

**“Geo-epidemiology, Chemistry, and Cholera: The Environmental Approach to Cholera in
Tsarist Russia, 1892-1905”**

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Introduction

On November 8, 2011 a news release of the American Broadcasting Company featured the headline: “Report: UN Peacekeepers Caused Cholera Epidemic in Haiti.” An advocacy group charged that the more than 457,000 victims of the epidemic, 6,477 who died, were “a product of the UN’s multiple failures,” and filed a legal petition on their behalf. The affidavit alleged that UN personnel from Nepal caused raw sewage to pollute the largest river in the country; that responders exhibited callous indifference toward the native population; and that troops from Uruguay brutally assaulted a Haitian man. Emphasizing the difficulty of eradicating cholera once it is introduced into a location, the complaint projected that the epidemic would continue unabated for years.¹ Undertaken in the aftermath of a devastating earthquake, the problems attributed to the United Nations [UN] relief effort in Haiti illustrate the complexity of responding to emergencies involving different cultures and ethnicities, and controlling cholera and other infectious diseases amid averse social conditions such as polluted water, widespread hunger and poverty. Historical studies of attempts to battle cholera epidemics, therefore, may disclose information capable of assisting the UN, World Health Organization [WHO], Center for Disease Control [CDC], and other agencies to confront or prevent epidemics today.

Cholera was the most destructive disease of the nineteenth century and few countries suffered more outbreaks over a protracted period of time than Russia. In the one hundred years between 1823 and 1922 Russia experienced 5.5 million cases, 2.2 million deaths, and fifty “cholera years” in which there were more than a few isolated instances of the disease.² During the first twenty-one years of the twentieth century the country was free of cholera for only two years (1903 and 1906) and, while the number of individuals stricken between 1912 and 1914 remained low, epidemics persisted throughout eighteen of the first twenty-one years leading health officials to conclude that cholera lived in Russia “in a semi-endemic state.”³ (Table 1.1)

Citing Russia’s lack of social development, poor governance, and second rate medical system, scholars have viewed late cholera epidemics in Russia as a sign of backwardness. Cold War antagonism and overconfidence in the ability of bacteriologists to prevent the disease caused misunderstanding. Scholars have stigmatized physicians who supported localist theories

¹ Matthew Mosk and Rym Momtaz, ABC News, November 8, 2011,
<http://abcnews.go.com/Blotter/report-caused-cholera-haiti/story?id=14904474>

² L. A. Tarassévitch, *Epidemics in Russia since 1914: Report to the Health Committee of the League of Nations*, Part II, No. 5 (Geneva: League of Nations, 1922), 5.

³ Ibid, 6.

Table 1.1 The Sixth Cholera Pandemic in Russia: 1902-1927

Year	Number of Provinces	Cases	Deaths	Mortality
1902	4	2167	1393	
1903				
1904	13	9226	6950	
1905	8	598	296	
1906				
1907	50	12,703	6424	
1908	69	30,705	15,542	
1909	50	22,858	10,677	
1910	72	230,232	109,560	
1911	29	3416	1646	
1912	2	9	3	
1913	7	324	129	
1914	15	1800	761	
1915	53	34,582	859	
1916	17	559		
1917	10	134		
1918	37	41,289	12,927*	
1919	33	3998		
1920	53	22,106		
1921		204,228 ⁴		
1922		86, 178 ⁵		
1923		141 ⁶		
1924		9		
1925		11		
1926		1		
1927		0		
Total		707,274	167,167	

Source: L. Tarassévitch, *Epidemiological Intelligence: Epidemics in Russia Since 1914*, Report to the Health Committee of the League of Nations, Part 1: No. 2 (Geneva 1922), 39. *Incomplete data.

⁴ A. I. Dobreitser, “Kholera v 1922 godu,” *Gigiena i sanitariia putei soobshcheniia* 3-4 (Iun’-Iul’ 1923): 85. *Epidemiological Intelligence*, Part II, No. 5, 7. There were at least 176,885 civilian cases and 5,837 in the military. The numbers included all allied republics.

⁵ *Epidemiological Intelligence: Statistics of Notifiable Diseases*, 1924 (Geneva: League of Nations, 1925), 24; and *Epidemiological Intelligence* No. 8 (Geneva, 1923), 14. 21,312 cases occurred in Ukraine and 121 in Poland.

⁶ Numbers for 1924 through 1926 are taken from “Fourth Epidemiological Report for the Year 1926,” (Geneva, 1927). The number for 1923 included 14 cases in the Ukraine.

that emphasized the environment in the development of epidemics, particularly miasmatists who thought that an airborne vapor or gas carried disease. Historians argued that, after Robert Koch (1843-1910) discovered the cholera vibrio in 1883, progressive countries quickly eradicated cholera by using contagionist measures such as sea and land quarantines, and surveillance of water supplies. In *The Cholera in Russia* Roderick McGrew noted that by 1900 purification of water sources and sanitary controls prevented cholera everywhere except in “backward areas” of Western and Eastern Europe, and Asia.⁷ Even Nancy Frieden in her laudatory account of Russian physicians stated that “a continuing rise in cholera mortality—indicated a serious failure to keep pace with medical progress in the West.”⁸ Observing that Koch’s experiments entailed that “the aetiology of cholera was fully-explained by the early-twentieth century” and that “the bacteriological model of infectious disease had succeeded in establishing its pre-imminent position over miasmatist approaches,” Charlotte Henze recently observed that “detailed and reasonably elaborate quarantine instructions” would have been “the only possible effective protection to the nation.”⁹ She argues that political and commercial considerations motivated the Russian government to embrace the miasma theory of Max von Pettenkofer (1818-1901) and that physicians used it for professional advancement.¹⁰

Widespread cholera riots, particularly during the 1892 epidemic,¹¹ further marginalized Russian society in the eyes of scholars. McGrew accepted Louis Chevalier’s thesis that cholera heightens normal social tensions and maintained conversely that a society that is able to deal with the stress caused by an epidemic proves itself a “stable society.”¹² In his influential work on cholera, Charles Rosenberg praised American social stability, persuasively arguing that all spheres of society accepted medical science and cooperated in battling the disease.¹³ However, he cautioned historians against engaging in social “criticism” as opposed to “analysis,” and proposed that economic and developmental problems accounted for many disparities between East and West.¹⁴

Indeed, numerous factors accounted for differences in the degree of difficulty that physicians in eastern countries faced when battling cholera. Russia’s location between Europe and Asia, its broad open borders, diverse topography, environment and social multiplicity made battling cholera epidemics more difficult than in other European countries. Variations in cultural and religious norms, particularly on the peripheries, complicated communications and caused misunderstandings that spurred cholera riots in these regions. While more effective application

⁷ Roderick McGrew, *Russia and the Cholera* (Madison: University of Wisconsin Press, 1965), 10.

⁸ Nancy Mandelker Frieden, *Russian Physicians in an Era of Reform and Revolution, 1856-1905* (Princeton: Princeton University Press, 1981), 79.

⁹ Charlotte E. Henze, *Disease, Health Care and Government in Late Imperial Russia: Life and Death on the Volga, 1823-1914* (London: Routledge, 2011), 25.

¹⁰ Ibid.

¹¹ For accounts of the cholera riots in 1892 see Robert Crews, “Civilization in the City: Architecture, Urbanism, and the Colonization of Tashkent,” in *Architectures of Russian Identity: 1500 to the Present*, James Cracraft and Daniel Rowland eds. (Ithaca, Cornell University Press, 2003), 117-132; Jeff Sahadeo, “Epidemic and Empire: Ethnicity, Class, and “Civilization” in the 1892 Tashkent Cholera Riot,” *Slavic Review* 64, No. 1 (Spring 2005): 117-139; and Theodore, H. Friedgut, “Labor Violence and Regime Brutality in Tsarist Russia: The Iuzovka Riots of 1892,” *Slavic Review* 46, No. 2 (Summer 1987): 245-265, and others.

¹² McGrew, *Russia and the Cholera*, 11.

¹³ Charles E. Rosenberg, *The Cholera Years: The United States in 1832, 1849, and 1866* (Chicago: The University of Chicago Press, 1987), 232.

¹⁴ Charles Rosenberg, “Cholera in Nineteenth-Century Europe: A Tool for Social and Economic Analysis,” *Comparative Studies in Society and History* 8, No. 4 (July 1966): 452-463.

of contagionist measures such as surveillance and isolation of patients ultimately helped alleviate cholera in Russia, the nation's physicians never applied a strategy based solely on quarantine. Rather, they developed a preventive and reactive approach that was unique to European countries. The system they used was broad in scope and included not only contagionist measures, but education regarding sanitary practices to avoid the disease, distribution of boiled water, emergency nutrition, and vaccination programs along the routes of travel to overcome deficient water supplies, inadequate sewage, and other developmental problems. Due to their training, perceptions of the etiology of cholera, and conditions in their native land, Russian physicians had ample cause to embrace the environmental theories that they continued to support. The work of these scientists led to breakthroughs in the nascent field of epidemiology and other scientific discoveries.

Considering the fiasco surrounding the UN relief force in Haiti, new scientific knowledge, and historiography, I suggest that a revision of the question regarding Russia's experience with cholera is in order. Rather than asking why cholera epidemics persisted into the twentieth century, I ask how, considering the disadvantages that they faced, the Soviets were able to drastically reduce cholera epidemics by 1927. Concentrating on the period between 1892 and 1905, I argue that, despite the chaos in Russia during the 1905 revolution, and the deep divide between many physicians and the government, Russian physicians had constructed a framework for dealing with cholera epidemics. Ultimately successful, this approach was geared to their training, epidemiologic, economic and social problems.

Russian Geo-epidemiology and the Characteristics of Cholera

If we use the cessation of cholera epidemics in Europe to determine the degree of social advancement or professional medical development that a nation achieved, the relationship between the decline in epidemics and western progress was incredibly uniform. Scientists agree that cholera is a tropical disease that originates in India's Bay of Bengal. With the exception of Russia, which suffered cases through the winters of 1921 and 1922, the disease predominantly appeared in the temperate climatic zone in summer, and it tended to withdraw through southeastern locations and seaports last. Cholera epidemics subsided in the United States and Great Britain between 1866 and 1873, in northwest Europe in 1892, in East Prussia and along the Spanish coastline as late as 1905, in southern Italy through 1910, and throughout scattered portions of Eastern Europe in 1915. Cholera remained in the Soviet Union through 1926, descending south down the nation's extensive river network, making its final appearances between the Caspian and Black Seas by 1925, where it sporadically returns. Cholera's gradual descent toward its home in India indicates that its early withdraw from Europe was not merely the result of superior western public health, but of natural forces. If the severity of the threat of cholera epidemics was unequal to the nations that experienced them, the history of the disease is a less than accurate indicator of social progress.

