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Genesis of the Anti-Plague System: The Tsarist Period

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Although the anti-plague system of the former Soviet Union developed fully during the Soviet era, its foundations were laid long before the Bolshevik Revolution of 1917. This article traces the evolution of the anti-plague measures from imposition of temporary quarantine in affected areas to the creation of the standard response system and the establishment of permanent anti-plague organizations. The purpose of this article is to demonstrate that by the end of the nineteenth century and the beginning of the twentieth century, despite numerous setbacks, the Russian imperial authorities succeeded in creating a nascent system of disease surveillance dedicated to protecting the population from especially dangerous infectious diseases such as plague.

Keywords Plague; Anti-Plague; Quarantine Measures; Epidemiology; Imperial Institute of Experimental Medicine; IIEM; KOMOCHUM; *Yersinia pestis*; Vaccine; Fort Alexander I; Domaradskij; Derbek; Zabolotniy

INTRODUCTION

Although the anti-plague (AP) system developed fully during the Soviet era, its foundations were laid long before the Bolshevik Revolution of 1917. This pre-Soviet history of the AP system is a story of constant battles against plague epidemics that, in some cases, decimated the populations of entire cities and provinces. A comprehensive historical survey of the occurrences of plague during the tsarist period would therefore help the reader understand the circumstances that eventually led to the formation of the Soviet AP system. Due to the large number of outbreaks, however, I chose to mention here only those that resulted in the development of measures that would later be incorporated into a coherent response system and serve as a basis for the creation of AP facilities in the Russian empire (hereafter, Russia).

Due to the common misperception in the Russian medical community that all plague outbreaks and epidemics were imported from abroad in the course of commercial activities or warfare, until the late 1800s the preventive measures implemented by public health authorities had a temporary character and lasted only for the duration of an epidemic or outbreak. Nonetheless, in the course of these outbreaks, the Russian imperial authorities took important measures that later served as a basis to organize and institutionalize a permanent response system. These measures included the publication of guidelines providing instructions to local authorities on setting up quarantine, treating affected people, and preventing the spread of the disease, notably by controlling communications with affected areas. Two other major measures instituted by the imperial system to stem the spread of plague and mitigate its consequences were the creation of a non-permanent commission, which issued instructions for physicians on identifying the disease and treating patients, and the establishment of a network of border quarantine checkpoints.

It was only in the late 1800s to the early 1900s that the first permanent organizations were created that can be truly considered predecessors of the Soviet AP system. Indeed, the imperial authorities established an oversight commission called the *Special Commission for the Prevention of and Fight against Plague* (KOMOCHUM), as well as a research institute specializing in the study of the plague bacteria (*Yersinia pestis)*, the Imperial Institute of Experimental Medicine, with a secure laboratory at Fort Alexander I. In addition, several field laboratories were established in areas where frequent epizootics occurred, and medical observation posts were set up at the borders and maritime ports to monitor these areas and prevent the importation of the disease. The research conducted by these facilities, and the expeditions they organized and dispatched to the far reaches of Russia and other regions of the world to study plague outbreaks among humans and animals, generated substantial data that helped to advance scientific progress in controlling plague. Further, the constituent parts of the Imperial AP system laid the foundation for the future composition and pyramidal organization of the Soviet AP system.

This article has two parts. The first provides an account of select plague outbreaks throughout Russian history and the responses developed by Russian authorities that gradually led to the creation of specialized AP organizations. The second part

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describes the infrastructure of the AP system as it emerged towards the end of the tsarist period.

I. OVERVIEW OF RESPONSE MEASURES IMPLEMENTED DURING THE TSARIST PERIOD

From the days of the Black Death—a plague pandemic that ravaged the European continent from the fourteenth to the eighteenth centuries—Russia experienced numerous plague outbreaks, some of which scarred the country by their ferocity (Sharov 1996).[1] This part provides an overview of these 400 years of plague history in Russia, but focuses on outbreaks that stimulated the adoption of measures that would later be used to form a permanent response system. This part is divided into four sections. The first provides an overview of historical references to plague outbreaks and epidemics in Russia that resulted in the development of epidemiological control measures. The second section discusses the early attempts made by Russian imperial authorities to create a standard response system. The third section discusses the establishment of the first non-permanent governmental commission tasked with stemming the spread of the disease. Finally, the fourth section presents an overview of sanitary protection measures undertaken at the borders of Russia in the late eighteenth to the early nineteenth centuries, including the establishment of an integrated system of quarantine checkpoints.

Historical References to Plague in Russia

The second worldwide plague pandemic, commonly referred to as the Black Death, is believed to have had its origin in the Gobi region of what is now Mongolia in the 1320s.[2] It then spread along the East-West trade route popularly called the Silk Road from 1330 to 1346 (Gottfried 1985). The first record of this westward movement was the destruction of the Nestorian Christian community at Lake Issyk Kul in the Tian Shan region of Central Asia (on the territory of present day Kyrgyzstan) in 1339. Plague is known to have reached the trading center Sarai on the lower Volga River and the Crimea in 1345, and the Caucasus in 1346.

In Crimea, according to some accounts, plague struck Mongolian forces that were laying siege to Kaffa (present-day Feodosia, Ukraine), a Black Sea port controlled by Genoese traders. In 1346, the Mongols decided to take advantage of their misfortune by catapulting corpses of plague victims into the city to spread the disease among the Genoese (Spencer & Scardaville 2001). The Mongols apparently succeeded in what may have been one of the earliest examples of biological warfare: plague devastated the city's population and the fortress surrendered. However, a few Genoese managed to flee by ship and thus brought the deadly disease to Genoa and the rest of Europe in 1347. The Black Death pandemic ravaged Europe over the next 60 years, causing the death of an estimated 25 million people, or roughly a quarter of Europe's population at the time (Domaradskij 1998).

Russian annals indicate that plague appeared in Russia in the summer of 1352 in Pskov, a city located in the western part of the country. The scale of the epidemic was such that a proper burial could not be arranged for each victim, and two or three bodies often were placed in the same coffin. The residents of Pskov appealed to the archbishop of Novgorod, Vasiliy, to visit and bless the city in the hope that this action would end the epidemic. Archbishop Vasiliy acceded to this request, but on his way back to Novgorod, he died of plague on July 3, 1352. His body was brought to Novgorod and buried at the St. Sophia cathedral.[3] The transport of the Archbishop's body had disastrous consequences, however, as his followers were instrumental in spreading plague throughout Novgorod and then onward to Chernigov, Kiev, Ladoga, Suzdal, Smolensk, and other cities throughout Russia. This epidemic was to affect Russia for more than two years.[4]

In 1360, plague afflicted the city of Pskov again. Historical records describe the disease symptoms in detail, indicating that it was of the bubonic type. By 1364, the epidemic had spread to the north of the country and in the process engulfed Belozersk, Dmitrov, Kolomna, Kostroma, Moscow, Mozhaisk, Nizhniy Novgorod, Pereyaslavl, Ryazan, Suzdal, Tver, Vladimir, Volok, and Yaroslavl. The plague reached Moscow and Tver in 1365, where it killed 20–30 people per day, and in some neighborhoods up to 100 (Derbek 1905, 20–22; Shirokogorov 1933, 8). One of the most vicious plague outbreaks occurred in Smolensk in 1387. According to one of the founders of Russian microbiology, Professor G.N. Gabrichevskiy, only five people survived in the entire city, which at that time had a population of about 35,000 (Gabrichevskiy 1904). Unfortunately, Russian historical accounts provide no information about what measures, if

[1]The term "outbreak" is a general one; it could refer to an incidence of disease affecting a few persons, a community (epidemic), or large regions of the world (pandemic). We make clear when an outbreak develops into an epidemic or pandemic.

[2]Historians have identified three worldwide plague pandemics. The first or the Justinian pandemic is estimated to have occurred between AD 541 and 750. It appears to have begun in Ethiopia and then quickly spread to Pelusium (ancient fortress city in Egypt located east of the modern Port Said), through the Middle East to the Mediterranean basin and, to a limited extent, to Mediterranean Europe. As far as we are aware, there are no records of the first pandemic having affected any of the regions that today constitute Russia. The second pandemic started in approximately 1330 in the Gobi Desert region and by 1347 had spread to Europe. Its effects on Russia are discussed in this chapter. The third pandemic appears to have begun in 1855 in the Chinese province of Yunnan, where troop movements during a local war rapidly spread the disease to China's southern coast. It reached Hong Kong and Canton in 1894, Bombay in 1898, and during 1899–1900 Africa, Australia, Europe, Hawaii, India, Japan, the Middle East, the Philippines and North and South America. This pandemic, which some believe continues to this day, came to seriously affect Russia.

