the desired product, it is formulated. If the bioproduct dissolved in the culture medium is the desired product, it is subjected to down-stream processing.

Culture, continuous—this is an open fermentation system in which a steady-state is achieved by adding nutrients continuously to the culture and balancing the added material by removing cells constituting the biomass.

Cytokine—proteins, such as lymphokines and monokines, which are released by a host's immunodefense system (primarily primed T-lymphocytes) when it detects an antigen. Cytokines, while part of the immune defensive response to invaders, may also stimulate toxic or damaging actions to the host that produces them.

Database—a collection of data, defined for one or more applications, which is physically located and maintained within one or more electronic computers.

Development—progressive advance from a lower or simpler to a higher or more complex form; the process of applying scientific and technical knowledge to the practical realization or enhancement of a specific product or capability.

DNA—deoxyribonucleic acid; the carrier of genetic information found in all living organisms (except for a small group of RNA viruses). Every inherited characteristic is coded somewhere in an organism's complement of DNA.

Enzyme—a special protein produced by cells that catalyze chemical processes of life.

Enzyme-linked immunosorbent assay (ELISA)—a rapid and sensitive means for identifying and quantifying small amounts of virus antigens or antiviral antibodies.

Escherichia coli (*E. coli*)—a species of bacteria that commonly inhabits the human lower intestine and the intestinal tract of most other vertebrates as well. Some strains are pathogenic, causing urinary tract infections and diarrheal diseases. Non-pathogenic strains are often used in laboratory experiments.

Expression—the translation of a gene's DNA sequence by RNA into protein.

Ferment—Codeword for the Soviet BW program that aimed to R&D bacterial and viral pathogens to harm and kill humans (in English – Enzyme).

Fermentation—the anaerobic bioprocess in which yeasts, bacteria, or molds are grown, or propagated,

within a closed container for one of three purposes; to optimize: (1) maximum biomass production; (2) maximal production of by-products such as alcohols, antibiotics, organic acids, and proteins (including toxins); or (3) maximum nutrient consumption as in waste treatment. There are two fermentation methods—batch and continuous culture (see above).

Five-year Plans:
First 5-year Plan, 1928-32
Second 5-year Plan, 1933-37
Third 5-year Plan, 1938-41
Fourth and Fifth 5-year Plans, 1946-50 and 1951-55
Sixth 5-year Plan, 1956-60
Seventh 5-year Plan, 1959-65
Eighth 5-year Plan, 1966-70
Ninth 5-year Plan, 1971-75
Tenth 5-year Plan, 1976-81
Eleventh 5-year Plan, 1981-85
Twelfth 5-year Plan 1986-90
Thirteenth 5-year Plan 1991

Fraction—a chemical agent or compound that may be separated out by chemical or physical methods from a solvent containing a mix of substances.

Fungus—the majority of fungi are made up by yeasts and mold, but also include mushrooms, rusts, and smuts. Yeasts are fungi that usually remain unicellular for most of their life cycle and belong to the fungal families, ascomycetes, basidiomycetes, and imperfect fungi. Mold represents a large group of fungi, such as *Penicillium*, which grows on food.

Gene—the fundamental unit of heredity. Chemically a gene consists of ordered nucleotides that code for a specific product or control a specific function.

Gene splicing—the use of site-specific enzymes that cleave and reform chemical bonds in DNA to create modified DNA sequences.

Genetic engineering—a collection of techniques used to alter the hereditary apparatus of a living cell enabling it to produce more or different chemicals. These techniques include chemical synthesis of genes, the creation of recombinant DNA or recombinant RNA, cell fusion, plasmid transfer, transformation, transfection, and transduction.

Genome—an organism's complete set of genes and chromosomes.

Genomics—the scientific discipline of mapping, sequencing, and analyzing genomes. There are two aspects to genomics. First, structural genomics is the construction of high-resolution genetic, physical,

and transcript maps of organisms. Second, functional genomics is the use of information generated by structural genomics to develop experimental approaches for assessing gene function.

Glavmikrobioprom—Glavnaya upravleniya mikrobiologicheskoi promyshlennosti (USSR Main Administration of Microbiological Industry).