Positing that countries located further west in Europe benefitted from a geographical location that helped them defend against cholera, Peter Baldwin introduced the concept of geo-epidemiology in *Contagion and the State in Europe, 1830-1930*. He argues persuasively that Western European nations received significant warning about cholera traveling overland, and benefitted from both quarantine and other measures that were applied in the locations between them and cholera's source in India. They also received intelligence regarding the whereabouts of

the latest victims,¹⁵ benefitting “from the experiments undertaken at great costs by their easterly neighbors.”¹⁶ Russia was geographically challenged by broad open frontiers over which the disease might pass from a source country.¹⁷ According to Baldwin’s theory, western locations stood less chance of encountering cholera than those in the East.¹⁸

The multitude of problems with which authorities in eastern nations dealt played a role in their opting for environmentalist strategies, as saturation of human carriers and environmental problems made quarantine appear ineffective. Nations located furthest southeast [i.e. closer to India] were apt to embrace localist approaches. Physicians in India during the early epidemics opted towards “miasma” theories, which Russia also accepted by 1848.¹⁹ English physicians relied upon reports from their colleagues in India and embraced localism, while Pettenkofer, who was a professor at the University of Munich, developed a “compromise” position between localism and contagionism based upon reports of Indian physicians and hygienists in England.²⁰ English physicians continued to follow the lead of Anglo-Indian physicians until 1867 when they opted for the theory of John Snow (1813-1858), who convincingly illustrated that contaminated water supplies caused cholera.²¹ After Snow’s work in England and Koch’s isolation of the cholera vibrio, authorities in the northwest European seaport of Hamburg, under Koch’s leadership after the 1892 epidemic, turned toward a more aggressive contagionist strategy.²²

Meanwhile, as authorities in north and western European nations began to lean toward contagionist strategies, the opposite occurred in south eastern countries. Physicians in Naples, which suffered from severe sanitary problems, adopted Pettenkofer’s localist theory.²³ The successors of Pettenkofer including Eduard Buchner (1816-1917) in Munich and others in Eastern Europe began emphasizing how germs and environmental issues interacted to spark an infection, lying latent and then developing according to local conditions.²⁴ In Russia, the laboratory specialists Daniil K. Zabolotnyi (1866-1929) and I. G. Savchenko left the laboratory to study the cholera vibrio in the natural environment, drawing the consternation of the

¹⁵ Peter Baldwin, *Contagion and the State in Europe, 1830-1930* (Cambridge: Cambridge University Press, 2005), 8. The English physician Frank Clemow proposed a similar model in 1903. See Frank Clemow, *The Geography of Disease* (Cambridge: Cambridge Geographical Series, 1903).

¹⁶ Ibid, 84.

¹⁷ Ibid, 8.

¹⁸ Ibid, 67, 84-85.

¹⁹ R. J. Morris, *Cholera, 1832, The Social Response to an Epidemic* (New York, N.Y.: Holmes and Meier, 1976), 181-183.

²⁰ Charles-Edward Armory Winslow, *The Conquest of Epidemic Disease: A Chapter in the History of Ideas* (Madison, Ws., University of Wisconsin Press, 1980), 317.

²¹ Erwin Ackerknecht, “Anticontagionism Between 1821 and 1867,” *Bulletin of the History of Medicine* 22, No. 5 (September-October 1948): 575-578. On John Snow and cholera see, among others, Sandra Hempel, *The Strange Case of the Broad Street Pump: John Snow and the Mystery of Cholera* (Berkeley: University of California Press, 2005); and Steven Johnson, *The Ghost Map: The Story of London’s Most Terrifying Epidemic—and How it Changed Science, Cities, and the Modern World* (New York: Riverhead Books, 2006).

²² Richard J. Evans, *Death in Hamburg: Society and Politics in the Cholera Years* (Penguin Books: 2005), 231—272, 365 and 366, 503-509, and others.

²³ Frank M. Snowden, *Naples in the Time of Cholera, 1884-1911* (Cambridge: Cambridge University Press, 2002), 67-69.

²⁴ Paul Weindling, *Epidemics and Genocide in Eastern Europe, 1890-1945* (Oxford: Oxford University Press, 2000), 21.

physiologist I. P. Pavlov.²⁵ Many historical studies acknowledge the preference of Russian physicians for environmentalism during this period.²⁶ European nations with southern coasts and those located furthest east were exposed to large numbers of carriers, and were vulnerable to cholera due to geography, the evolution of the biological agent in later epidemics, and the natural environment.

Russia's size and demographic makeup presented considerable problems for carrying out an effective contagionist strategy. The country's administrative districts were large and it suffered from a shortage of soldiers that could institute cordons within them. Baldwin speculates that such measures would have likely resulted in only "an interruption of communication along the main roads."²⁷ Due to the nation's "far-reaching overland boundaries," many Russian physicians after 1874 came to the conclusion that conducting an effective quarantine along the Persian border was impossible due to "dense and intimate" contacts with the endemic regions of the disease, and many felt that the disease was endemic in their country.²⁸

By the time of the 1892 epidemic factors related to commerce and industrialization prompted Russian physicians to view the Volga River, which was the largest in Europe, as the primary route of transmission for the disease.²⁹ In a dissertation in 1999, the Russian physician Ol'ga Kedrova concluded that the Lower Volga suffered the highest cholera rates in Russia due to the region's geographical layout, in which lie important routes of commercial and recreational transportation connecting the banks of the Caspian Sea, the Caucasus, Central Asia and European Russia. The Lower Volga experienced intensive movement of populations, particularly in the summer,³⁰ and distributed cholera to the rest of the Empire. Late railroad construction exacerbated this problem.

There was validity to Russian physicians' perception that cholera was endemic to their country, and the evolution of the vibrio was also partly responsible. *Vibrio cholerae* has appeared in at least 140 variations,³¹ or strains. In the period between 1883, when Koch isolated *V. cholerae* O1, and 1906, bacteriologists identified microbes with similar properties. Many scientists began to pursue laboratory research to determine the significance and destructive

²⁵ D. V. Mikhel', "Rossiiskaia mikrobiologija i kholera na rubezhe XIX-XX vv.: iz laboratorii v pole," *Aktual'nye problemy istorii Rossiiskoi tsivilizatsii. Sbornik materialov i mezhevuzovskii nauchnoi konferentsii k 100 letniu SGU*, 2009, 151-152.

²⁶ Henze, *Disease*; Lisa Walker, "Public Health, Hygiene and the Rise of Preventative Medicine in Late Imperial Russia, 1874-1912," (Ph.D. diss.: University of California, Berkeley, 2003), and "The Pen and the Test-Tube Revisited: Generational Identity, Scientific Innovation and Russian Reception to Bacteriology, 1890-1914," *The Soviet and Post-Soviet Review* 32 No. 1 (2005): 269-291; John F. Hutchinson, "Tsarist Russia and the Bacteriological Revolution," *Journal of the History of Medicine and Allied Sciences* 40 (1985): 420-439; and *Politics and Public Health in Revolutionary Russia, 1890-1918* (Baltimore: Johns Hopkins University Press, 1990).

²⁷ Baldwin, *Contagion*, 67.

²⁸ Ibid, 211 and 212.

²⁹ For an account detailing the fear of the capacity of immigrants departing St. Petersburg to carry disease to the West see Howard Markel, *Quarantine! East European Jewish Immigrants and the New York City Epidemics of 1892* (Baltimore: John Hopkins University Press, 1997).

³⁰ Ol'ga Viktorovna Kedrova, "Dinamika i osobennosti epidemicheskikh proiavlenii kholery v nizhenem povolzh'e period s 1892 po 1996 god," (Dissertatsiya na soiskanie uchenoi stepenii kandidata meditsinskikh nauk, Ministerstvo zdravookhraneniia Rossiiskoi Federatsii, Rossiiskii nauchno-issledovatel'skii protivchumnyi institut "Mikrob," Saratov, 1999), 88.

³¹ David Karaolis, Ruiting Lan, and Peter R. Reeves, "The Sixth and Seventh Cholera Pandemics Are Due to Independent Clones Separately Derived from Environmental, Nontoxigenic, Non-O1 *Vibrio Cholerae*," *Journal of Bacteriology* 177 (June 1995): 3191.

capacity of various microbes.³² In 1906 the German scientist E. Gotschlich discovered a bacterial agent at the El tor quarantine station on the Sinai Peninsula in Egypt that is genetically closely-related to *V. cholerae* 01.³³ The *El tor vibrio*, as it is called, became increasingly dominant during the sixth cholera pandemic because natural selection favors it over *V. cholerae* 01, which more quickly kills the host, giving it less chance for survival. *El tor* outbreaks are characterized by less severely ill, highly mobile human hosts capable of passing the germ to others over a prolonged time period.³⁴ Recent experiments indicate that the agent for the sixth (1899-1926) and seventh (1961-2011) pandemics, evolved from El tor isolates,³⁵ causing the most prolonged period of cholera epidemics in Russian history.³⁶ The broad spread of a more durable biological agent permeating a country that encompassed one sixth of the world's land mass made defending against the disease a difficult task.

By the 1920s the evolution of the vibrio became important to strategies to eradicate the disease and bolstered the case for mass vaccination, as Russian physicians noticed its decreased capacity to cause death. The eminent Russian immunologist Lev A. Tarasevich (1868-1927) and others postulated that by 1907 cholera had become endemic, particularly in the Lower Volga and Don River regions in towns that suffered from poor sanitary conditions. They felt that the vibrio, in struggling to survive outside of the warm, tropical climates where it thrived, degenerated into a more survivable form.³⁷ While physicians knew that vaccination provided only limited protection, they used the practice among populations that were in imminent threat of developing epidemics as part of a broader plan to eliminate the breeding grounds of the disease.