[3]For more details on this issue, see: Russian Internet project IT-Med Clinic On-line. 2002. The History of plague epidemics in Russia (in Russian). 23 May 2002. http://www.it-med.ru/library/lib_article.php?id=196&l=?&start=0&order=click.

[4]Historical data do not report clinical signs that are characteristic of bubonic plague—such as swelling of the lymph glands or the appearance of red and black spots on the body—therefore it is not clear whether this epidemic was caused by pneumonic or bubonic plague.

TABLE 1
Plague outbreaks in Russia in the fifteenth to sixteenth centuries[1]

Location	Year	Number of deceased
Smolensk	1401	Unknown
Pskov	1406–1407	Unknown
Northern Russia	1417	Unknown
Kiev	1419	Unknown
Kostroma	1420	Unknown
Rostov	1421–1423	Unknown
Pskov	1421–1423	Unknown
All of Russia	1425	Unknown
Pskov	1426–1427	Unknown
Novgorod	1426–1427	Unknown
All of Russia	1442	Unknown
Pskov	1465–1467	Unknown
Pskov	1472	Unknown
Novgorod	1472	Unknown
Novgorod	1487–1488	Unknown
Pskov	1506–1508	Unknown
Novgorod	1521–1522	Unknown
Pskov	1522	11,500
Novgorod	1527	Unknown
Pskov	1532–1533	Unknown
Novgorod	1533	Unknown
Pskov	1552	25,000
Novgorod	1552	279,594
Polotsk	1563	Unknown
Polotsk	1566–1568	Unknown
Smolensk	1566–1568	Unknown
Novgorod	1566–1568	Unknown
Pskov	1566–1568	Unknown
Pskov	1592	Unknown
Ivangorod	1592	Unknown

[1]Derbek 1905, 23–40; Vysotskiy et al. 1897, 21–26.

any, were taken in the fourteenth century to prevent plague and alleviate its effects. In fact, the first reference to the imposition of quarantine to limit the spread of plague was recorded in Russia only in 1571 (Derbek 1905, 23–40; Vysotskiy et al. 1897, 21–26). (See Table 1.)

Records from the seventeenth century provide a more detailed account of the response measures implemented by imperial authorities. While Tsar Aleksey Mikhailovich (1645–1676) was fighting to retake Smolensk from the Poles in the summer of 1654, plague broke out in Moscow. A description of the chaos created by the disease in the capital was included in a letter sent to the tsar by Prince (*knyaz*) Mikhail Pronskiy (Domaradskij 1998). Upon hearing the bad news, the tsar ordered his wife—Tsarina Mariya Ilinichna Miloslavskaya—to leave the capital and settle temporarily in the Kalyazin monastery on the outskirts of Moscow.

From the beginning of the outbreak, Russian authorities began implementing active response measures that included setting up checkpoints on all roads leading into the capital. Moscow and other cities affected by the epidemic were immediately encircled by checkpoints and all communications with neighboring settlements were temporarily suspended. In addition, houses suspected of being infected were promptly sealed off and guards posted at their doors to prevent anyone from entering or leaving. Anyone who attempted to circumvent the checkpoints by taking side roads was put to death. Especially stringent procedures were established at checkpoints on the roads between Moscow and Smolensk because of the fear that the disease would reach the tsar and his troops. The road to Kalyazin monastery, where the tsarina and the heir to the throne were sheltered, was also heavily guarded.

By September 1, 1654, nearly half of Moscow's population had perished (Derbek 1905, 44–61; Vysotskiy et al. 1897, 27–32). Dead bodies were strewn around the city because most of the gravediggers had died of plague and no one else would replace them. When burials could be arranged, family members were not allowed to change the dead person's clothes, as required by Russian Orthodox rules. Instead, the dead had to be buried in the courtyards of their houses without religious ceremonies. Houses abandoned because of the death of their owners, and the property inside them, were destroyed. The clothes of diseased people were burned and anyone who had been in contact with them was fumigated with wormwood (*polyn*). Similarly, premises used to house infected people were fumigated with wormwood for three days and then aired out for two weeks (Derbek 1905, 44–61).

As plague continued to rage, popular unrest intensified and soon turned into massive riots. Before leaving Moscow, the tsarina ordered all gates to the Kremlin to be sealed and all windows bricked up in an attempt to prevent incursions by rioters. The stonemasons who sealed the windows were allowed to lay bricks only from the outside and were not allowed inside the palace. Throughout the epidemic, the tsar received regular updates on the situation in Moscow through couriers. The couriers delivered dispatches to a checkpoint on the road to the Troitsko-Sergiyev monastery (located 80 km from Moscow), where all dispatches were held above a fire for disinfection and copied on clean paper, after which the originals were burnt. The rewritten copies were then delivered to the tsar. The heads of townships from various *oblasts* (provinces) were also required to report to the tsar and tsarina every case of plague; their written reports were disinfected as described above and copied at the checkpoints before delivery (Derbek 1905, 44-61; Tarkhov 2001).[5]

[5]Over the centuries the territorial-administrative division of the Russian Empire had undergone many complex changes, as the territorial expansion eastward and southward continued at a relentless pace. Prior to the Bolshevik Revolution of 1917, the main unit of territorial-administrative division of the Russian Empire was an *oblast* or *guberniya* (province), which was followed by a *uezd* (district) and a *volost* (county) (in a descending order).

Starting in December 1654, the epidemic began to subside, eventually to the point when it was safe for the tsar and his entourage to return to Moscow. The patriarch of the Russian Orthodox Church, Nikon, also returned to the city and issued an order to kill all stray dogs because they fed on the bodies of plague victims and therefore were suspected of spreading the disease (Domaradskij 2003, 2). In spite of the measures taken to stop the disease from spreading, in July 1656, plague appeared in Kazan, Kiev, and Smolensk, and then spread along the Volga River all the way to Astrakhan, where it remained active until 1657. An estimated 200,000 people in Moscow died of the disease from 1654 to 1656 (Derbek 1905, 44–61; Vysotsky et al. 1897, 27–32). On December 10, 1656, the epidemic in the capital was officially declared to be over. Nevertheless, the checkpoints continued to function around the affected settlements for two more months and were disbanded only if no new cases were reported during that period. Violation of this order was punishable by death (Derbek 1905, 44–61).

A prominent Russian medical historian, F.A. Derbek, notes that for the tsarist government, the main obstacles in implementing epidemiological control measures were the population's ignorance of the public health threat posed by plague, and an overall shortage of dedicated medical personnel capable of enforcing those measures (Derbek 1905, 44–61). Indeed, throughout the plague epidemic of 1654–1657, the disease often spread because many infected people would escape from the quarantined area and transmit the deadly disease to others. Nonetheless, by applying basic epidemiological control measures, such as alerting authorities about new cases, closing the roads to Moscow, and sealing off other infected cities, as well as isolating infected people and carrying out disinfection and quarantine, tsarist authorities were able to slow down the epidemic and eventually contain it.

In the second half of the seventeenth century, Russian authorities began implementing controls at the borders of the empire to prevent the importation of plague from abroad. Information on disease outbreaks occurring abroad was regularly reported to the tsar's court through various means, including commercial channels (traveling merchants), military personnel deployed abroad, spies, the network of Imperial Foreign Office (*Posolskiy prikaz*) embassies and representations abroad, and the customs offices. For instance, the heads of customs offices were instructed to question foreigners entering Russia about possible epidemics of dangerous diseases in their respective countries. Foreign vessels were not allowed to dock in Russian ports if there was credible information about the existence of epidemics in countries from whence they had departed. In addition, all foreigners entering Russia had to undergo quarantine. If news of an outbreak came from abroad, relations with the affected country were suspended. For instance, in 1665, after receiving news about a plague epidemic in England, the tsar wrote a letter to King Charles II in which he announced the cessation of Russian trade relations with England and other foreign states. These protective measures appeared to have been effective, as the country did not record any cases of plague during that year and in the next three decades (Derbek 1905, 61–65). It was not until 1692 that a plague outbreak was recorded in Astrakhan. This epidemic continued for five months and killed 10,383 people, or about 65 percent of the city's population (Derbek 1905, 66–69). By the end of the seventeenth century, epidemiological control measures had been widely introduced in Russia, including the isolation of persons ill with plague, the imposition of quarantines, and the distribution of explanatory public health notices about plague outbreaks (Stavskiy et al. 2002).