Gossanepidnadzor—Russian State Sanitary and Epidemiological Inspection (renamed *Rospotrebnadzor* in 2004).

Gulag—Glavnoe upravlenie ispravitelno-trudovykh lagerey (the Soviet Union's penal system; more commonly, used as a general name for the network of harsh labor camps in Siberia and other distant parts of the Soviet Union).

Hazard—the likelihood that an agent or substance will cause immediate or short-term adverse effects or injury under ordinary circumstances of use.

HEPA (High Efficiency Particulate Air) filters—the highest efficiency filters readily available on the open market and used in the aerospace, biomedical, electronic, and nuclear fields. By definition, HEPA filters must capture 99.97 percent of contaminants at 0.3 microns in size.

Host—a cell whose metabolism is used for growth and reproduction of a virus, plasmid, or other form of foreign DNA.

Host-vector system—compatible host/vector combinations that may be used for the stable introduction of foreign DNA into host cells.

Hybridoma—a special cell produced by joining a tumor cell (myeloma) and an antibody-producing cell (lymphocyte). Cultured hybridoma produce large quantities a particular type of monoclonal antibodies.

ID_{50}—the number of microorganisms required to infect 50 percent of exposed individuals.

Immunomodulator—see "biomodulator."

Infection—the invasion and settling of a pathogen within a host.

Infectious—capable of causing infection; spreading or capable of spreading to others.

Intellectual property—the area of the law encompassing patents, trademarks, trade secrets, copyrights, and plant variety protection.

Interferon—a type of glycoprotein discovered in the 1950s having potential as anti-cancer and anti-

viral agents. Three types of interferons are known, alpha (IFN-α), beta (IFN-β) and gamma (IFN-γ). The gamma interferons are usually classified as cytokines.

In vitro—literally "in glass;" pertaining to biological processes or reactions taking place in an artificial environment, usually the laboratory.

In vivo—literally "in the living;" pertaining to biological processes or reactions taking place in a living system such as a cell or tissue.

Izvestiya (*News*) —nationwide daily newspaper published by the Presidium of the Supreme Soviet of the Soviet Union (contrast with Pravda).

Komsomol—Vsesoyuzny Leninsky kommunistichesky soyuz molodezhi (All-Union Lenin Communist Youth League).

LD_{50}—the dose, or amount, of a chemical needed to cause death to 50 percent of exposed individuals.

Log— the term "log" is shorthand for a "power of ten." Two logs (10^2) are 100 and six logs (10^6) are 1 million. If a scientist experiences a six log reduction of virus viability in a solution, the titer has dropped 1 million times. An example of a six log reduction would be a drop from 10^8 to 10^2.

Metabolism—the sum of the chemical and physiological processes in a living organism in which foodstuff are synthesized into complex biochemicals (anabolism); complex biochemicals transformed into simple chemicals (catabolism), and energy is made available for the organism to function and procreate.

Metabolite—a substance vital to the metabolism of a certain organism, or a product of metabolism.

Microorganism—a microscopic living entity, including bacteria, fungi, protozoa, and viruses.

Micron—one millionth of a meter. The diameter of a human hair is approximately 100 microns.

Mikrob—State Scientific Research Institute of Microbiology and Epidemiology of South-East Soviet Union in Saratov.

Ministry institute—a general designation for an R&D facility controlled by a ministry, including all anti-plague institutes, which were under the Ministry of Health.

Minzdrav—Ministry of Public Health.

Monoclonal antibody—an antibody produced by a hybridoma that recognizes only a specific antigen.

Morbidity—the relative incidence of disease.

Neuromodulator—see "biomodulator."

Oblast—an administrative division in Russian that is akin to a Western province or state.

Oligonucleotides—short DNA molecules, usually containing fewer than 100 bases.

Opportunistic pathogen—a microorganism that is pathogenic to only immunocompromised persons.

Pathogen—an organism that causes disease.

Pathogenic—causing or capable of causing disease.