These breeding grounds included low-lying port cities that were located on estuaries. Evidence suggests that *V. cholerae* 01, as found in the intestinal tract, and non-01 cholera, which inhabits aquatic and estuary environments, are a single species. They can survive outside the body and in marine environments in an undernourished and dormant state that modern microbiologists cannot detect. Estuaries are places along coasts where fresh water from rivers and streams mix with salt water and form "brackish" water.³⁸ They are some of the most dynamic environments on earth, creating more organic matter than similar-size forests, grasslands and farmlands, and support a unique variety of animal and plant life that are suited to their environment.³⁹ In the Bay of Bengal where the vibrio originates, cholera is fed by an inorganic source of nitrogen, carbohydrates and minerals that are specific to its requirements.⁴⁰

³² T. D. Fadeeva, *Kholera i bor'ba s nei* (Moskva: Medgiz, 1959), 50-53.

³³ D. E. Stewart-Tull, "Vaba, Haiza, Kholera, Foklune or Cholera: in any language still the disease of seven pandemics," *Journal of Applied Microbiology*, no. 4 (October 1991): 586.

³⁴ Kelley Lee, "The Global Dimensions of Cholera," *Global Change and Human Health* 2 (2001): 9. See also M. Shamim Hasan Zahid, Zavid Waise, M. Kamruzzaman, A. N. Ghoshi, G. Balakirsh Nair, S. A. M. Khairul Bashar, John J. Mekalanos, Shah M. Faruque, "An experimental study of phage mediated bactericidal selection and the emergence of the El Tor Vibrio cholera," *The Indian Journal of Medical Research* 2, No. 1 (Feb. 2011): 218-224.

³⁵ David K. Karaolis, Lan, Ruiting, and Peter R. Reeves, "The Sixth and Seventh Cholera Pandemics Are Due to Independent Clones Separately Derived from Environmental, Nontoxigenic, Non-01 *Vibrio Cholerae*," *Journal of Bacteriology* 177 (June, 1995): 3193.

³⁶ K. D. Patterson, "Cholera Diffusion in Russia, 1823-1923" *Social Science and Medicine* 38, No. 9 (1994): 1185-1186.

³⁷ Tarassévitch, "Epidemics: Part II, No. 5," 12.

³⁸ Rita R. Colwell and William M. Spiro, "The Ecology of Vibrio Cholera," in Dhiman Barua and William B. Greenough III eds., *Cholera: Current Topics in Infectious Disease* (New York: Plenum Publishing Company, 1992), 107-108, 123.

³⁹ EPA: United States Environmental Protection Agency, "Basic Information about Estuaries." www.water.epa.gov/type/oceb/nep/about.cfm

⁴⁰ Richard Finklestein, "Cholera, *Vibrio cholera* 01 and 0139, and Other Pathogenic Vibrios."

Warm rains cause changes in temperature and variations in the salt content of estuaries due to the influx of a large volume of non-salt water “mobilizes stored nutrients in the bottom sediments.” Copepods, which are small crustaceans found in seawater, almost all forms of non-salt water, and both deep and shallow waters, play an important role. They carry bacteria to “the gut tracts, first of crabs, clams, and oysters,” then humans contract the disease by eating seafood in an undercooked state and pass it to others through a variety of channels.⁴¹

The ability of Russian environments to duplicate conditions in India is speculative, but the intense movement of trade over the Volga River, which was the largest in Europe, along with the Mariinskaia canal system, which connected the Upper Volga and St. Petersburg, created an environment that was especially prone to cholera. The cities and towns along this trade route suffered disproportionately from cholera epidemics and Astrakhan, which was located furthest south on a delta with tributaries in the Caspian Sea, was especially at risk. (Figures 1 and 2) In 1907, the Director of the Tsarist Ministry of the Interior’s Bacterial Laboratory in Astrakhan, Nikolai Nikolaevich Kladnitskii, took samples of suspected cholera from the Volga River. He discovered that the most dangerous water was located near the banks where it remained unmoved by river traffic. Taking samples from a hole in the deep waters of the middle of the river, he found no sign of cholera, while those taken from near the shoreline and in the areas of the Kutuma and Tsareva Rivers produced positive results. There “the cholera vibrio literally swarmed” in “*mërtvie prostranstva*” or “dead spaces.”⁴²

Also, the St. Petersburg professor Grigorii Khlopin noted that cholera and plague routinely passed through Astrakhan and that local conditions often boosted the intensity of an epidemic. Cholera struck Astrakhan eighteen times between 1823 and 1898 and on four of these appearances (1830, 1847, 1872 and 1892) the vibrio “wreaked havoc.” Khlopin observed that Astrakhan’s “high streams and river channels [were] the most harmful features affecting the health of the people.”⁴³ A fourteen-foot bank provided the inhabitants with some protection, but the city remained susceptible to flooding such as occurred in the cholera year of 1908. The city did not “benefit from a safe elevation as some cities, for example, Moscow.”⁴⁴

Khlopin was well aware that his own city, St. Petersburg, suffered similar problems. Located where the Neva River meets the Gulf of Finland, the city was vulnerable to flooding due to low elevation and water channels running through the city. St. Petersburg and Astrakhan suffered many intensive bouts of cholera and other epidemic diseases.⁴⁵ The problem of dealing

<<http://gsbs.utmb.edu/microbook/ch024.htm>>

⁴¹ Alfredo Morabia, Epidemiologic Interactions, Complexity, and the Lonesome Death of Max von Pettenkofer,” *American Journal of Epidemiology* 166, No. 11 (October 2007): 1236.

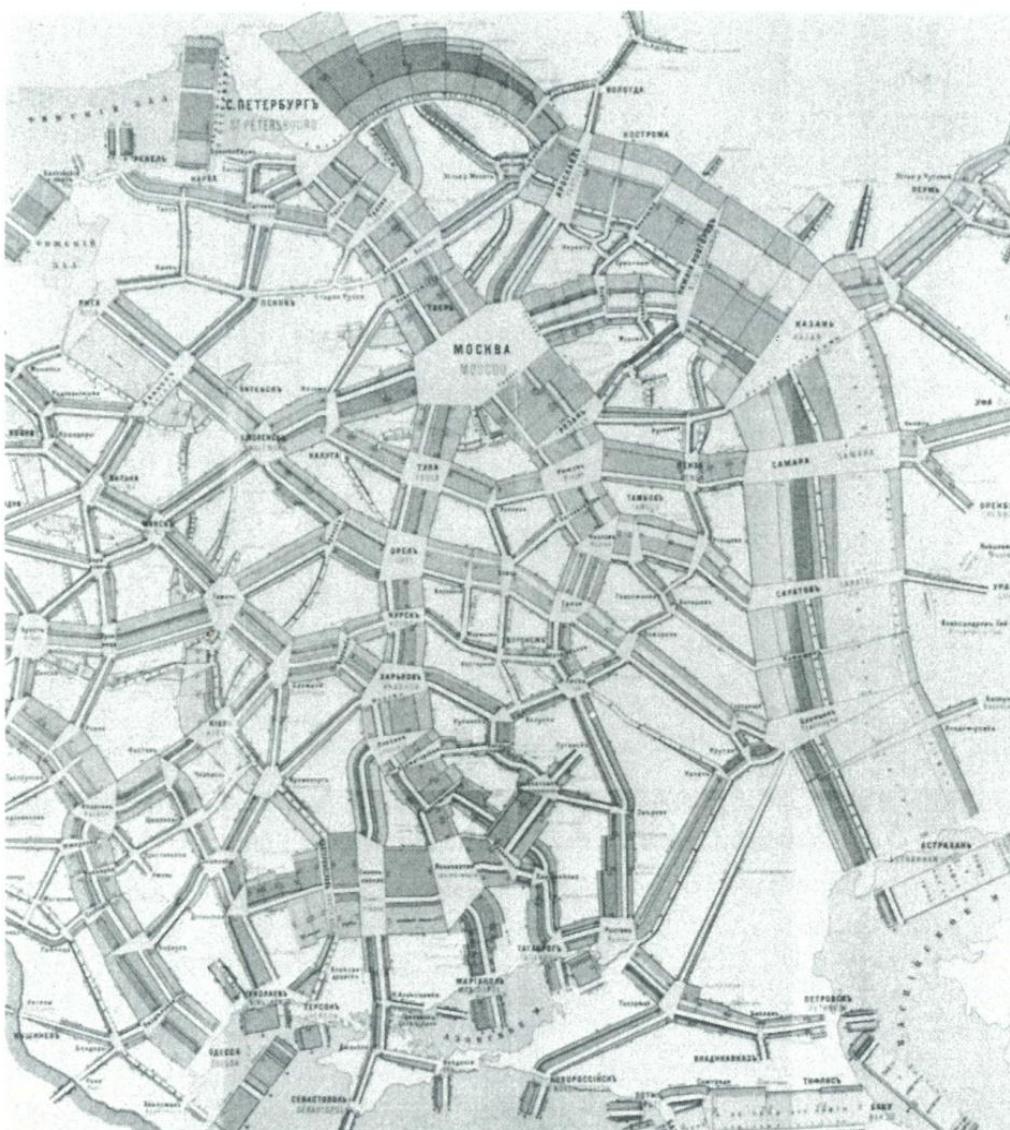
⁴² S. N. Kladnitskaia, *N. N. Kladnitskii, 1868-1935: Bydaiushchesia deiateli otechestvennoi Meditsiny* (Moskva: Gosudarstvennoe izdatel’stvo meditsinskoi literatury, 1956), 128. Both cholera and copepods can survive with low oxygen and in anaerobic environments. Pasteur invented the term “anaerobic” and was interested in it as a causal factor in the development of disease. See René Dubos, *Pasteur and Modern Science* (New York: Anchor Books, 1960), 84-85, and others. Still waters are low in oxygen and deep waters are anaerobic, but the significance of oxygen levels to the development of cholera is unknown.

⁴³ G. V. Khlopin, *Materialy po ozdorovleniu Rossii: Sanitarnoie opisanie g. g. Astrakhani, Samari, Saratova i Tsaristynskaia mer ikh ozdorovlenia* (St. Petersburg: Tipografia Ministerstva Vnutrennikh Del, 1911), 41.