During the eighteenth century, plague appeared in Russia several times, but none of the outbreaks was of a magnitude comparable with what had occurred in the past. For instance, from 1703 to 1705, a plague outbreak that had ravaged Istanbul spread to the Podolsk and Kiev *guberniyas* (provinces) in Russia and then to Poland and Hungary. After defeating the Swedes in the battle of Poltava in 1709, Tsar Peter I (also called Peter the Great) dispatched part of his army to Poland, where plague had raged since 1707. Despite preventive measures, the disease spread among the Russian troops. In 1710, the plague reached Riga (then part of Sweden, now the capital of Latvia), where it was active until 1711 and claimed 60,000 lives. During the Northern War (1700–1721), the Russians laid siege to Riga, and after the Swedes surrendered the city in 1710, the Russian army lost 9,800 soldiers to the plague. The Russian military chronicles of the time note that more soldiers died of the disease after the taking of Riga than from enemy fire during the siege of the city.

Tsar Peter I imposed strict measures to prevent the spread of plague to Russia during the Northern War. Soldiers suspected of being infected were isolated and taken to areas far from military encampments. In addition, the configuration of the encampments was designed to isolate divisions, detachments, and smaller units of soldiers. When plague reached Narva (located in present-day Estonia) and threatened to spread to St. Petersburg, the newly built capital of Russia, Tsar Peter I ordered the army to cordon off the entire perimeter along the Luga River, including temporarily halting all activity on the river. In order to prevent the movement of people and goods from Narva to St. Petersburg and Novgorod, roadblocks and checkpoints were set up on all roads. The tsar's orders were strictly enforced, and those who disobeyed were hung. Yet despite these protective measures, plague entered Russia and spread to Gdov, Izborsk, Pskov, Porkhov, and Torzhok, and lasted five months (Stavskiy et al. 2002, 70–82).

During the plague episodes described above, the Russian authorities applied new or previously used methods that helped to contain the spread of the disease and limit the number of victims. Nevertheless, all of these measures had a provisional character: they were intended to respond to a specific outbreak but were not designed as a coherent set of measures to be implemented systematically at the first sign of plague. The advent of such a standard response system came only a few years later, as described in the following section.

First Attempts at Creating a Standard Response System

The first attempts to organize epidemiological control procedures and carry out preventive sanitary response measures date to the aftermath of the 1727–1728 plague epidemic in Astrakhan. At that time, plague epidemics of varying degrees of intensity were under way in Asia Minor, Persia, Egypt, and Syria, as well as the Crimea. On October 26, 1726, fearing the importation of the deadly disease, Russian authorities issued an edict imposing quarantine on everyone arriving from abroad. The edict also mandated the creation of checkpoints along the border of the Kiev *guberniya*, where travelers arriving from Turkey were quarantined (Derbek 1905, 82–91).

Despite these measures, the plague reached Russia. According to Derbek, the plague epidemic of Astrakhan was started by a Cossack, one of a group of peasant soldiers responsible for guarding the borders of the empire.[6] He was traveling from the Holy Crucifix Fortress (now the town of Budyonnovsk in Stavropol *krai,* Russia) and died of the disease upon arriving in Astrakhan on September 4, 1727 (Derbek 1905, 82–91). Although the Cossack's body was promptly taken outside the city limits for burial, the disease still spread. Following the recommendations of local doctors, municipal authorities burned the houses of people infected with plague, and everyone infected or suspected of being infected was quarantined. By December 1727, the number of quarantined people reached 116, about 10 of whom died. By January 29, 1728, municipal authorities posted guards at 39 residences that housed plague patients. The accounts of local doctors reveal that all of the isolated patients later recovered. With the arrival of spring, however, the epidemic made a comeback and reached its peak in late June, when more than 50 people died every day. On June 30, 1728, the governor of Astrakhan ordered the immediate evacuation of the entire population to the steppes about seven miles away from the stricken city, which was then sealed off. Before the evacuation, the population was inspected for signs of illness and anyone exhibiting symptoms was separated from the rest and placed in an encampment about a mile away. By August 7, 1728, the epidemic had ended, although isolated cases of plague continued until September 6, 1728. In the final tally, the Astrakhan plague epidemic lasted just over a year and took the lives of about half of the city's population (Derbek 1905, 82–91).

In 1728, in response to the Astrakhan epidemic, the Russian imperial authorities issued several decrees aimed at controlling the future spread of plague. Among these decrees, the *Instructions for Governors and Heads of Townships* (Article 38) required that all governors immediately inform the Senate—a consultative government body created by Peter the Great in 1711 to advise the monarch—if plague cases were detected in their respective *guberniyas*.[7] Furthermore, Article 38 required that governors ensure the physical examination of all persons suspected of carrying the disease and their subsequent isolation. In addition, it was mandated that sites where plague victims were found had to be encircled by checkpoints and quarantined for the duration of the outbreak or epidemic (Derbek 1905, 82–91). The houses of infected persons were to be burned along with all of the personal property they contained, including farm animals and cattle. The governors were instructed to inform the neighboring provinces and cities about every plague case occurring on their territories. If a plague outbreak occurred in a neighboring province, the governors of both the affected and neighboring provinces were instructed to immediately set up roadblocks and checkpoints along the provincial borders. These checkpoints were to remain operational for at least six weeks. Letters brought by couriers were heated above a fire and copied three times. The application by authorities of these combined measures demonstrates their intuitive understanding of the importance of the timely isolation of infected people to limit the spread of plague.

The Russo-Turkish war of 1736–1739 coincided with a plague epidemic that was particularly devastating in Ukraine. In July 1737, a Russian army led by Field Marshal Count B. Münnich successfully stormed the Ochakov fortress (located in present-day Ukraine). For unknown reasons, plague suddenly appeared in the fortress in April 1738. The disease spread quickly to the Kinburn Peninsula (also in Ukraine) and then traveled up the Dnieper River to the Ukrainian Cossack state, known

[6]Cossacks were peasant soldiers in Ukraine and parts of the Russian Empire, who held certain privileges and enjoyed political autonomy in return for rendering military service to the Tsar. The first Cossack companies were formed in the fifteenth century in Ukraine, which at the time was a part of the unified Polish-Lithuanian state, in response to the frequent Tatar raids from the south. By the late eighteenth century Cossacks lost much of their political autonomy and became an elite part of the Russian imperial military forces. Cossack communes were based on the principles of self-governance and political and social equality. Each commune was ruled by an elected leader or ataman, while the large Cossack assembly elected the head of several communes or hetman. By the early twentieth century there were eleven Cossack communes in the Russian Empire, including the Cossack communes in Astrakhan and Tersk (now Krasnoyarsk *krai*). For more information on Cossacks, see: Ure, John. 2002. *The Cossacks: An Illustrated History*. Woodstock, NY: Overlook Press.

[7]Governing Senate was established by the decree of Tsar Peter I (Peter the Great) on February 22, 1711. The Senate replaced the Boyar Duma, which was a consultative body that advised the monarch on policy matters. Initially Senate was a temporary collegial body established for the purposes of ruling the country in the absence of the monarch, when it was authorized to make decisions and issue orders. Originally the Senate was comprised of nine members and secretary, who were appointed by Tsar. The Senate members were selected from the civilian and military officials who belonged to the upper three tiers of the Table of Ranks (*Tabel o rangakh*), which was a formal list of positions and ranks in military, government and judiciary that was introduced by Tsar Peter I in 1722 in an attempt to disrupt the traditional distribution of positions in accordance with hereditary titles of nobility. The influence and importance of the Senate fluctuated considerably in different periods. In 1763 in an attempt to increase the importance of the Senate, it was reformed and divided into six departments, including four that were located in St Petersburg and two in Moscow. The third department was in charge of the peripheries of the Russian Empire, communications, public healthcare, medicine and education. In 1775, however, the Senate's functions became limited to the judicial area. Subsequently with the creation of various state ministries, the Senate became the supreme judicial and oversight body.

as Zaporozhian Host.[8] By July 1738, the Ochakov plague epidemic had been so deadly that only 300 people survived out of the 5,000 composing the five regiments of the Russian army.[9] According to army reports of the time, in May and June 1738 the Russian army stationed in Ochakov lost 1,722 soldiers to plague. Despite quarantine, checkpoints, and roadblocks, traveling Cossacks spread plague across Ukraine and into Malorossia (in present-day eastern Ukraine), where in the month of June, 507 people perished in the towns of Zinkiv and Svatova Luchka (both in the Lugansk *oblast* of modern Ukraine) (Derbek 1905, 91–107).

The commandant of Izum city (in the Kharkiv *oblast* of Ukraine) dispatched Dr. Eshdi, a doctor working at the local hospital, to investigate the outbreaks in Zinkiv and Svatova Luchka. Dr. Eshdi failed to correctly diagnose the plague, however, and as a result the epidemic soon engulfed Izum, where half of the population (6,610 people) perished (Derbek 1905, 91–107).[10] In June 1738, the disease spread to Bahmut (present-day Artemivsk in the Donetsk *oblast*, Ukraine), in August to Pechenegi (in Kharkiv *oblast*, Ukraine), in September to Lebedyan (in Lipetsk *oblast*, Ukraine), and then on to the Belgorod and Kursk *guberniyas* in Russia. From Bahmut, soldiers carried plague to Azov city (present-day Rostov *oblast*, Russia), where several thousand people died. In October 1738, the disease appeared in Kharkiv, where it killed about 800 people in two months (Derbek 1905, 91–107).