Peptide—a linear polymer of two or more amino acids. A polymer consisting of many amino acids is called a polypeptide. Peptides are similar to proteins but smaller. Small molecules that can synthesized by joining individual amino acids are, by convention, called peptides rather than proteins. The dividing line is at about 50 amino acids; i.e., if the polymer contains fewer than 50 amino acids it is a peptide, if more, it is a protein.

Plasmid—small, circular, self-replicating forms of DNA existing within bacteria. They are often used in recombinant DNA experiments as acceptors of foreign DNA.

Plasmid transfer—the use of genetic or physical manipulation to introduce a foreign plasmid into a host cell.

Polymerase chain reaction (PCR)—a technique used in laboratories to quickly create thousands to millions of copies of genetic material for purposes of analysis.

Pravda (*Truth*)—nationwide daily newspaper published by the Central Committee of the CPSU (compare with *Izvestiya*).

Problem 5—codename for the top-secret Soviet program to defend against biological attacks and imported exotic diseases.

Production—the conversion of raw materials into products or components thereof through a series of manufacturing processes.

Protein—see peptide.

Recombinant DNA (rDNA)—the hybrid DNA resulting from the joining pieces of DNA from different sources.

Risk—the probability of injury, disease, or death for persons or groups of persons undertaking certain activities or exposed to hazardous substances. Risk is sometimes expressed in numeric terms (in fractions) or qualitative terms (low, moderate or high).

RNA—ribonucleic acid; found in three forms—messenger, transfer, and ribosomal RNA. RNA assists in translating the genetic code of a DNA sequence into its complementary protein.

Safe—not threatened by danger, or freed from harm, injury, or risk.

2nd Directorate—Agency within the USSR MOH that directed the anti-plague system.

Security—being secure from danger; freedom from fear and anxiety; measures taken by governments to guard against espionage, sabotage, and surprises.

Seed—a bacterial or viral collection used as a "stock" for the large-scale production the organism itself or products that it may ferment.

Serological studies—laboratory immunological procedures that depend on interactions between antibodies and antigens to confirm or reject specific associations between them.

Siberian plague or ulcer— сибирская язва (Russian name for anthrax).

Synthesis—the production of a compound by a living organism.

T-cells—a class of lymphocytes, derived from the thymus, involved primarily in controlling the host's cell-mediated immune reactions and in the control of B-cell development (see B-cell). The T-cells coordinate the host's immune system by secreting lymphokine hormones. There are three different types of T-cells: helper, killer, and suppressor.

Technology—the scientific and technical information, coupled with know-how, that is used to design, produce, and manufacture products or generate data.

Technology transfer—the process of transferring intellectual property (intangible ideas such as algorithms, designs, and software) to organizations, including universities and commercial companies, to ensure it is well utilized. For successful technology transfer, the intellectual property must be protected through means such as copyrights and patents.

Threat—an indication of something impending and usually undesirable or dangerous; something that by its very nature or relation to another threatens the welfare of the latter.

Toxicity—the quality of being poisonous, or the degree to which a substance is poisonous.

Toxicology—the scientific discipline concerned with the study of toxic chemicals and their effects on living systems.

Toxin—a poisonous chemical byproduct of microorganisms, animals, or plants. (See also endotoxin and exotoxin.)

Toxoid—a toxin that has been chemically modified so that it is no longer toxic but still is able to induce antibody formation. Some toxoids may be used as vaccines against toxins.

Trait—a characteristic that is coded for in the organism's DNA.

Transduction—the transfer of one or more genes from one bacterium to another by a bacteriophage (a virus that infects bacteria).

Transfection—the process in which a bacterium is modified in a way that allows the cell to take up purified, intact viral, or plasmid DNA.

Transformation—the introduction of new genetic information into a cell using naked DNA (i.e., without using a vector).

Vector—a transmission agent, usually a plasmid or virus, used to introduce foreign DNA into a host cell; also the all-inclusive name for a Biopreparat institute in Koltsovo that had several names, including IMB and VNII-MB.

Vest. AMN—Vestnik Akademii Meditsinskikh nauk SSSR (*Journal of the Medical Academy of Sciences of the Soviet Union*).

Virus—a virus particle after it has entered a host cell and has subverted or is in the process of subverting that cell's genetic mechanism to ensure its replication.