⁴⁴ Ibid, *Materialy*, 51.

⁴⁵ Historians have asserted that Moscow suffered lower rates of disease than St. Petersburg because it had a more active zemstvo. Khlopin was a St. Petersburg physician associated with the MVD, which perhaps gave him incentive to defend St. Petersburg, but his description of the differences in terrain, and consideration of the amount of trade

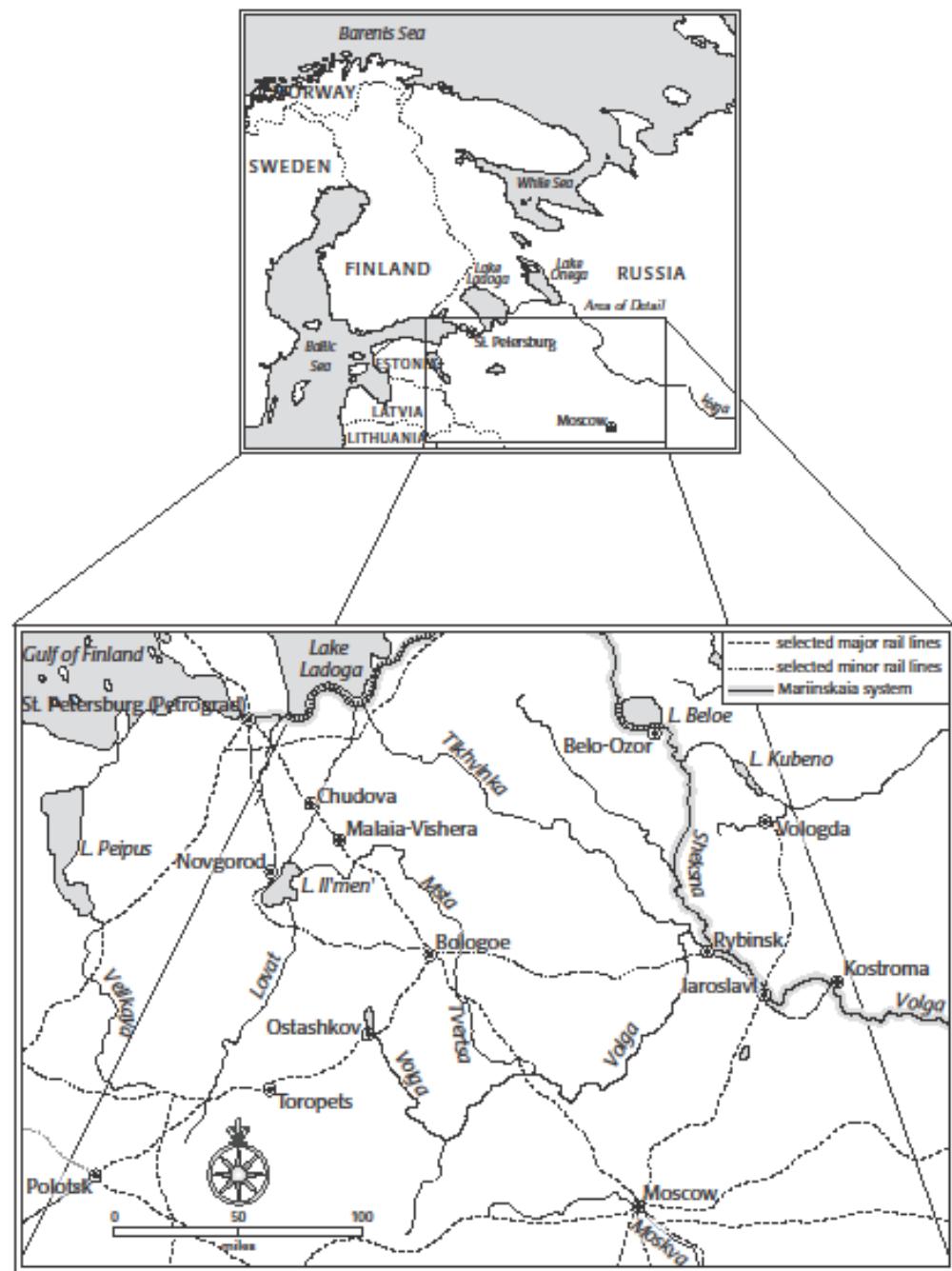
Figure 1 The Movement of Trade through Russia circa 1900



Source: *Carte des voies navigable de la Russie // Apercu des chemins de fer des voies navigable de la Russie, (St. Petersburg, 1900)*.

with which physicians in St. Petersburg contended, is cause for reconsideration of the degree of superiority that Moscow may have held. For more information see Frieden, *Russian Physicians*, 152-153; and Hutchinson, *Politics*.

Figure 2 The Mariinskaia System



Source: Professor Richard Gilbreath, Cartography Department, University of Kentucky

with disease in the cities, towns and villages along the Volga River and Mariinskaia System, particularly the Lower Volga, constituted a nightmare for Russian physicians. With a modest budget, little support from the government, and extensive environmental and social problems, they were forced to cope with an almost endless succession of all types of epidemics.

The more knowledge that scientists gather about cholera, the easier it becomes to understand why it was so difficult to combat. The WHO recognizes the complexity of cholera and cites “local endemicity, living conditions, forced or voluntary population movements, environmental and cultural factors, and the effectiveness of any control measures put into place” as the reasons that epidemics are so difficult to predict.⁴⁶ Such unpredictability affects preparation of early warning systems even when health officials possess extensive knowledge of the place and circumstances in question. Water supply, sanitation, hygiene, population demography, community, and other factors may affect the development of an epidemic.⁴⁷ The epidemiologist Alfredo Morabia cites complexity in germ-environment interaction as the reason that Koch’s isolation of the cholera vibrio in 1883 did not enable public health personnel to prevent the disease from turning up in various communities.⁴⁸ Recent cholera epidemics in Kuwait and Haiti make it clear that the disease remains a threat to society, particularly when people do not receive adequate food and clean water, live in vulnerable environments, and have contact with individuals from areas where the disease is endemic. With a new understanding of the true complexity of cholera, the important role that the environment plays in its etiology, and the intense movements of people along the Volga/Mariinskaia System, it is easy to understand why neither government physicians nor those in the provinces supported a strategy based on preventing the vibrio from crossing their borders. They emphasized containment of the disease within their country and concentrated on local environments as their training mandated.

The Chemical Research Schools: Liebig, Pasteur, and Pettenkofer

The intense competition between research schools in continental Europe played a role in how Russian physicians chose to deal with disease. Loyalties often proved to be an obstacle to cooperation as scientists struggled for intellectual supremacy. The chemist Justus Liebig (1803-1873) directed one of the first successful schools. The director of a research school provided supervision, management and leadership; his early successes and inspirations, and even his frustrations, affected how he ran his program.⁴⁹ Liebig’s most ambitious students acted as disciples and advocates who adopted his intellectual framework and duplicated his methods by forming schools of their own.⁵⁰ The importance of pedagogy and training in such institutes has inspired use of the term, “research school,”⁵¹ which consisted of two primary components: the cognitive framework that practitioners shared, and institutional setting.⁵² A viable intellectual

⁴⁶ “Oral Cholera Vaccine Use in Complex Emergencies: What Next?” *Report of the WHO Meeting, 14-16 December, 2005* (Cairo, Egypt: Global Task Force on Cholera Control, World Health Organization, 6-7).

⁴⁷ Ibid, 24.

⁴⁸ Ibid.

⁴⁹ J. B. Morrell, “The Chemist Breeders: The Research Schools of Liebig and Thomas Thomson,” *AMBIX: The Journal of Society for the Study of Alchemy and Early Chemistry* Vol. XIX, No. 1 (March 1972): 4.

⁵⁰ Ibid, 3-4.

⁵¹ Gerald L Geison, “Research Schools and New Directions in the Historiography of Science,” *Osiris 2nd Series* 8 (1993): 231.

⁵² Alan J. Rocke, “Group Research in German Chemistry: Kolbe’s Marburg and Leipzig Institutes,” *Osiris 2nd Series* 8 (1993): 77.

framework permitted the director to teach, motivate and persuade students to buy into his ideas and techniques, which determined the school's impact and longevity.⁵³ Due to early development, the schools of chemistry proved most influential regarding theories of infectious disease. The environmentalist orientation that Russian physicians used to battle cholera can be traced to these schools.

As Il'ia Metchnikov (1845-1916), who was one of the founders of Russian bacteriology, later recalled, Liebig routinely contemplated the theory of "putrefaction—a process analogous to one taking place in the decomposition of corpses, of meat, eggs and albuminoid matter."⁵⁴ Chemists believed this process caused a variety of problems including coagulation of milk or the foul smell of urine after coming into contact with air. Failing to link fermentation with the vital processes of yeast, as other chemists had proposed, Liebig concluded that the process involved inert matter that appeared during the decomposition of complex, minute, biological elements. He thought that the process was "diametrically opposed to life" and responsible for miasmas.⁵⁵ Liebig's framework was widely accepted and most theories of disease evolved from his work.

Attempts to formulate strictly biological explanations of disease were ignored. By 1840 Jacob Henle (1809-1885), whose protégé Robert Koch would later establish a research school in Berlin, published *Pathologische Untersuchungen*, hypothesizing that a "contagion animation" or "living virus" was the causative agent in disease. The idea that human intercourse promoted the transmission of disease was not new. The word "contagion" comes from the Latin *contagio*, meaning "contact," therefore contagious theory involves the transfer of disease between individuals through direct or indirect contact. The word "quarantine" originated in the seventeenth century in Venice when during the plague Italian authorities began detaining ships for forty days (in Italian a *quarante*).⁵⁶ Henle argued that microorganisms entered the body through contact between sick and healthy persons and could not be detected due to inadequate microscopes.⁵⁷ Metchnikov observed that Henle's idea, as well as his interest in investigating the cause of disease, was lost to Liebig's notoriety.⁵⁸ The same was true for the Florence bacteriologist Filippo Pacini (1812-1883). The International Commission on Bacteriological Nomenclature now credits Pacini with discovering the cholera vibrio thirty years before Koch. Pacini felt that his nationality and lack of affiliation with a research school obscured his discovery.⁵⁹

Louis Pasteur (1822-1895), a chemist, became famous because he was the first to connect germ theory to Liebig's principle. He recognized that disease was contagious but emphasized that like fermentation of alcohol it develops due to a process requiring other factors such as a specific climate due to the time of year.⁶⁰ Influenced by Pasteur, Russian physicians began concentrating on processes occurring due to the introduction of foreign matter or germs into a new environment. They knew that disease required the presence of a microbe, but felt that its interaction with the environment and the resulting processes were equally or more important than

⁵³ Morrell, "The Chemist Breeders," 3.