At the onset of the epidemic, sanitary rules were frequently violated as relatives and family members were allowed to attend funerals, gatherings that probably contributed to the spread of the disease. However, after Johann Jacob Lerche, an experienced German doctor who had been practicing in Russia since 1731, was dispatched to Kharkiv, the sanitary situation improved (Derbek 1905, 91–107; Chernomorsky 2001). Dr. Lerche immediately ordered local authorities to burn 30 houses in which people had died from plague (Derbek 1905, 91–107). Those infected with the disease were isolated in a field hospital set up outside the city. City residents who were not infected but had been exposed to plague were quarantined in their homes, which were guarded, and had food delivered to them on a daily basis. Because of these stringent quarantine measures, the epidemic soon subsided and by March 20, 1739, the city was reopened. In October, plague appeared in Kursk and three nearby villages, but the timely application of sanitary and quarantine measures halted its spread. In 1740, Russian officials declared that the epidemic had ended.

After the epidemiological emergency was over, Russian authorities ordered doctors who had been involved in the treatment of victims and the enforcement of quarantine to prepare reports detailing the methods that appeared to have been effective in curing the disease and halting its spread. For this purpose, a questionnaire made up of 51 questions was distributed to the relevant doctors so that they could prepare their reports in a standard format. Also during the epidemic, for the first time in Russia, a case of plague was confirmed based on the results of an autopsy performed by the aforementioned Dr. Eshdi in Izum (Derbek 1905, 91–107).

Second Attempt at Institutionalizing Anti-Plague Response Measures: Formation of the First (Non-Permanent) Commission on Plague

The catastrophic effects of the plague epidemic of 1770–1772 in Moscow motivated Russian authorities to once again institutionalize plague control measures. Nevertheless, the road that led to the creation of the first, yet non-permanent, commission on plague was fraught with obstacles because of the reluctance of political and medical figures to recognize the presence of the disease.

During the Russo-Turkish war of 1769–1774, as Russian troops advanced and captured the fortresses of Khotyn (in present-day Chernivtsi region, Ukraine), Zhurzha (the present-day port city of Giurgiu, Romania), and the cities of Iasi (Romania), Bucharest (Romania), Fokshani (Romania), and Galatz (Romania), they entered areas where cases of plague had been reported by locals, who referred to the disease as the "deadly ulcer" (*morovaya yazva*). Russian soldiers contracted the disease from infected prisoners of war and plundered booty. The first signs of plague appeared in the Moldovan cavalry corps headed by General Von Shtoffeln after the corps occupied Iasi in January 1770. What appeared to be a case of bubonic plague spread from infected patients at a military field hospital to a wounded soldier, and then to the rest of the city. Fearing the wrath of Empress Catherine II (Catherine the Great) for failing to provide adequate sanitary protection for his troops, Von Shtoffeln coerced the local doctors to conclude that the deadly disease was a malignant fever and not plague. Only later, when Count (*graf*) Rumyantsev dispatched Gustav Orreus, a talented Russian doctor of Finnish origin, to investigate the disease, was it established that the outbreak was indeed plague. Belatedly, following the advice of Dr. Orreus, Von Shtoffeln ordered the isolation of all plague-infected patients in a separate hospital. Those who were suspected of having become infected were isolated in yet another hospital. However, after the general refused to withdraw his forces from the city, many of his troops became infected, including the general himself, who died in late May 1770. Only 300 of the 1,500 patients received at the hospital between May 18 and August 18, 1770, survived. Subsequently, the disease spread to Moldavia, Walachia, Transylvania, Poland, and, by the summer of 1770, to Ukraine, from where it threatened the central regions of Russia (Derbek 1905, 107–40; Domaradskij 1998, 12).

Not only were the Russian authorities late in responding to the threat, but complicating matters, Empress Catherine II

[8]Zaporozhian Host was the Cossack name for the Ukrainian Cossack State, which existed from 1648 to 1782 and incorporated most of the central part of present day Ukraine as well as parts of Byelorussia.

[9]Each regiment (*polk*) in the Russian Imperial Army at the time consisted of 1,000 soldiers.

[10]According to Derbek, the incorrect diagnosis of the initial cases of plague was one of the reasons for the subsequent epidemic.

herself refused to publicly acknowledge that the epidemic was caused by plague, even though in her private correspondence with the general-governor of Moscow, Count P.S. Saltykov, she had alerted him about the necessity of taking preventive epidemiological control measures against the disease (Korostelev 2000).

Plague cases began to appear in Moscow in November 1770. On December 21, 1770, the chief physician of the Moscow General Hospital, Dr. A.F. Shafonskiy, correctly diagnosed bubonic plague and promptly reported this alarming finding to A. Rinder, a German doctor who was in charge of overseeing all public health services in the city (Korostelev 2000; Oborin No date).[11] But Rinder mistrusted the judgment of the Russian doctor and ignored his report, an action that the renowned Russian medical historian, Ya.A. Chistovich later called a fatal mistake that contributed to the spread of the disease (Korostelev 2000).

The Moscow Medical Council, which was composed of nine prominent doctors including Shafonskiy and Rinder, was convened the next day. Its members recognized that plague was present in the city and immediately informed Count Saltykov and the Senate of Russia in St Petersburg (Oborin No date). Following this development, the Moscow General Hospital was encircled by troops for additional protection. However, the conflict between Shafonskiy and Rinder continued to play out, and on January 21, 1771, Rinder made an official statement rescinding the opinion of the Medical Council and claiming that the disease being treated at the Moscow General Hospital was not "true pestilence" or plague (Oborin No date). On February 5, 1771, Shafonskiy responded by submitting a comprehensive report that he had written to Moscow general-governor Saltykov in which he refuted Rinder's arguments. For unexplained reasons, however, the authorities believed Rinder's version and were less alarmed with the situation on the ground (Oborin No date).

On March 10, 1771, K. Yagelskiy discovered incontrovertible evidence of plague in the center of Moscow, which was examined and confirmed by Shafonskiy. Moscow municipal authorities then reluctantly began to implement epidemiological response measures, including the setting up of field hospitals at the Nikolo-Ugreshsk, Simonov, and Danilov monasteries, located in different boroughs of Moscow (Korostelev 2000).[12] The controversy over the epidemic's origins was resolved in early summer when the epidemic claimed the life of Dr. Rinder, who had contracted plague from one of his patients. Shafonskiy then assumed the leadership of the Medical Council. On August 19, 1771, municipal authorities issued an order prohibiting public gatherings and shutting down inns, shops, taverns, and manufacturing facilities of different kinds (Oborin No date). The city was placed under quarantine.

In September 1771, the plague epidemic in Moscow reached colossal proportions. During the single month of September, 20, 401 people perished. According to Domaradskij (1998), about three-fourths of Moscow's population fled the city. Russian authorities implemented strict measures aimed at stemming the spread of the disease and restoring order, but the population feared the destruction of contaminated property and actively resisted by hiding infected people and concealing dead bodies. Moscow residents buried the dead in the courtyards of their houses at night, hid them in cellars, threw them into wells, or simply abandoned them in the streets (Oborin No date).

The State Council decided to implement additional measures to prevent plague from spreading to St. Petersburg, then the capital of the Russian Empire.[13] In particular, the State Council appointed the aforementioned Dr. Lerche as Moscow's chief sanitary inspector. Dr. Lerche's first orders were to quarantine all infected people and to prohibit all public gatherings, including a ban on religious ceremonies and the closing of all churches in the city. Accompanied by his assistants, Dr. Lerche toured the city daily to ensure the proper enforcement of epidemiological control measures (Chernomorsky 2001). Nevertheless, the imposition of quarantine measures and the banning of church services infuriated the public. On September 15, 1771, growing public dissatisfaction culminated in massive riots that became known as the Plague Revolt (*chumnoy bunt*). The unrest lasted for three days, during which the rioters destroyed quarantine checkpoints and looted the houses of nobility (Derbek 1905, 107–140; Shirokogorov 1933, 9). In the ensuing chaos, Archbishop of Moscow Amvrosi was killed by an angry mob after he demanded that a religious icon and the box of donations be removed from one of the city's gateways where crowds had gathered to pray (Amvrosi's action is believed to have been intended to prevent the worshipping crowds from facilitating plague transmission). Finally, the empress decided to quell the riots and dispatched four regiments of Russian imperial guards led by Count G.G. Orlov to restore order to the devastated city (Domaradskij 1998; Korostelev 2000).