Weaponize—the process of researching and developing a pathogen or toxin to the point where it becomes suitable for use in a weapons system.

Zh. mikrobiol—Zhurnal mikrobiologii, epidemiologii i immunobiologii (*Journal of Microbiology, Epidemiology and Immunology*).

Zoonosis—a disease communicable from animals to humans under natural conditions.

Appendix 4: Complete Volume of Contents of Levi's *Interesting Stories…*

Page start	*Page end*	*Title or description*	*Primary author*[168]	*Other authors*	*Additional Content*
		Volume 1 (1994)			
5	5	Foreword	Moisey Iosifovich Levi		
6	7	From the Editor	M.I. Levi		
8	44	Gerbils, Plague, and the Volga (The Story of a Paradox)	M.I. Levi		
45	71	Professor I. S. Tinker's Life of Discovery	Aleksandr Iosifovich Tinker		
71	157	Konstantin Vasilevich Durikhin (The Story of an Inspiration)	M.I. Levi		
158	164	Boris Nikolaevich Pastukhov – Bureaucrat and Person	M.I. Levi		
166	168	Bird Detective	Nadezhda Nikolaevna Basova		
		Volume 2 (1994)			
3	26	What Can We Learn from Human Cases of Plague?	Grigory Dmitrievich Ostrovsky		Four tables, seven photographs.

[168] Given names and patronymics are given the first time an author appears on this list. Initials are used in subsequent appearances. If given names and patronymics were not available in the original text, initials are used throughout.

27	59	Unexpected Puzzles About Enzootic Plague	Innokenty Stepanovich Soldatkin	Yu. V. Rudenchik	Four tables, one photograph (of author Soldatkin), eight references.
60	85	History of Control Measures in Natural Plague Foci. Lessons from the Soviet Experience	Yu. V. Rudenchik	I.S. Soldatkin	Three tables, three figures, one photograph (presumably of author Rudenchik, but not labeled), 24 references.
86	150	Passive Hemagglutination Reaction for Plague: 25 Years of Struggle, Triumph, and Limitations	M.I Levi		Eleven tables, one photograph (portrait of author), 14 references.
151	181	Teacher and Colleagues	Yury Grigorevich Suchkov		One photograph (portrait of author), nine references.
182	187	Boris Konstantinovich Fenyuk, Chief Zoologist of the AP Service	I.S. Soldatkin		One photograph (showing author with subject).
188	200	Viktor Mikhaylovich Zhdanov — Fate of a Scientist (Early Period)	M.I. Levi		
201	208	My Departure from the AP System	M.I. Levi		
		Volume 3 (1994)			
3	3	Foreword	M.I. Levi		
4	11	Nikolay Grigorevich Olsufyev – Scientist and Teacher	Irina Sergeevna Meshcheryakova		One photograph (portrait of Olsufyev).
12	31	My Encounters with Nikolay Grigorevich Olsufyev	Yury. A. Myasnikov		

249	320	Forgotten Photographs	M.I. Levi	Yu.G. Suchkov	Thirty-four photographs.
			Volume 5 (1997)		
3	3	Foreword	M.I. Levi		
4	50	Tracking Down the Answer to the Riddle of Plague Enzoosis, Part III: Caucasus	A.I. Dyatlov		One figure.
51	129	Logical Model of Plague Enzoosis	M.I. Levi		One photograph (portrait of author), 11 figures, 12 tables, 63 references.
130	140	So Close and Yet So Far (Unculturable Forms of the Plague Pathogen)	Yu.G. Suchkov	M.I. Levi	One photograph (portrait of author), three tables, 19 references.
141	162	Investigation of the Soil and Substrate from a Colony of Great Gerbils in an Epizootic Territory of a Natural Plague Focus	M.I. Levi	Yu.G. Suchkov, Igor Vasilevich Khudyakov, Boris Nikolaevich Mishankin, R.S. Zotova, I.Yu. Suchkov, Ye.N. Yemelyanenko, V.Yu. Litvin, A.L. Gintsburg, D.I. Pushkareva, D.B. Kulesh, S.U. Kreyngold, K.A. Shestakov	One figure, five tables, 30 references.
163	175	Plague in Moscow	I.V. Domaradsky		