⁵⁴ Elie Metchnikoff, *The Founders of Modern Medicine: Pasteur, Koch, Lister* (Delanco, New Jersey: Gryphon Editions LLC, 2006), 20.

⁵⁵ Ibid. 21-22.

⁵⁶ Dubos, *Pasteur*, 95-96.

⁵⁷ Metchnikoff, *The Founders*, 24-25.

⁵⁸ Ibid. 30.

⁵⁹ Norman Howard-Jones, *The Scientific Background of the International Sanitary Conferences, 1851-1938* (Geneva: World Health Organization, 1975), 28, 43-52, and 64.

⁶⁰ Metchnikoff, *The Founders*, 30.

the bacteria itself. Pasteur established a link between lactic fermentation and both yeasts and bacteria. Experimenting with sticks of butyric and lactic acid he discovered the principle of ‘specificity’ of ferments, which became important in determining the causal relationship between specific microbes and various diseases. As the processes of fermentation and putrefaction were connected to various yeasts and groups of bacteria, the same was true for butyric and acetic acid. He discovered that yeasts brought about alcohol fermentation, but that lactic and butyric require special organisms.⁶¹ German chemists contested Pasteur’s theory, but the idea that vital activity rather than spontaneous generation initiated the processes of disease-causing putrefaction and fermentation remained the staples of nineteenth-century germ theory.⁶² Pasteur is generally regarded to have proved, contrary to Liebig’s theory, that putrefaction was not the product of contact between albuminoid substances and decomposing matter, nor did new bacteria originate through spontaneous generation of decomposing microorganisms.⁶³ Rather, it came about by their introduction into an organism, and their vital activity putrefied albuminoid matter.”⁶⁴

Pasteur’s work helped build the foundation for modern bacteriology, but his concepts retained elements of chemistry and a strong environmental component. Historians often mention “Pasteur and Koch” together with no further analysis, as if doing so should dissuade all further discussion regarding the agency of “bacteriology” as opposed to “hygiene.” They view the two as differentiated fields that coalesced through cooperation and diplomacy and accept Koch and Pasteur’s methodologies as nearly identical.⁶⁵ While there were similarities, Koch restricted his focus to the microbe, human carriers, and water supplies. Bruno Latour has convincingly articulated the effect of Pasteur’s hero status in France,⁶⁶ and the Frenchman enjoyed similar acclaim in Russia, motivating a generation of Russian physicians to search for environmental explanations that involved the soil. They knew, as did Pasteur and the Munich Professor Max von Pettenkofer, that the environment played an important role in developing disease.

A student of Liebig, Pettenkofer stressed the importance of fermentation of decomposing matter as an influence on the ability of a given area to cause epidemic disease. He accepted that a contagious element might be present in the spread of cholera, but did not consider it very important. Pettenkofer relied almost exclusively upon empirical observation rather than laboratory investigation and his school remained viable as assumedly more effective methods evolved. Some scholars have dismissed Pettenkofer as a less than progressive member of nineteenth-century European public health, and even an obstruction to progress. They have viewed his feuds with Koch as a zero-sum game, and his suicide in 1901 as a concession of defeat.⁶⁷ Part of this perception was due to Pettenkofer’s early support for the miasma theory. His understudy Rudolph Emmerich (1852-1914) persisted in arguing in favor of the concept into the twentieth century.⁶⁸ Pettenkofer’s observations anticipated the cause of disease with a degree

⁶¹ Ibid, 31.

⁶² Ibid, 39-40.

⁶³ Albuminoid substances contain water-soluble protein—albumin. They are soluble in salt solutions and their primary and secondary structures are vulnerable to destruction by heat.

⁶⁴ Metchnikoff, *The Founders*, 42-43.

⁶⁵ See Hutchinson, *Politics*, 105; and others.

⁶⁶ Bruno Latour, *The Pasteurization of France* (Cambridge: Harvard University Press, 1988).

⁶⁷ Also see Evans, *Death in Hamburg*; Norman Howard-Jones, *The Scientific Background of the International Sanitary Conferences*, and “Gelsenkirchen Typhoid Epidemic of 1901, Robert Koch, and the Dead Hand of Max von Pettenkofer,” *British Medical Journal* 1 (1973):103-105. For an alternate view see Morabia, “Epidemiologic Interactions.”

⁶⁸ See for example, Howard-Jones, “Gelsenkirchen,” 103-105.

of foresight that was perhaps unequalled. Modern epidemiologists such as Alfredo Morabia understand the prescience of his conclusions. By tirelessly compiling evidence he established a multi-faceted framework for understanding the causes of disease that, Morabia argues, may have most closely articulated the etiology of cholera and anticipated how epidemiologists work today. Mono-causal theories resting entirely upon the concept of germs were oversimplified.⁶⁹

Pettenkofer, who improved the environments in several cities,⁷⁰ asserted that the cholera germ became a miasma after undergoing the process of putrefaction in the soil. Those soils in high rocky or dry areas, he believed, were unable to produce a cholera miasma, "but low porous soils could." He wrongly believed that this occurred in areas where there was low groundwater because a miasma could only originate when there was sufficient distance between the groundwater and its former surface. For this reason, he argued, that cholera occurred due to low groundwater, and almost always in the dry summer months.⁷¹ Morabia attributes this miscalculation to misunderstanding of the need to consume more water and fruit during the summer and periods of drought when high concentrations of cholera prevailed in unfilled wells and shallow rivers.⁷² Pettenkofer discarded the miasma aspect of his theory after Koch's experiments, but continued to view the soil as a major enabling or prohibiting factor in the development of disease. His theories were the wellspring for much empirical work in Russia in the late-nineteenth and early-twentieth centuries.

Believing that chemical tests for cholera gave contradictory results, he suggested a research methodology heavily influenced by the Natural History School of German Medicine that he felt would lead to a "causal nexus." The school advocated extensive and detailed observation and in-depth description of the many determining factors of numerous cases, such as individual predispositions to disease, geography, climate and socio-economic status. Like Pasteur, Pettenkofer embraced the idea that each disease had its own specific etiology.⁷³ Influenced by Pettenkofer's student, Friedrich Erismann, and others, and experiences with cholera in their native country, Russian physicians emphasized the soil and processes such as fermentation. As an early medical dictionary notes, Pasteur and Pettenkofer developed foundational principles that were "not unallied" to each other.⁷⁴ Russian physicians would search for these processes throughout the period under study.

Pettenkofer also used methods and considered factors that anticipated the field of social hygiene. In the 1850s Pettenkofer and his group sent out a circular in Bavaria to physicians in order to monitor and document a vast array of observations regarding cholera. The respondents commented on a variety of issues including riverboat and railway traffic, social class, food quality and consumption, alcohol use, origin and spread of the disease, water levels and soil conditions. The material was gathered, observed and compared searching for connections through the process of logical deduction. He perused the material and concluded that everything led to one "absolutely essential" factor--the soil.⁷⁵ Three of the five "conditions" that he

⁶⁹ Morabia, "Epidemiologic Interactions," 1238.

⁷⁰ See Wolfgang Locher, "Pettenkofer and Epidemiology: Erroneous Concepts -- Beneficial Results," in *History of Epidemiology: Proceedings of the 13th International Symposium on the Comparative History of Medicine -- East and West*, Yosio Kawakita, Shizu Sakai and Yasuo Otsuka eds. (Tokyo: Ishiyaku EuroAmerica Inc., 1993), 112-114.

⁷¹ Morabia, "Epidemiologic Interactions," 1235-1237.

⁷² Ibid, 1237.

⁷³ Locher, "Pettenkofer and Epidemiology," 102-104.

⁷⁴ Fielding H. Garrison, *An Introduction to the History of Medicine with Medical chronology, Suggestions for Study and Bibliographic Data* (London: W. B. Saunders Company, 1929), 270, 658-659.

⁷⁵ Locher, "Pettenkofer and Epidemiology," 105-106.

identified as necessary to initiate a cholera epidemic emphasized the soil. In addition to individual susceptibility to disease based upon eating habits and transmission of the germ through human intercourse, he emphasized the permeability of air and water in soil occupied by people, variability in its composition, and organic breakdown of materials in the environment.⁷⁶ He composed a formula recognizing the cholera vibrio as the agent “x” in the equation “x + y = z” and believed that “x” interacted with an unknown substrate “y,” which was probably either the correct time or place, to form “z,” cholera. He believed that neither “x” nor “y” acting alone could precipitate the disease. The precise nature of the germ x determined the characteristics of z, while the quantity of z decided the amount of cholera in a location.⁷⁷

Pettenkofer also tabulated the collective effects of annual wastes that one person released upon the ecosystem to illustrate the extent of the problem that epidemiologists faced ere facing. Each person was responsible for thirty-four kilograms of feces, 428 kilograms of urine, ninety kilograms of kitchen and house refuse, 560 kilograms of compact wastes, and 7300 kilograms of liquids, which entered the ecosystem as a byproduct of cleaning. All of these wastes had to be disposed of through sewer systems.⁷⁸ Russian physicians working against cholera often used this methodology. Investigations relying upon a massive compilation of empirical evidence became the norm.

There was perhaps no other country (save Bavaria, later part of Germany) where Pettenkofer’s work exerted a greater influence than in Russia where the Swiss physician Friedrich F. Erismann (1842-1915) espoused his principles. Erismann married the Russian physician Nadezhda P. Suslova (1843-1918) while studying in St. Petersburg in 1869. After completing a series of statistical investigations in Russia, he traveled to Western Europe to study under Pettenkofer, and in 1875 moved back to Russia for good. He is perhaps most well-known for his studies of the link between health care in factories and disease in the surrounding rural countryside. Erismann became Professor of Hygiene at Moscow University in 1882, and began to encourage his medical students to emphasize preventive medicine, which became the cornerstone of zemstvo medicine.⁷⁹ One historian describes the principles of zemstvo medicine as emphasis on “the causative relationship between natural phenomena and social life--the laws that govern mankind,” and “all those public and private occurrences, the understanding of which directly or indirectly aids the discovery of those laws.”⁸⁰ Another scholar notes that zemstvo medicine involved “gathering knowledge about the local population, its habits and sanitary conditions, and the ways it was infected by disease, in order to provide not only a curative, but preventative care.”⁸¹ These descriptions bear a remarkable similarity to the German Natural History School that influenced Pettenkofer.