Count Orlov, accompanied by Dr. Orreus, arrived in Moscow on September 26, 1771, and immediately summoned all of the doctors in Moscow to an emergency meeting to assess the situation (Derbek 1905, 107–140; Domaradskij 1998, 12; Korostelev 2000). The doctors confirmed that both bubonic and septicemic plague were present in the city. They also discussed existing preventive measures, including taking frequent baths, wearing clothes soaked in vinegar, and isolating persons suspected of being infected. After conferring with the doctors, on September

[11]Rinder was known as a "stats-physician." The prefix "stats," which was originally derived from German language, was widely used in the Tsarist Russia to designate high ranking civilian and military officials.

[12]It must be noted that the field hospital at the Simonov monastery had the capacity to house 2,000 patients.

[13]The State Council was a supreme consultative body, which discussed the draft legislations introduced by the ministers before they were approved by the monarch. The Council also possessed jurisdiction to review complaints directed against the Governing Senate and other executive bodies of power. The Chairman and other members of the State Council were appointed by the monarch. The State Council consisted of several departments and the State Chancellery, which was headed by the State Secretary.

30, 1771, Orlov issued an official statement acknowledging that a plague epidemic was present in Moscow and outlining measures to prevent the further spread of the disease. On October 6, 1771, he convened the doctors again and created the *Commission for Preventing and Curing the Deadly Ulcer* (*Kommissia dlia predokhranenia i vrachevania ot morovoi yazvi*), which was mandated to develop methods to prevent the spread of plague and to cure infected people. During this meeting, Orlov admonished the doctors and pointed out that their initial failure to diagnose plague correctly and their subsequent disagreements about the origins of the epidemic had led to devastating consequences for Moscow's population (Korostelev 2000). The commission met daily throughout the duration of the epidemic. One of the tangible results of these meetings was the issuance of instructions for doctors entitled *Brief Announcement: Methods to Identify, Treat and Prevent the Deadly Ulcer* (*Kratkoye uvedomleniye, kakim obrazom poznavat morovuyu yazvu, takzhe vrachevat i predokhranyat ot onoy*).

Orlov should also be credited with implementing innovative solutions aimed at eliciting public support for epidemiological response measures. In particular, monetary incentives were established for those who voluntarily underwent quarantine: five rubles for unmarried individuals and 10 rubles for married people, along with a set of new clothes. In addition, Orlov disbursed financial rewards to those who informed the authorities about people who concealed that they were infected or who sold clothing that had been worn by plague victims. The rewards ranged between 10 and 20 rubles, which at that time represented substantial sums of money for the impoverished population of Moscow (Derbek 1905, 107–140; Domaradskij 1998, 12; Korostelev 2000). Simultaneously, quarantine methods were continually improved throughout the plague epidemic. For instance, quarantine time periods of different lengths were imposed on people who had been in the same room with a sick person, as compared with those who had only visited an infected area (Stavskiy et al. 2002, 32).

Shortly after Orlov's arrival in Moscow, the effective implementation and coordination of preventive epidemiological control measures dramatically improved the situation. In October of 1771, the death toll had stood at 17,651, but by November it had decreased to 5,235, and in December to 805, while in January of 1772 it stood at 330 (Derbek 1905, 107–140; Domaradskij 1998, 12; Shirokogorov 1933, 9; Vysotskiy et al. 1897, 33–38; Korostelev 2000). On November 15, 1771, Empress Catherine II announced that the Moscow plague epidemic was over. The commission, however, continued to function until September 6, 1775, when it was disbanded by imperial decree (Korostelev 2000). According to some estimates, the epidemic took the lives of about 52,000 inhabitants out of a population of 300,000 (Derbek 1905, 107–140; Domaradskij 1998, 12; Shirokogorov 1933, 9; Vysotskiy et al. 1897, 33–38). According to other estimates, it claimed somewhere between 60,000 and 100,000 lives (Korostelev 2000).

Creation of a Network of Quarantine Checkpoints and Quarters

The persistent belief in the foreign origins of plague prompted Russian authorities to consider setting up a system of sanitary protection at the state borders. In 1775, the Senate established regular frontier quarantine posts in the Kiev and Smolensk *guberniyas*. An edict issued by the Senate in 1786 contained specific provisions outlining the duties of officials at the frontier quarantine stations, including instructions for isolating and quarantining sick individuals and those persons who were suspected of having been in contact with them. On July 7, 1800, the Senate approved the *Regulations for Frontier and Port Quarantines*, which elaborated in detail the quarantine requirements that Russian officials were to follow to ensure the sanitary protection of the borders (Derbek 1905, 107–140; Domaradskij 1998, 12; Shirokogorov 1933, 9; Vysotskiy et al. 1897, 33–38).

The network of border quarantine posts was enlarged later on, after a series of plague outbreaks in the Caucasus. The Transcaucasus region (encompassing present-day Armenia, Azerbaijan, and Georgia), which had been incorporated into Russia only in the second half of the nineteenth century, was especially affected by plague. Situated at the intersection of important commercial routes between Europe and Asia and crisscrossed by frequent military campaigns, this region was vulnerable to the importation of various deadly diseases, including plague. Thus, in the nineteenth century, plague outbreaks occurred with some frequency and killed thousands of people in cities across the Caucasus, including Shemakha (present-day Samaxi), Ganja and Baku in Azerbaijan; Gyumri, Karakilisa, Alaverdi, Echmiadzin, Amamlu, and Yerevan in Armenia; and Telavi, Signakhi, Gori, Kutaisi, Batumi, Dusheti, Anauri, and Tbilisi in Georgia (CNS 2003a, 5). Fearing the spread of plague to Russia proper, the imperial military and civilian authorities set up special quarantine checkpoints (*karantinniye zastavy*) in several regions of Georgia (Surami, Tsalka, and Akhaltsikhe) and Armenia (Karakilisa) in 1803 (CNS 2003a, 5; Stavskiy et al. 2002, 33).

By 1810, the forts constituting the Caucasus defense line (*Kavkazskaya oboronitelnaya liniya*) housed 15 quarantine quarters (*karantinniye dvory*) (CNS 2003b, 6–7).[14] All military personnel and civilians departing from the Caucasus en route to Russia had to pass through these quarters. The quarantine requirements were strictly enforced and those who violated them were subject to capital punishment. Personnel at the quarantine quarters followed rigorous reporting requirements, which entailed the frequent submission of activity updates directly to the governor of the Caucasus region or the commander-in-chief of the Russian armed forces in the Caucasus. Such reports often included analyses of the epidemiological situation

[14]The Caucasus defense line was a system of defensive fortifications in the North Caucasus that was intended to protect the southern parts of Russian Empire from the attacks by the Caucasian highlanders and Turkey in the eighteenth and nineteenth centuries. It stretched along the North Caucasus from Kizlyar on the Caspian Sea in the east to Anapa on the Black Sea coast in the west.

in the area with respect to emerging "suspicious diseases" as well as proposals for stemming their spread (Stavskiy 2002, 33).

II. ESTABLISHMENT OF THE FIRST PERMANENT ORGANIZATIONS SPECIALIZING IN PLAGUE CONTROL IN THE RUSSIAN EMPIRE

The advancements in science and the practical medical and sanitary experience accumulated over the years by native and foreign experts led the Russian government to grasp the importance of consolidating its medical and scientific resources in specialized institutions to promote further progress in combating plague. As a result, several permanent organizations specializing in plague research were created, forming the main contours of the future Soviet AP system. By the time of the 1917 Bolshevik Revolution, the nascent AP infrastructure of Russia consisted of an oversight commission, the *Special Commission for the Prevention of and Fight against Plague* (KOMOCHUM), one specialized research institute (the Imperial Institute of Experimental Medicine or IIEM and its AP laboratory at Fort Alexander I), 10 AP field laboratories, and several medical observation posts at select border points and maritime ports (Stavskiy 2002, 33). In addition, research at these specialized organizations led to discoveries about the occurrence of plague in Russia and gave rise to public health measures that would later be implemented and developed in the Soviet Union.

Creation of the Core Research Infrastructure

The Imperial Institute of Experimental Medicine

The creation of a permanent infrastructure specializing in plague research started with the establishment of the IIEM on December 8, 1890. Located in St. Petersburg, the IIEM was not only the first organization specializing in AP research but also the first scientific research institute of Russia. Its main objective was to determine the causes of plague as well as other highly infectious diseases and to develop new methods for treating them. The institute housed a unique scientific library, which has been largely preserved to this day (IEMRAMS No date).