176	181	Concerning the History of the Development of the Tularemia Vaccine	I.M. Gabrilovich		
182	188	Nikolay Tarasovich Bykov	Z.A. Bykova		One photograph (portrait of N.T. Bykov).
189	200	Up the Steep Slope	I.V. Domaradsky		
201	209	Aleksandr Kondratevich Shishkin, Director of the Rostov-on-Don AP Institute	Svetlanova Aleksandrovna Shishkina		Two photographs.
210	224	Contribution of I.G. Ioff to the Epizootiology of Plague	N.F. Labunets		
225	231	Vladimir Nikolaevich Lobanov (biographical sketch)	V.V. Lobanov		Two photographs.
232	244	Notes on the Epidemiologist Grigory Moiseevich Medinsky	B.N. Mishankin		Two photographs.
245		The March of the Plagueologists	I.V. Khudyakov		
246	258	Epistolary Support for Saving the AP System	B.N. Mishankin		
259	314	Forgotten Photographs	M.I. Levi	Yu.G. Suchkov	48 photographs.
315	340	Alphabetized Index of Names in Issues 1–5	Editor		

Volume 6 (1997)

3	3	Foreword	M.I. Levi		
4	23	100th Anniversary of the AP Service	K.A. Kuznetsova		One photograph (portrait of author), one table, 13

227	234	Reminiscences of K.V. Durikhin	Alla Yevgenyevna Popova		One photograph, list of 10 publications written by Popova in collaboration with or under the supervision of Durikhin.
235	250	Citizens' Initiative in Scientific Research	M.I. Levi	I.V. Khudyakov, Yu.G. Suchkov	Three photographs (portraits of authors), one table.
251	271	Forgotten Photographs	M.I. Levi	Yu.G. Suchkov	19 photographs.
272	281	Pneumonic Plague in Bakanas	A.L. Kartashova		Two photographs (including portrait of author), one table, three figures, three references.
286	292	I Like...	A.L. Kartashova		Five references.
293		Correction	Editor		Correction to I.V. Khudyakov, "The March of the Plagueologists" *Interesting Stories*, 5 (1997), p. 245.
294	305	Index of Names in Issue 6	Editor		
			Volume 7 (1998)		
3	3	Foreword	M.I. Levi		
4	86	Notes of a Physician–Plagueologist	Nina Kuzminichna Zavyalova		Twenty-one photographs, one table, with afterword by N.N. Basova and Yu.G. Suchkov.
85	123	Plague Fort	Yu.P. Golikov	T.V. Andryushkevich, Yu.A. Mazink,	Fifteen photographs, eight references.

231		In Response to the Request Concerning the Article by L.F. Zykin	R.T. Gerasimenko		
232	238	How It Was Proven That the Cholera in 1965 Was Caused by El Tor Vibrio	L.F. Zykin		
239	251	Isolation of Cholera Toxin by Soviet Scientists	L.F. Zykin		Sixteen references, one photograph.
252	294	Forgotten Photographs	M.I. Levi	Yu.G. Suchkov	Forty-two photographs.
295	297	Plague Vaccine Strain Yields a Thermobiotic	M.I. Levi		one figure.
302	313	Index of Names in Issue 7	editor		

Volume 8 (1998)

3	3	Foreword	M.I. Levi		
4	21	High-Risk Infections in the Research by Zinaida Vissarionovna Yermolyeva	Elena Alekseevna Vedmina		Four photographs.
22	36	Enduring Lines of History	Gyulnara Asambaevna Temiralieva	Irina Semenova Arakelyan	Three photographs.
37	52	Volgograd AP Institute: From Sunrise to Sunset	Leonid Fedorovich Zykin		One photograph, four references.
53	56	Grigory Alekseevich Balandin as a Scientist and Person	V.S. Uraleva		
57	67	Memorial Essay on Academician Georgy Pavlovich Rudnev, 1899–1970	Rostislav Alekseevich Taranin		Four photographs.
68	87	Reminiscences of Working in the Budennovsk AP Division and the State Commission (1958-1959) for Approving New Plague Vaccine Strains	A.I. Tinker		Two photographs, 23 references.