Both Pettenkofer and Pasteur influenced many Russian students. In addition to Erismann and Grigorii Khlopin, Pettenkofer influenced the prominent St. Petersburg physician G. I. Arkhangel'skii. Sergei Nikolaevich Vinogradskii (1856-1953) directed the Department of Microbiology of the Imperial Institute of Experimental Medicine (IIEM) in St. Petersburg from 1890 until 1902, and then the entire institute until 1905. While director, he sought assistance from the Pasteur Institute and eventually worked there, operating an experimental farm after

⁷⁶ Ibid, 106.

⁷⁷ Winslow, *The Conquest*, 317-323.

⁷⁸ Ibid, 110.

⁷⁹ Frieden, *Russian Physicians*, 99-102. The zemstvos were local political councils formed in the 1860s as part of the Great Reforms of the 1860s after the Tsarist defeat in the Crimean War (1853-1855).

⁸⁰ Ibid, 102.

⁸¹ Walker, “Public Health,” 158.

1922.⁸² Vinogradskii's work on soil nitrification, along with the work of Mechnikov, who was associate director of the Pasteur Institute in Paris for many years,⁸³ brought microbiology to the attention of Russian science.⁸⁴ Much of Mechnikov's research pertained directly to cholera. Through his laboratories in Odessa and Paris he mentored prominent Russian microbiologists including Aleksandr Mikhailovich Bezredka (1870-1940), Nikolai Fedorovich Gamaleia (1859-1945), and Vasilii Leonidovich Omelianskii (1867-1928).⁸⁵ Omelianskii succeeded Vinogradskii as Director of the IIEM, serving well into the 1920s. The IIEM would play an important role in combating cholera in Russia, particularly in the development of epidemiology and preventive vaccination. N. F. Gamaleia and Iakov Iulievich Bardakh (later of Novosibirsk University) helped Mechnikov find and develop the Odessa Bacteriological station in 1866 before Mechnikov left Russia for Western Europe. Mechnikov, Bardakh, and Odessa scholars such as P. N. Diatropov, L. A. Tarasevich, and D. K. Zabolotnyi were essential in developing Soviet immunology. Mechnikov moved to Paris rather than Berlin after Pasteur showed interest in his theory of immunity, which Koch had imperiously dismissed.⁸⁶ By the time that the 1892 cholera epidemic ended, Russian physicians' preference for environmentally-focused hygiene and bacteriology were becoming well-established. Their training gave many of them the confidence to challenge the mandates of Robert Koch.

Erismann's Critique of Bacteriology

Influenced by Pettenkofer and the English physician David Douglas Cunningham (1843-1914), Friedrich Erismann understood the intricate relationship between cholera and various environments. Cunningham served thirty-three years as a physician in India and his experiences caused him to conclude that the spread of cholera in that country did not follow the routes of transportation away from Lower Bengal. There the vibrio was capable of self-generating in epidemic form from within the environment in various places due to atmospheric conditions. In his lectures, Erismann emphasized Cunningham's experiences, arguing that the routes of travel played a subordinate role in India and that increased demographic movement did not redirect the spread of cholera. Places that were outside of the epidemic zones often developed sporadic cases that were not genetically related to the cholera in Lower Bengal. Europeans referred to this type of outbreak as "cholera nostrus." Cunningham had examined six locations that were strongly affected by railroad military transport, and six places that were located farther away. In the distant locations, 16 out of 10,000 people died from cholera, while those close to the lines experienced only 6.2.⁸⁷ Cunningham, and Erismann, concluded that the railroad in India did not strongly influence cholera's pattern of transmission.⁸⁸ The two scientists understood that the

⁸² Alexander Vucinich, *Science in Russian Culture, 1861-1917* (Stanford: Stanford University Press, 1970), 330-331.

⁸³ Zalkind, *Ilya Mechnikov*, 119. See Locher, "Pettenkofer and Epidemiology," 102-120.

⁸⁴ Vucinich, *Science in Russian Culture*, 327-332.

⁸⁵ Ibid, 324.

⁸⁶ Daniel P. Todes, *Darwin Without Malthus: The Struggle For Existence in Russian Evolutionary Thought*. (Oxford: Oxford University Press, 1989), 86. Mechnikov departed Odessa after local officials blamed the station for an anthrax epidemic in 1887.

⁸⁷ F. F. Erismann, *Kholera: epidemiologiya i profilaktika s obschestvenno-sanitarnoi tochki zreniya. Lektsii, chitannyya studentam starshikh kursov meditsinskogo fakul'teta IMPERATSKAVO Moskovskvago Universiteta (vesnoiu 1893 goda)*. Moskva: I. N. Kushnerev, 1893, 20- 21.

⁸⁸ Ibid, 21.

etiology of cholera in India, where it generated from within the environment, differed from its behavior in Europe, but there was little consensus regarding its etiology as one traveled closer to India. Erismann knew that the vibrio behaved differently in various places, that the biological properties of the disease varied, and that weaker, less-deadly outbreaks could not be explained. Disagreements in the Russian scientific community over how to approach the disease in the aftermath of Koch's bacterial discoveries caused extreme confusion that would not be adequately sorted out for three decades.

Erismann acknowledged that Koch's experiments had contributed to the general knowledge and understanding of cholera. Koch had provided new knowledge regarding the biological characteristics of cholera, clarification regarding the development of "the cholera poison" within the body and "the general epidemiology of the disease."⁸⁹ The "bacteriological fever" that ensued after 1883 motivated scientists to study how the disease behaved in population centers, disclosed new information regarding immunity, and helped investigators distinguish cholera from other diseases. Almost all investigators had come to recognize that the cholera vibrio played a role in causing the disease, but its precise function remained ambiguous.⁹⁰

Erismann expressed concern that such fascination might lead to mistakes, lamenting that Koch's experiments had unduly shifted the focus of investigators to "the cholera commus" itself.⁹¹ He cautioned that excessive attention to the bacillus was leading scholars to ignore other characteristics of the disease, what might occur in its absence, how epidemics developed, and what caused the formation of the bacillus.⁹² Even contagionists used localism as a starting point and often disclosed new information. Some bacteriologists even became extreme localists. They felt that cholera could rise independently from within a local environment and cause an epidemic.⁹³

Scholars often mistakenly assume that all bacteriologists were contagionists, but such was not the case. Some bacteriologists began arguing in favor of what Pettenkofer had called "an autochthonist interpretation." They argued that the cholera vibrio was capable of rising in epidemic form in congenial environments when a variety of conditions were met. Both Pettenkofer and Erismann rejected such an argument, which differed from miasma in that those supporting it did not believe in a vapor or spontaneous generation, but that pathogenic microorganisms could survive over an extended period of time and, when conditions were propitious, regenerate in epidemic form. The idea that an epidemic might result from biological interactions in the soil reflected the influence not only of Pettenkofer, but Pasteur. Many Russian bacteriologists were environmentalists and few believed in miasma.

Like Pettenkofer, Erismann was a "contingent" contagionist who considered environmental and social factors to be important components in the etiology of cholera. Citing the St. Petersburg Professor, G. I. Arkhangel'skii, he noted that it was obvious that "Asiatic" cholera did not self-generate from the environment in Europe, asserting that it was carried onto the continent from East India. Investigators had confirmed the biological link between the properties of Indian and European cholera. The tsarist government, he argued, had incorrectly interpreted the 1829 epidemic in Astrakhan as "self-rising," stemming from "an unusual change

⁸⁹ Ibid, 2. Koch proved that the *vibrio* emitted a deadly poison inside the intestine. See N. Gamaleia, *The Bacterial Poisons*, trans. Edward Pojson Hurd (Detroit: George S. Davis, 1898), 33 and 34. (Reprinted by Bibliolife of Charleston, S. C. n. d.).

⁹⁰ Erismann, *Kholera*, 1, 4.

⁹¹ Under microscopic examination the cholera *vibrio* appears similar in shape to a comma.

⁹² Erismann, *Kholera*, 2, 3.

⁹³ Ibid, 2.

in the weather.”⁹⁴ Several investigators had postulated that conditions in Lower Bengal, where cholera was endemic, could be duplicated in other places. One such scientist was the French Medical Inspector, M. Fauvel, who had concluded that a cholera epidemic in 1884 in Toulon had materialized through local conditions. Subsequent investigation revealed that Fauvel was mistaken and that the Toulon epidemic was “real Asiatic cholera.”⁹⁵

The English physician Frank Clemow, who spent many years studying cholera in Russia, later observed that Erismann expressed “the clearest exposition” of the environmentalist interpretation. A contagionist, Clemow acknowledged that “strong evidence” supported the idea that elevation and moisture in soil influenced the development of an epidemic.⁹⁶ Yet, like Erismann, Clemow concluded that it was almost always possible to trace the origin of the disease following contagionist reasoning. With a few exceptions he felt that the evidence supported the argument that cholera did not originate from the environment, but directly or indirectly resulted due to a pre-existing case. By 1904, Clemow’s experiences in Russia had motivated him to write a book on geography and disease that in many ways anticipated the concept of geo-epidemiology. He observed that cholera more often threatened countries in tropical climates and those that were located closest to India.⁹⁷ His experiences studying cholera in Russia caused him to emphasize the environment in his articulation of the development of disease.