The opening of the institute would not have been possible without the vigorous efforts of Prince A.P. Oldenburgskiy, who became its trustee and oversaw most of the institute's activities. From the outset, Prince Oldenburgskiy invited the best specialists and prominent scientists to join the institute. By 1891, the organizational structure of the institute was comprised of six scientific departments: the physiology department, headed by I.P. Pavlov; the chemistry department (M.V. Nencki); the bacteriology department (S.N. Vinogradskiy); the pathologic anatomy department (N.V. Usakov); the syphilology department (E.F. Shperk); and the epizootiology department (K.Ya. Gelman) (IEMRAMS No date). Later the Pasteur vaccination station, also located in St. Petersburg and founded by Prince Oldenburgskiy in 1886, joined the institute as a vaccination department headed by Dr. V.A. Krayushkin (Grekova & Golikov 2001).

Creation of the Special Commission for the Prevention of and Fight against Plague (KOMOCHUM)

The discovery of the causative bacterium of plague,*Y. pestis,* by the French bacteriologist Alexandre Yersin in 1894 prompted Russian imperial authorities to establish a new organization dedicated to anti-plague studies. On January 11, 1897, Emperor Nicholas II issued an edict establishing the *Special Commission for the Prevention of and Fight against Plague,* also known by its Russian acronym KOMOCHUM (Onishchenko et al. 1999).[15] The commission was both an oversight organization that issued rules related to work with plague and a research organization that conducted studies in this field.

In accordance with the imperial edict, Prince Oldenburgskiy was appointed chairman of the commission. His deputy on financial matters was the imperial Minister of Finances S.Yu. Vitte, while his deputy on scientific matters was Dr. A.A. Vladimirov, the head of the department of epizootiology at the IIEM (*The Plague Fort*).

Originally, KOMOCHUM was based at the IIEM; however, it was clear from the outset that KOMOCHUM scientists needed a separate laboratory facility where scientific work on plague would be conducted under safe conditions. Thus, on January 26, 1897, Prince Oldenburgskiy received permission from the military minister to set up laboratory facilities at the former naval fortress Fort Alexander I—then used as an ammunition storage depot—located on an artificial island in the Gulf of Finland (*The Plague Fort*; *Northern Fortresses*).[16] While Fort Alexander I was being remodeled to house a bacteriological laboratory complex, KOMOCHUM temporarily used two auxiliary buildings at IIEM for the production of plague and cholera vaccines (*The History* . . .). After its completion, the Fort Alexander I laboratory was officially named the *Special Laboratory of the Imperial Institute of Experimental Medicine for Production of Anti-plague Preparations* (*Osobaya laboratoriya Imperatorskogo instituta eksperimentalnoy meditsiny po zagotovleniyu protivochumnykh preparatov*). By a decision of KOMOCHUM of May 13, 1898, Dr. M.G. Tartakovskiy, then deputy head of the department of epizootiology at IIEM, was appointed director of the newly built laboratory complex at Fort Alexander I (*The Plague Fort*).

After the laboratory at Fort Alexander I became operational, KOMOCHUM decided to restrict research on plague and issued an order on August 22, 1899 stating that experiments and studies of bubonic plague were to be conducted exclusively at the Fort

[15]The Russian acronym KOMOCHUM stood for *Osobaya komissiya dliya preduprezhdeniya chumnoi zarazy i borby s neyu v sluchaye eyo poyavleniya v Rossii*.

[16]The Fort Alexander I was built in 1838–1845 by colonel Fan der Veide on an artificial island in the Gulf of Finland close to the naval fortress of Kronstadt. Fort Alexander I was designed to protect the southern waterway to St. Petersburg by coordinating cross-fire with forts Peter I, Risbank, and Kronshlot. With the development of modern artillery ordinance in the 1860s, Fort Alexander I lost much of its military value. Thereafter, it was used largely for the storage of ammunition and sea mines. It was officially decommissioned and excised from the register of fortresses in 1896.

Alexander I facilities. All plague-related activities at other institutions in St. Petersburg, including the IIEM, were prohibited. As a result, IIEM researchers had to travel to the fort to conduct their studies in this secure area.

Isolated from the Russian mainland by water, Fort Alexander I was an ideal location for scientific work on plague. Communication with the mainland was maintained via a small steamship named *Mikrob* (*The Plague Fort*). Access to the fort was restricted and all visitors had to carry a pass specifying the purpose and duration of their stay. Gendarmes ensured the physical security of the site and, according to an article published in the *Niva* journal in 1907, no visitor was allowed to stay on the island after sunset. Because of this rigorous security regime, no case of unauthorized access to the laboratory facilities was reported throughout the existence of the AP laboratory at Fort Alexander I (Eizen 1907).

According to the memoirs of the fort's last director, Dr. A.N. Cherventsov, the AP laboratory was very well equipped. It had two main parts: the contagious ward (*zaraznoye otdeleniye*) and the non-contagious ward (*nezaraznoye otdeleniye*). The non-contagious ward included a vivarium that housed laboratory animals, including monkeys, rabbits, mice, guinea pigs, and deer. The main laboratory animal, however, was the horse, as it provided the large volume of blood necessary for the production of AP serum (*The Plague Fort*). The facility had stables that could accommodate 16 or more horses. The fort was also equipped with an equestrian riding ring in its inner court and an elevator designed to lift the horses into the laboratory.

Personnel at Fort Alexander I were subject to strict safety rules while working in the contagious ward. Thus, all medical personnel had to wear rubber-lined capes that were worn on top of the laboratory uniform and special trousers tucked into rubber boots. Laboratory assistants used mercury dichloride as the main disinfectant in their daily work (*The Plague Fort*). Internal safety procedures required the immediate isolation of any staff member exhibiting the symptoms of plague. Those suspected of having contracted the disease remained in an isolation area, separated from the rest of the facility by an elaborate system of hermetically sealed doors. Food was delivered to the isolation area through a small window in the door. A physician and a nurse would monitor the condition of the quarantined patients from a room adjacent to the isolation area, and only doctors were allowed to enter the isolation area. In spite of these strict safety measures, two physicians—Drs. V.I. Turchaninov-Vyzhnykevich and M.F. Shraiber—became infected with plague and died in 1904 and 1907, respectively (Eizen 1907).

Fort Alexander I offered good living conditions for its personnel, with every staff member having a private room. The facility also included a library, a billiard room, guest rooms, and a conference room. The fort housed a collection of scientific materials, including preserved organs of diseased animals and a vast number of parasites, thought to be plague vectors, extracted from animals (*The Plague Fort*). Students who enrolled at IIEM bacteriological courses frequently visited the fort to gain practical laboratory experience. Although there is no reliable information on the number of people employed at Fort Alexander I, the scientists who worked there included A.A. Vladimirov, V.I. Turchaninov-Vyzhnykevich, M.G. Tartakovskiy, N.M. Berestenev, I.Z. Shurupov, A.I. Berdnikov, M.F. Shraiber, A.N. Cherventsov, V.I. Isayev, I.I. Shushkevich, and L.V. Podlevskiy (*The Plague Fort*).

In addition to researching plague, medical personnel at the fort worked directly with pathogens that cause other especially dangerous diseases, such as cholera, anthrax, spotted typhoid, paratyphoid fever, tetanus, and scarlet fever. Thus it was that between 1898 and 1917, the AP laboratory manufactured 1,103,139 vials of sera against staphylococcal and streptococcal infections, tetanus, and scarlet fever (*The Plague Fort*). The laboratory also produced 4,795,384 cubic centimeters of plague vaccine, 2,343,530 cubic centimeters of plague serum, 1,999,097 cubic centimeters of cholera vaccine, and 1,156,170 cubic centimeters of cholera serum (*The Plague Fort*). Further, the laboratory produced sufficient typhoid vaccine to treat 1,230,260 people. Vaccines and sera produced at the laboratory are said to have been responsible for helping stop several cholera epidemics, epidemics of spotted typhoid and paratyphoid fever, practically all plague outbreaks in the Volga and Transcaucasus regions, and plague epidemics in Odessa and the Far East (*The Plague Fort*). Some sera and vaccines produced at the fort were exported.

Creation of a Network of Anti-Plague Laboratories and the Discovery of Hosts

Under IIEM auspices, KOMOCHUM regularly organized expeditions to study plague and cholera in regions where these diseases were endemic. Headed by one of the founders of Russian and later Soviet microbiology, Dr. D.K. Zabolotniy, these expeditions traveled not only to the far reaches of Russia, but also to such foreign nations as India, Persia, China, and Mongolia (*The History . . .*). In particular, KOMOCHUM teams of scientists traveled to the steppes of the Astrakhan *guberniya*, where plague cases often occurred (Domaradskij 2003, 4; *The History . . .*).[17] These expeditions resulted in the collection of data that advanced studies of the environmental factors contributing to plague outbreaks and epidemics. The concentration of human plague cases in particular geographic areas prompted the leadership of KOMOCHUM and the administration of IIEM to consider setting up AP laboratories in close proximity to these sites. As a result, the first AP laboratory in the European part of Russia was established in 1901 in Astrakhan (Ioshko 2001).