268	271	Result of Contest for Best Article in Issues 1–7 of Interesting Stories About the Activities and People of the AP System of Russia and the Soviet Union	Yu.G. Suchkov		
272	337	Forgotten Photographs	M.I. Levi	Yu.G. Suchkov	64 photographs.
338	346	Index of Names in Issue 8	Editor		

Volume 9 (1999)

3	3	Foreword	M.I. Levi		
4	13	On the Anniversary of Klavdiya Aleksandrovna Kuznetsova	I.V. Khudyakov	Yu.G. Suchkov	One photograph (portrait of Kuznetsova).
14	21	Moisey Fishelevich Shmuter–Organizer of Diagnostic Erythrocyte Production	M.I. Levi		One photograph (of Shmuter).
25	41	On the 145th Anniversary of the Birth of the Prominent Naval Doctor, Scientist, and Public Health Organizer V.I. Isaev	Ivan Alekseevich Klimov		Two photographs (of Isaev and author Klimov), seven references.
42	76	What To Call Them Now: Scarlet-Like Fever or Pseudotuberculosis, False Tuberculosis, or False Plague?	Gennady Dmitrievich Serov		One photograph (of author), 47 references.
77	82	Amaliya Samoylovna Fomicheva	L.G. Voronezhskaya	L.S. Podosinnikova, N.N. Basova	One photograph (of Fomicheva).
83	88	Biblical Stories of Early Witnesses of Plague	N.N. Basova		7 references.

221	247	Forgotten Photographs	M.I. Levi	Yu.G. Suchkov	Twenty-six photographs.
248	254	Index of Names in Issue 9	Editor		

Volume 10 (2000)

3	3	Foreword	M.I. Levi		
5	21	Materials on the History of Brucellosis Work at Rostov AP Research Institute	V.S. Uraleva		One photograph, 54 references.
22	40	Beginnings and Rise of Histopathology at Mikrob Institute	Igor Viktorovich Isupov		Ten photographs.
41	72	Reminiscences of Dmitry Titovich Verzhbitsky	Kseniya Borisovna Ilina		Fourteen photographs, six figures (reproduced documents).
73	81	Multicolored Fear During the Cholera Outbreak in Kara-Kalpakiya in the Summer of 1965	M.I. Levi		
82	87	Once Again About Plague	N.N. Basova		
88	146	Infection and Mankind: A look at the Interspecies Battle at the Threshold of the Third Millennium	Vladimir Petrovich Sergiev		One photograph (portrait of author), four tables, 115 references.
147	188	On the Problem of Mathematical Modeling and Predicting the Parameters of the AIDS Epidemic in Russia	Boris Vasilevich Boev		One photograph (portrait of author), six figures, five tables, 14 references.
189	196	The Future of Entomological Systematics	S.P. Rasnitsyn		
197	279	Life and the Cell	Renat Rashitovich Ibadulin		One photograph (portrait of author), two figures, two tables, 33 references.

280	281	Results of Contest for Best Article Published in Issue 9 of *Interesting Stories About the Activities and People of the AP System of Russia and the Soviet Union*	Editor		
282	299	Forgotten Photographs	M.I. Levi	Yu.G. Suchkov	Seventeen photographs.
300	431	Bibliography	Editor		
432	438	Index of Names in Issue 10	Editor		

Volume 11 (2001)

3	3	Foreword	M.I. Levi		
4	72	Progress Toward Controlled Antibiotic Therapy of Patients with Purulent Septic Infections	M.I. Levi		One photograph (portrait of author), 13 figures, four tables.
73	137	Multicellular Organisms as Information-Computer Systems	R.R. Ibadulin		Twenty-seven references.
138	219	Little-Known Plague Epidemic in Primorsk Region and Vladivostok in 1921 and Plague in Odessa in 1910	Yu.G. Suchkov		Seven figures, ten photographs, 21 tables, reproductions of title pages of the reviewed books.
220	223	Bioterrorism–A Real Threat	L.A. Melnikov		Seven references.
224	231	Several Considerations on the Threat of Bioterrorism	I.V. Domaradsky		
232	254	Geographic Information Systems in Epidemiology: Possibilities of Counteracting Terrorism	B.V. Boev		One table, one figure.
255	260	Mikhail Trofimovich Titenko–Military Physician and Plague Scientist, A Person Who Served the Public	Svetlana Aleksandrovna Lebedeva		Two photographs (of the author and Titenko).