Like Clemow, Erismann rejected spontaneous generation, but acknowledged that some outbreaks could not be explained. In some cases, epidemiologists were unable to locate the “splits or cracks,” as Pettenkofer had called them, through which Asiatic cholera might have slipped into a location. He noted that Pettenkofer believed that cholera could be brought surreptitiously into a location without starting an epidemic, remain there for an extended period of time, and cause an outbreak when the correct conditions arose. On some occasions, advantageous environmental conditions and perfect timing could result in “small local outbreaks,” but this “cholera nostrum” ran its course without causing the medical community to panic. Erismann believed that Koch’s vibrio was the only agent that caused actual cases of cholera, but neither contagionists nor localists were able to explain increasing numbers of cases and Erismann questioned how these “cholera-like” cases should be classified. He reasoned that certain forms of cholera were not particularly durable and easily destroyed.⁹⁸ In other words, that a different vibrio had caused the epidemic. Considering that evolutionary biologists now believe that *El tor* played a role in causing the sixth pandemic, Erismann’s logic proved remarkably accurate.

By the beginning of the new century Russian bacteriologists were building a cognitive foundation for fighting cholera that was based more upon the principles of Pasteur than Koch. In an article regarding the Saratov waterworks in 1900, the bacteriologist A. M. Shapiro provided a concise account that reflected how Russian physicians understood the evolution of water quality. He recognized three historical stages: the ancient and medieval eras, which lasted up until 1850

⁹⁴ Ibid, 19. Arkhangel’skii published a book and an article which, taken together, amount to a comprehensive history of cholera between 1823 and 1892. When he completed the article in 1892, the epidemic was still in progress. See G. I. Arkhangel’skii, *Kholernye epidemii v evropeiskoi chaste Rossii v 50-ti-letnii period 1823-1872 gg.* (S.-Peterburg: Tip. M. Stasiulevicha, 1874); and *Kholera v Peterburge v prezhlne gody.* (S. Peterburg: Shredera, 1892).

⁹⁵ Ibid, 20 and 21. For more information on the Toulon epidemic see Frank M. Snowden, *Naples*, 75.

⁹⁶ Frank Clemow, cited in Howard-Jones, *The Scientific Background*, 36.

⁹⁷ Frank Clemow, *The Cholera Epidemic of 1892 in the Russian Empire* (London: Longmans, Green, and Co., 1893), 55-56. Also Frank Clemow, *The Geography of Disease* (Cambridge: Cambridge Geographical Series, 1903).

⁹⁸ Erismann, *Kholera*, 21-23.

and during which water quality was determined by physical appearance, smell and taste of water; the period between 1850 and 1880, when water quality relied upon chemical testing and appraisal; and, the years after 1880, when public health officials began relying on bacterial screening.⁹⁹ Given the prestige of Koch's experiments, it would be easy to conclude that Shapiro would, if not *should*, hold views that were entirely harmonious with Koch. Instead, he observed that Pasteur had successfully refuted Liebig's theory of fermentation by proving that "fermentation occurs, individually, under the influence of microorganisms, that rotting, decaying and smoldering" are initiated by microorganisms in the presence of ammonia, nitrogen, nitrogen acidity, and carbolic acid—"typhoid, cholera and other" diseases enter the body through "special bacteria." Since it was possible for water that had passed chemical tests to cause cholera and typhoid, bacteriology eclipsed chemistry as most important in fighting the disease.¹⁰⁰

Shapiro's explanation of the transformation between the chemical and bacterial phases in water quality provides an understanding of how most Russian bacteriologists interpreted the evolution of their field. Both Koch and Pasteur had proven that specific microbes caused infectious diseases, but Russian physicians considered that empirical studies had demonstrated that conditions beyond the presence of the microbe might precipitate or hinder an epidemic. Like Pasteur, they retained the chemical foundation because they knew that processes like fermentation were potential catalysts for disease. They were essentially searching for Pettenkofer's missing element "y" in his formula $x + y = z$. Nitrogen, carbon and other elements were believed to play a role in causing an epidemic and, as we now know, this hypothesis contained much truth. Vinogradskii, who studied soil nitrification, motivated physicians to investigate this connection further.¹⁰¹ As mentioned above, Zabolotnyi and Savchenko left the laboratory to study cholera microbes in the environment. Zabolotnyi later published the first Russian textbook on epidemiology and is considered one of the founders of the field.¹⁰² Pasteur and Pettenkofer's influence, the changing nature of the cholera vibrio, Russia's environment, and geo-epidemiology caused bacteriology and hygiene to develop together in Russia. Russian physicians quite reasonably rejected mono-causal explanations of the disease.

Zemstvo physicians versus Koch

In addition to Erismann, Nikolai F. Gamaleia, who helped establish Russia's first bacterial laboratory in Odessa, and other many other Russian bacteriologists persistently attacked Koch's theories. In the aftermath of the 1892 epidemic, Gamaleia argued that Koch had failed to isolate a clean culture of cholera in the laboratory and did not follow his own methodological principles, the well-known Koch's Postulates. He published a pamphlet on the fundamentals of bacteriology in 1899, and composed environmental explanations for the 1904 epidemics in Baku

⁹⁹ A. M. Shapiro, *Gigiena vody i Saratovskie fil'etry, Doklad' doktora A. M. Shapiro o bakteriologicheskem izsledovanii deistviia Saratovskikh fil'trov iz ochistky vodoprovodnoi vody, prochitannyi v publichnom zasedanii Saratovskago Sanitarnago Obshchestva 21-go oktiabria 1900 goda.* (Saratov, 1900), 9. Also see A. M Shapiro, *Gigiena vody i Saratovskie fil'tri* (Saratov, 1910).

¹⁰⁰ *Ibid.* 17.

¹⁰¹ Vinogradskii published a comprehensive volume of his life's work on soil. See S. N. Vinogradskii, *Mikrobiologiya pochvy, problemy i metody: piat'desiat let issledovanii* (Moskva: Izdatel'stvo Akademii Nauk SSSR, 1952). Also see Iu. A. Mazing, T. V. Andriushkevich, Iu. P. Golikov, *Rasskazy o velikom bakteriologe S. N. Vinogradskom* (Sankt-Peterburg: Rostok, 2002).

¹⁰² Mikhel', "Rossiiskaia," 141-154. See also D. K. Zabolotnyi, *Osnovy epidemiologii*. Leningrad-Moskva, 1927.

and Saratov, and St. Petersburg in 1908.¹⁰³ He consistently criticized Koch's theories as inadequate to stop cholera in the Russian environment.

By the time of the 1905 revolution, many Russian community physicians were furious with the government for enacting cholera legislation that they felt restricted their autonomy. The legislation permitted what was essentially a reactive approach to cholera featuring emergency cholera commissions and surveillance of suspected cholera carriers along the railroads and water routes, but did not call for extensive quarantines.¹⁰⁴ At the 1905 cholera conference of the Pirogov Society, the most influential organization for Russian community physicians, the members energetically supported localism and the movement of commerce. Bearing in mind Henze's argument that Russian physicians favored localism for professional development,¹⁰⁵ one might interpret community physicians' support for localism as an attempt to gain favor with the government. However, the members' vote to support the 1905 Revolution and call for the downfall of the monarchy renders this hypothesis in most cases unlikely.¹⁰⁶ Their arguments were generally well-balanced, and their criticism of contagionist measures more reflected an antipathy for Robert Koch's methods than attempts to ingratiate themselves with St. Petersburg.

Dr. V. L. Pentkovskii of Lublin complained that disinfection took considerable time, effort, and money, and was unevenly performed. People cleared themselves of suspicion of carrying the cholera vibrio only after undressing and bathing. Their clothing and baggage were placed in chambers and subjected to pressurized steam, causing furs, leather garments and hats to deteriorate. He complained that the railroad often avoided enforcing the laws regarding disinfection in order to placate passengers and to avoid paying them recompense for damaged articles.¹⁰⁷ Pentkovskii's criticism contained practical merit. Disinfection was an onerous process that officials were performing in a manner that not only interfered with commerce and did little to stop cholera.

He noted that the method of disinfection promoted by the German immunologist and bacteriologist Carl Flügge was effective, but required nearly four hours of time and elaborate preparations, making it expensive. Pentkovskii suggested a quicker method that would minimize damage to clothing and require less technical and administrative oversight.¹⁰⁸ Flügge had opposed Mechnikov's theory of immunology and was a senior student of Robert Koch.

S. V. Konstansov of Astrakhan asserted that Koch's preferred method of disinfection was not working according to theory. Most often, he noted, "the theoretical and applied sciences" make incremental increases in knowledge, but that there are times when "science makes abrupt advances—capable of answering important questions that are uncritically accepted. He cited

¹⁰³ See N. F. Gamaleia, *Etiologiia kholery s tochki zreniya*, (1893); for the textbook see *Osnovy obshchei bakteriologii*. (Odessa: "Slavianskaia" tipografija N. Khrisogelos, 1899); for information regarding the epidemics in Odessa and Saratov see *Kholera i Bor'ba s Neiu. S prilozheniem kart, izobrazhaishchikh rasprostranenie kholernykh epidemii* (Odessa: Tipografiia Iuzhno-Russkago Obshchestva Pechatnago Dela. Pushkinskaia sob. Dom' No. 18, 1905); and for the 1908 epidemic in St. Petersburg see *Kholera v' Odesse i plan bor'by s kholernymi epidemiiami osobенно v primenenii k S. – Peterburgu* (Odessa: Tipographiia Aktzionernogo Iuzhno- Russkago Ova Pechatnago Dela, 1909).

¹⁰⁴ *Pribavlenie 1-e k svody: Pravitel'stvennykh rasporiazhenii po priiatii mer protiv zanosa raspostraneniia kholery i chumy vnutri Imperii i po sukhoputnym i morskim granitsam* (S-Peterburg: Tipografia Ministerstva Vnutrennikh Del, 1904).

¹⁰⁵ Henze, "Disease."

¹⁰⁶ See Frieden, *Russian Physicians*.

¹⁰⁷ V. L. Pentkovskii, "Peredvizhnaya dezinfektsionnyia kamery na more i na sushi," *Pirogovskii s'ezd po bor'be s kholeroi*, 70.