In addition, various plague epidemics in western Kazakhstan prompted the creation of five AP laboratories: in Novaya Kazanka in 1902, Urdinsk (present-day Urda) in

[17]In the aftermath of a small plague outbreak in the village of Kolobovka in 1899, which took the lives of 23 people, KOMOCHUM scientists clinically proved that the plague was of a pneumonic variety. This diagnosis was also confirmed by performing appropriate bacteriological analysis.

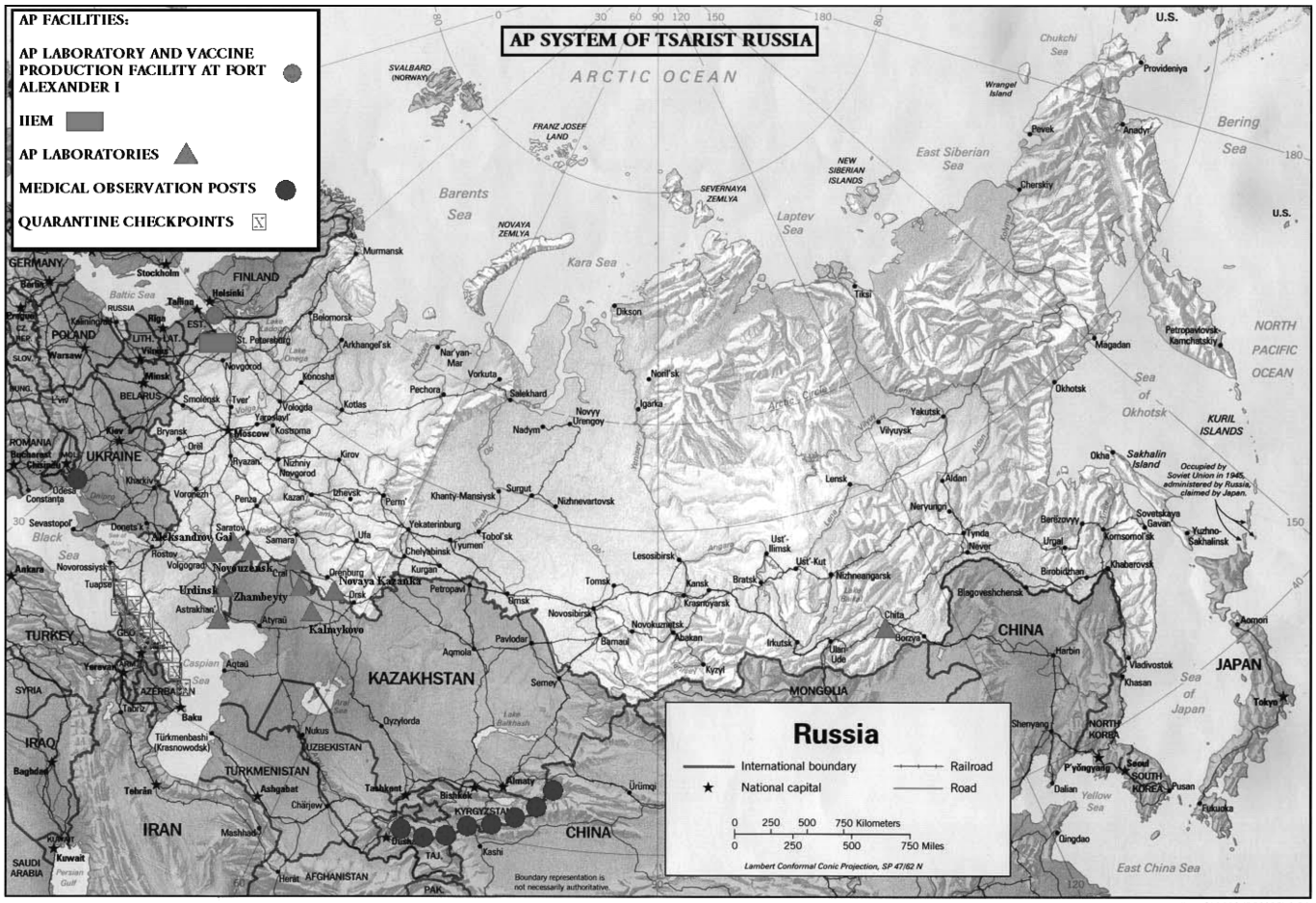

FIG. 1. The AP System of Tsarist Russia. (The map "Russia (Shaded Relief) 1994" is a courtesy of the Perry-Castañeda Library Map Collection, University of Texas, Austin, ⟨http://www.lib.utexas.edu/maps/commonwealth/russia_rel94.jpg⟩).

1909, Zhambeyty and Uralsk (present-day Oral) in 1912, and Kalmykovo in 1913 (Domaradskij 2003, 7; CNS 2003b, 7). In Russia, AP laboratories were established in Aleksandrov-Gay (Saratov *oblast*), Novouzensk (Saratov *oblast*), Tsarytsino (Volgograd), and Chita (Siberia) in 1913 (Domaradskij 2003, 9). This network of laboratories represented in embryonic form what would later evolve into a web of AP stations covering the southern and southwestern regions of the Soviet Union (see Figure 1).

Central to understanding plague outbreaks was the question of why the plague appeared to be endemic in certain areas and not in others. In December 1911, at a convention organized in Astrakhan, doctors debated this issue extensively (Zabolotniy 1956, 249). To be sure, there was a common suspicion that the main natural hosts for *Y. pestis* were the susliks (*Citellus suslica*), a type of rodent that populated the Astrakhan steppes in large numbers, but at that time there was no evidence to back this hypothesis. After a series of unsuccessful attempts at isolating *Y. pestis* from susliks, the first suslik hosting *Y. pestis* was discovered in October 1912 by Dr. I.A. Deminskiy. This discovery came at a high price, as Dr. Deminskiy contracted the pneumonic form of plague while isolating the pathogen from the body of the diseased suslik, and soon died (Ioshko 2001, 21).[18]

By the end of 1912, D.K. Zabolotniy had developed a plan for scientific studies that aimed to clarify the factors of plague endemicity in the Astrakhan *guberniya*. From 1913 onward, IIEM assumed primary responsibility for overseeing studies in the Astrakhan province. To achieve this objective, in March 1913, IIEM organized and dispatched to the province 10 scientific teams that were well equipped with the necessary laboratory and field equipment (Problems . . . 1968; Zabolotniy 1956, 249).

[18]The death of Dr. Deminsky is an illustrative example of the selfless dedication to science. Even on his deathbed Deminsky was more concerned with conveying valuable scientific information to his colleagues than his own well-being. In his final telegram Deminsky wrote: "I contracted the pneumonic form of plague from the susliks. When you arrive take the cultures that I had isolated. All the laboratory records are in order. The rest you will be able to find out from the laboratory. My body should be examined as an experimental case of a human contracting the plague from suslik. Goodbye."

Field research was not limited to the European part of Russia. In fact, in 1914 the discovery of a second group of natural plague hosts, marmots (*Marmota sibirica*), resulted from the pioneering scientific research of Dr. Tikhomirov, who was dispatched by IIEM to Kyrgyzstan to investigate annual plague outbreaks among local inhabitants (CNS 2003b, 1).

As scientific teams identified the boundaries of epizootic areas in the Astrakhan and Saratov *guberniyas*, as well as in the Uralsk and Don *oblasts*, it became clear that plague was endemic in the southeast part of European Russia. At a convention of plague specialists in Saratov in 1914, scientists were unanimous about the need to establish AP research institutes in proximity to natural plague foci (Domaradskij 2003, 10). Saratov was considered the most suitable location for an institute because it was situated on the Volga River, thus providing access to riverine transportation, and because it was an important railway hub. Nevertheless, Russia's entry into World War I and the subsequent social and political unrest that culminated in the Bolshevik Revolution of 1917 significantly delayed these plans.

Creation of Medical Observation Outposts at Borders and Ports

Observation stations at borders and ports were the third component of the imperial AP system. The decision by the Odessa city council (*duma*) and provincial administrative assembly (*zemstvo*) to establish a bacteriological observation station at the Odessa maritime port to monitor the epidemiological situation in the port area and prevent the importation of plague and other dangerous diseases can be considered the first effort to create a permanent AP station.[19] The city council passed the relevant resolution on May 21, 1886, and the observation station was established shortly thereafter, making it the first permanent AP facility in Russia (Ukraine Ministry of Health 2003, 2). The founders of the station included three prominent Russian scientists: I.I. Mechnikov, N.F. Gamaleya, and Y.Y. Bordakh. Soon thereafter, similar bacteriological stations were created in Kiev (1886), Yekaterinoslavl (1897), and Chernigov (1897). It must be noted that local provincial or district governments provided the funding for these stations (Onishchenko 2003, 107).