367	385	Forgotten Photographs	M.I. Levi	Yu.G. Suchkov	Seventeen photographs.

Volume 12, Issue 1 (2002)[169]

[169] Edited by Nadezhda Nikolaevna Basova.

179	179	Director of the Center for Scientific Ideas and Developments	M.M. Avrutsky	
180	193	*Interesting Stories About the Activities and People of the AP System of Russia and the Soviet Union* and 'Informational Principles of Life'	R.R. Ibadulin	

Volume 12, Issue 2 (2002)[170]

4	39	Northwest Caspian Plague Focus and Several Aspects of Activities There	Boris Georgievich Volkov	One photograph (portrait of author), 20 refs.
40	60	Reminiscences and Thoughts About a Teacher, Colleagues, and Work in the AP System	Yury Vladimirovich Kanatov	One photograph (portrait of author).
61	102	Biotechnological Improvements in EV Plague Vaccine Preparation at the Stavropol AP Institute	A.I. Tinker	Seven figures, 12 tables, 42 references.
103	110	Reminiscences About Plagueologists	Tamara Ivanovna Anisimova	
111	131	Reminiscences About Boris Mikhaylovich Kasatkin	Mark Andreevich Dubyansky	
132	142	Susceptibility of Animals to Plague Infection: Methodological Recommendations for Determining Differences Among Animal Individuals, Populations, and Species in their Susceptibility to Plague Infection	A.I. Dyatlov	
143	152	In the 'Kitchen' for Development of a Screening Test To Identify Opiate Users by Detecting Antibodies to Morphine Using a Solid-Phase Enzyme Immunoassay with β-Lactamase	Natalya Borisovna Gamaleya	

[170] Edited by Yuri Grigorevich Suchkov

About the Editors

Casey W. Mahoney is a Nunn-Lugar Fellow with the US Department of Defense Deputy Assistant Secretary of Defense for Threat Reduction and Arms Control. His research for CNS and other organizations has focused on WMD security in the former Soviet Union, Eurasian regional affairs and extremism, and small arms control standards. Mahoney has contributed to nuclear safeguards engagement and concepts development at Pacific Northwest National Laboratory (PNNL). He has also provided subject matter expertise for diplomatic strategy development and education programming for the Comprehensive Nuclear-Test-Ban Treaty Organization through the PNNL Nuclear Explosion Monitoring and Policy Program and CNS International Organizations Nonproliferation Program. He received his MA in Nonproliferation and Terrorism Studies (Monterey Institute of International Studies, 2012) and BA in Russian and Political Science (Middlebury College, 2011).

James W. Toppin received a BA in Russian Studies from Principia College in 1972 and is a freelance translator of Russian and French.

Raymond A. Zilinskas earned a PhD at the University of Southern California in 1981. After graduation, he worked for the US Office of Technology Assessment, United Nations Industrial Development Organization, and University of Maryland Biotechnology Institute. He served as a biological weapons inspector on the UN Special Commission on Iraq in 1994. Currently, he directs the Chemical and Biological Weapons Nonproliferation Program at the James Martin Center for Nonproliferation Studies, Monterey Institute of International Studies, in Monterey, California (a graduate school of Middlebury College). His recent major publications include the important reference work *Encyclopedia of Bioterrorism Defense in 2010* (co-edited with Rebecca Katz) and the encompassing book *The Soviet Biological Weapons Program: A History in 2012* (co-authored with Milton Leitenberg).

Production and design by Rhianna Tyson Kreger

www.nonproliferation.org
www.miis.edu

Monterey Institute
of International Studies

A Graduate School of Middlebury College

CNS
James Martin Center for
Nonproliferation Studies