Ten years later, at the end of 1896, the Russian imperial authorities in Central Asia received news of large plague outbreaks in neighboring Iran, Afghanistan, and China and decided to set up eight medical observation outposts (*vrachebno-nablyudatelniye punkty*) along the border between the Semirechinsk *oblast* and China. The first such outpost was opened on February 6, 1897, in the village of Atbashi (Naryn *oblast*, Kyrgyzstan), located at the foothills of the Tien Shan mountain range (Kyrgyzstan AP specialist 2003). These outposts monitored the epidemiological situation and conducted surveys of human plague cases in the areas adjacent to the border. Due to the size of the geographic area covered by Russia, however, the response to plague outbreaks was not always timely and sufficient. Thus, in 1898, a plague epidemic in the villages of Marzich and Anzob (Aini district) in Tajikistan killed almost 90 percent of their populations before the Turkestani general-governor managed to stem the spread of the disease by instituting and enforcing strict quarantine measures (Tajikistan AP specialist 2003).

[19] Zemstvo in the Tsarist Russia was an elective district or provincial administrative assembly that was a local form of government.

CONCLUSION

The preceding discussion demonstrates that the evolution of epidemiological and quarantine measures into an organized system of AP institutions in Russia did not occur until the late nineteenth century and the beginning of the twentieth century. Several factors account for the slow pace of progress. First, the biggest impediment to the creation of a permanent AP system was the lack of knowledge of the etiology of plague. For centuries the prevalent belief in the Russian scientific and medical communities was that plague was an exotic disease that originated in foreign countries and was imported to Russia as a result of commerce and military campaigns. This misconception explains why the imperial authorities paid so much attention to strengthening the sanitary protection of the frontiers and ports. Second, response measures devised by the Russian authorities lasted only for the duration of an outbreak or epidemic. Third, the accumulation of scientific knowledge concerning the origins of plague was a protracted process complicated by frequent errors of judgment. However, by perfecting the application of basic epidemiological measures, such as the imposition of quarantine on affected areas and the isolation of infected people, Russian doctors slowly gained insights into the mechanisms of disease transmission. This slow progress eventually led to a breakthrough: the discovery of how plague bacteria are transmitted to humans through natural reservoir hosts and flea vectors. This development stimulated further achievements in epidemiology and bacteriology.

The recognition of the devastating economic and social consequences of plague epidemics prompted Russian imperial authorities to consolidate scientific and medical resources into specialized research institutions devoted to protecting the public health from dangerous infectious diseases. Thus, on the eve of the 1917 Bolshevik Revolution, Russia possessed a network of AP facilities that consisted of a plague vaccine production facility, a centralized research laboratory, and a small network of field stations specializing in disease monitoring. The turmoil of the Bolshevik Revolution and the Civil War that followed nearly brought an end to this AP system, but its components survived and, indeed, were rebuilt into a more sophisticated system under the Soviet rule.

REFERENCES

Center for Nonproliferation Studies (CNS). 2003a. Anti-plague Service of Armenia (in Russian). Monterey: Center for Nonproliferation Studies.

———. 2003b. Preliminary Report on the Anti-plague System of Central Asia, the Caucasus, and Kazakhstan (in Russian). Monterey: Center for Nonproliferation Studies.

Chernomorsky, Pavel. 2001. German in Russia: Wise Foreigner (in Russian). *Russkii Zhurnal* (October 5). Available at: http://www.russ.ru/politics/20011005-cher-pr.html.

Derbek, F.A. 1905. *The history of plague epidemics in Russia from the foundation of the state until present* (in Russian). St. Petersburg.

Domaradskij, Igor V. 1998. *Plague* (in Russian). Moscow: Izdatelstvo Meditsina. Available at: http://domaradsky.h1.ru/Plague_book.htm.

Domaradskij, Igor V. 2003. Plague in the European Part of Russia (commissioned report, in Russian). Moscow.

Eizen, I. 1907. The heroes of duty (in Russian). *Niva* 15. Available at: http://www.nortfort.ru/alexander/foto_n1.html.

Fort Aleksander I: History. *Northern Fortresses*, Undated. Available at: http://www.nortfort.ru/alexander/index_e.html.

Gabrichevskiy, G.N. 1904. *Bubonic plague and the means to combat it* (in Russian). Moscow.

Gottfried, Robert S. 1985. *The Black Death: Natural and Human Disaster in Medieval Europe*. New York: The Free Press.

Grekova, T.I., and Yu. P. Golikov. 2001. Institute of Experimental Medicine of Russian Academy of Medical Sciences. In T.I. Grekova and Yu.P. Golikov eds. *Medical St. Petersburg* (in Russian). St. Petersburg: Folio-Press. Available at: http://www.medline.ru/public/histm/medmono/100/21.phtml.

Institute of Experimental Medicine of the Russian Academy of Medical Sciences (IEMRAMS). *Organization of the Institute: 1885–1890*, Undated. Available at: ⟨http://www.iemrams.spb.ru:8100/english/histiem.htm⟩.

Ioshko, V. 2001. Silent Heroism: In dedication to 100th anniversary of the Astrakhan anti-plague station (in Russian). *Volga* 130 (24051; September 5). Available at: http://volga-astrakhan.ru/index.php3?act=paper&n=24051

Korostelev, N.B. 2000. Wrathful Tsarina in Moscow: Plague epidemic of 1770–1772 and the struggle with it (in Russian). *Moskovskiy Zhurnal* 12; December. Available at: http://mj.rusk.ru/show.php?idar=800340

Kyrgyzstan AP specialist. 2003. Personal communication.

Oborin, Mykola. 1998. A View on Treatment of Patients with Plague and Its Prophylaxis in Ukraine and Russia in the 18th Century (in Russian). *Agapit* 9–10. Available at: http://www2.histomed.kiev.ua/agapit/ag56/ag56-20e.html.

Onishchenko, G.G., Monisov, A.A., Federov, Y.M., Kutyrev, V.V., and Kokushkin, A.M. 1999. Stages of Development of Russia's plague control service (in Russian). *Meditsinskaya Parazitologiya i Parazitarnyye Bolezni* No. 4:3–6.

Problems of Especially Dangerous Diseases (in Russian). 1968. The Scientific Journal of the All-Union Scientific-Research Anti-Plague Institute Mikrob in Saratov, Russian Federation 1.

Sharov, Andrey. 1996. Life Threatening: Are we economizing on plague? (in Russian). *Rossiyskaya Gazeta*, 21 June.

Shirokogorov, I.I. 1933. *Plague* (in Russian). Baku, Azerbaijan Soviet Socialist Republic.

Spencer, Jack, and Michael Scardaville. 2001. Understanding the Bioterrorist Threat: Facts and Figures. *Backgrounder* (Heritage Foundation) 1488. (11 October). Available at: ⟨http://www.heritage.org/Research/NationalSecurity/BG1488.cfm⟩.

Stavskiy, E.A., Cherny, N.B., Chepurnov, A.A., and Netesov, S.V. 2002. Anthology of Some Biosafety Aspects in Russia (up to 1960). In: Richmond, Jonathan Y., ed. *Anthology of Biosafety: BSL-4 Laboratories*, Vol 5. Mundelein, IL: American Biological Safety Association.

Tajikistan AP specialist. 2003. Personal communications.

Tarkhov, S. 2001. Changes in the administrative-territorial division of Russia over the last 300 years (in Russian). *Geografia* 15. Available at: http://geo.1september.ru/2001/15/2.htm.

The History of Institute of Experimental Medicine of the Russian Academy of Medical Sciences. Undated. Available at: http://www.medline.ru/medhistory/medbuildings/iem1his.shtml

The Plague Fort: Special Laboratory of the Institute of Experimental Medicine (in Russian). Undated. Institute of Experimental Medicine (St. Petersburg) of the Russian Academy of Medical Sciences. Available at: http://iemrams.spb.ru:8100/russian/fort.htm.

Ukraine Ministry of Health. 2003. *I.I. Mechnikov Anti-Plague Scientific and Research Institute of Ukraine* (in Ukrainian). Odessa, Ukraine: Ukraine Ministry of Health.

Vysotskiy, N.O., Liyubimov, N.M., and Kotovshchikov, N.I. 1897. *The Lectures on plague read for students and doctors at the Imperial Kazan University* (in Russian). Kazan: Typo-lithography of Kazan University.

Zabolotniy, D.K. 1956. *Selected Works* (in Russian). Vol. 1. Kiev, Ukraine Soviet Socialist Republic.