¹⁰⁸ Ibid.

disinfection as an example of “uncritical transfer of theoretical scientific facts into practical life.”¹⁰⁹ Koch, Konstansov wrote, produced a method for laboratory disinfection in the 1880s and endorsed a series of chemical agents to prevent infections. Public health officials had blindly applied this process, which involved using mercuric chloride.¹¹⁰ Noting that “bacteriology and epidemiology had since made significant steps,” Konstansov suggested discontinuing the practice and investigating it further. He charged that Koch had overestimated the strength of the disinfection agents because he had used an experimental bacterial culture that was tainted due to exposure to disinfection matter. The faulty experiment, Konstansov explained, motivated Koch to claim that spreading a 1:5000 concentration of mercuric chloride would kill spores within a few minutes, but a specialist named Frankel discovered that even a far stronger concentration of mercuric chloride was ineffective over a twenty minute period. An investigator named Nocht had waited as long as four hours with no result. Konstantsov stated that the work of other scientists supported these conclusions.¹¹¹

Konstansov turned his attention to the localist theory of the Pettenkofer protégé, Rudolf Emmerich, who continued to support a version of the miasma theory, but other elements of his understanding of cholera etiology were more practical. He argued that the cholera vibrio, when combined with nitric acid in the body, caused the cholera poison. Emmerich maintained that vegetables and fruits held large quantities of nitric acid salts during epidemics. He had also observed that the cholera vibrio could lose virulence during passage through the intestinal canal and exit the body in inert form, but that when it later came into contact with the soil it could regain its virulence.¹¹² Emmerich claimed to have found that contact with nitrous soils made the vibrio three times more potent than in normal soil. This process gave cholera microbes the capacity to cause an infection.¹¹³ Konstantsov did not express iron-clad belief in Emmerich’s theory, but noted that scientists should test the hypothesis, complaining “it is as if [this theory] does not exist.” He acknowledged the logic of the theory, observing that many epidemics carried “all the signs of localist infections.”¹¹⁴ Like many Russian physicians, Konstansov felt that the cholera vibrio required specific conditions to spark an epidemic.

Social Conditions and Culture

The fear that prevails just prior to cholera epidemics has done more for the cleanliness of the populations and cities of Western Europe than all of the mandates of science or the requirements of everyday life. The influence of cholera on culture fully establishes the need to teach the history of its successive appearances in Europe.¹¹⁵

N. F. Gamaleia, 1905

Many Russian physicians supported Friedrich Erismann’s observation that social conditions formed the “breeding grounds” of epidemics. The historian John Hutchinson has

¹⁰⁹ S. V. Konstansov, “Dezinfektsiia eia prakticheskoe znachenie voobshche i pri kholere v chastnosti,” *Pirogovskii s* “ezd no bo’rbe s kholeroi

¹¹⁰ Ibid, 77-78.

¹¹¹ Ibid, 78.

¹¹² Ibid, 85.

¹¹³ Ibid.

¹¹⁴ Ibid, 85.

¹¹⁵ Gamaleia, *Kholera i bor’ba s neiu*, 1.

criticized Russian physicians' extension of environmentalist theory into the social realm as an "absurd connection—between sanitary improvement—and the extension of civil and political rights."¹¹⁶ Hutchinson's criticism has merit. Like their colleagues in England—for example the British physician, social hygienist, and eugenicist, Havelock Ellis, whom Gamaleia and others admired—community physicians often revealed contemporary prejudices in their attempts to articulate the connection between disease and social conditions. They also infrequently appeared motivated by politics and a quest for professional autonomy. However, by connecting social issues and cholera, community physicians laid the groundwork that the Soviets later used to control cholera during the New Economic Policy (1921-1927).¹¹⁷

Both bacteriologists and hygienists took this connection seriously. Gamaleia, one of the founders of Russian bacteriology, was a proponent of sociological approaches to disease. Beginning his article on the 1904 epidemic by observing that the fear of cholera had resulted in progress, he criticized Koch's contagionist theory, concluding that the breeding grounds of the 1904 cholera epidemic in Baku materialized in the practices of Muslim women who socialized for long hours at public baths. Eight out of twenty bacterial investigations that were performed at these "banias" revealed the presence of large quantities of the cholera vibrio.¹¹⁸ In an article in *Russkii Vrach* (the Russian Physician), I. M. Leplinskii and I. S. Eliashvili, supported Gamaleia's conclusion.¹¹⁹ Lepinskii repeated his findings the following year at the Pirogov Society's cholera conference.¹²⁰ The role that adverse social and cultural conditions played in causing cholera epidemics was one of the major topics that they addressed.

For example, N. V. Kirilov, who had studied Chinese medicine for twenty years, criticized the Russo-Japanese War and addressed the problems that refugees in Manchuria suffered in the military conflict. He argued that war had caused cholera in Northern China and Manchuria in the late 1800s and was again triggering the same problems. Living in isolation in the mountains of Manchuria caused a large number of refugees to fall ill. People were surviving without vegetables or baked bread and sometimes went without food. War and famine facilitated the onset of cholera.¹²¹

E. Ia. Stolkind of Moscow linked Russia's deplorable sanitary conditions with the government's failure to raise "the culture and welfare of the population." Citing medical documents from 1891, he noted a list of problems that included widespread pollution of drinking water, faulty sewers, drains, dumps, garbage facilities, and soils that were soaked with sewage. He complained that the Russian population did not eat sufficient quantities of food, and that the economic infrastructure was insufficient to feed the population. Factories and artisan establishments were crowded, and suffered from poor maintenance, ventilation, and drainage.¹²² These problems promoted cholera epidemics.

Stolkind then addressed conditions in the Caucasus, which he noted were particularly poor. In 1892 a large number of Armenians, especially Tatar exiles, practiced poor hygiene.

¹¹⁶ Hutchinson, *Politics*, 89-91, 105, and 218.

¹¹⁷ For more information see the author's dissertation, John P. Davis, "The Struggle with Cholera in Tsarist Russia and the Soviet Union, 1892-1927," (Ph.D. diss., University of Kentucky, 2012), chapters 8 and 9.

¹¹⁸ Ibid, 72.

¹¹⁹ I. M. Lepinskii and I. S. Eliashvili, "Kholera v. g. Baku," *Russkii Vrach* 49 (1904): 1652.

¹²⁰ I. M. Lepinskii, "Deiatel'nost prozektorskogo kabineta Bakinskoi gorodskoi Mikhailovskoi bol'nitsy o vremia kholernoi epidemii v 1904 g. v g. Baku." *Pirogovskii s"ezd po bor'be s kholeroi*, 87.

¹²¹ N. V. Kirilov, "(Istoria i epidemiologija kholery) Kholernya epidemii Dal'nago Vostoka i mery bor'by s nimi v Kitai i v nashikh predelakh." *Pirogovskii s"ezd no bor'be s kholeroi*, 3.

¹²² E. Ia. Stolkind, "O merakh bor'by s kholeroi," *Pirogovskii s"ezd no bor'be s kholeroi*, 167.

Heaps of manure and other un-sanitary conditions prevailed in populated areas. The streets were narrow and crooked and people lived in crowded homes and drank polluted water from streams and rivers.¹²³ The government spent approximately seven and a half kopecks per year for each person in the Caucasus, while the average in the rest of the Empire was twenty-two kopecks per person. There was often only one physician per county or military district and in some places none. Stolkind observed that people in rural areas, especially the Tatars, sought the services of their own “quacks,” and distrusted physicians. There was only one school in Dagestan Oblast, which encompassed 1277 square kilometers with 315,000 inhabitants. Only 3% of the budget in the Trans-Caucasus Region was allotted for education while 62% was set aside for police and prisons.¹²⁴ Stolkind asserted that “the hosts of disease in the Caucasus are the poverty and ignorance of the population,” a lack of physicians and poor sanitary conditions. In 1892, approximately 162,000 inhabitants of the Caucasus fell ill from cholera—84,000 died.¹²⁵

Stolkind argued that there was a need for zemstvo self-government in the Caucasus, but expressed regret that the nobility dominated these councils and practiced the concept of *Kulturträger*. They used the zemstvos to control local populations and maintain a broad cultural gap. By practicing “divide and conquer,” they played nationalities against one another.¹²⁶ Struggling against one another, they lost their ability to defend themselves. Armenians, Georgians, and Tatars often resisted government oppression, but found themselves either incarcerated, banished, shot, or the target of pogroms.¹²⁷ Stolkind linked this repression with the development of cholera. Just as in 1892, Caucasians were passively waiting for a cholera epidemic to develop.¹²⁸ As Stolkind described the situation, the people in the Caucasus were obviously exploited and, considering Pirogov support for the 1905 revolution, he may have viewed them as allies against the government.

His description of the Tsar’s Jewish subjects corroborates this possibility. Stolkind described the population in the Pale of Settlement as enduring even worse “cultural-sanitary and economic conditions.” He cited a report from 1887 by the Imperial Proclaimed Commission on the Jewish question. The commission’s director maintained that 90% of the Jews lived in “a precarious mass—with the very worst hygiene and living conditions.”¹²⁹ The commission described the Jews as a “despairing proletariat, the likes of which exists in no other part of Russia.”¹³⁰ In 1898, 139,000 of these inhabitants were farmers, but five years later tens of thousands had been converted into artisans, laborers or merchants: “real proletarians” who were vulnerable to oppression, unable to flee, and lived in “far worse conditions in comparison with proletariats in other countries.” Stolkind observed that workers in small artisan shops were paid 3.5 to 4 rubles a week and seldom received raises, and wages often dropped as low as 2.5 to 3 rubles or even 1.5 to 2.¹³¹ Approximately 90% of Jewish residents did not have sufficient foodstuffs in their damp cellars to feed themselves or their children. In Vilnius and other places Jews resided in two-floor cellars; in Odessa more than two thousand lived in cellars without

¹²³ Ibid, 168.

¹²⁴ Ibid.

¹²⁵ Ibid. 168.

¹²⁶ Ibid.

¹²⁷ Ibid.

¹²⁸ Ibid.

¹²⁹ Ibid.

¹³⁰ Ibid, 168-169.

¹³¹ Ibid, 169.

windows.¹³² Stolkind had cited many unfortunate conditions, though his choice of language often seemed more aimed at identifying support for the revolution rather than quelling cholera.

Finally, he worked his way back to the point. Between 1892 and 1894, he observed, “cholera found well prepared soil among the Jews: It is understood why the death rate among the Jews is so high and ever increasing. And it will not be astonishing if in the future [due to] the following causes (overcrowding, resorting to begging, chronic hunger, pogroms, wars etc.), cholera will collect even more [victims] among the Jewish population than in the last epidemic.”¹³³

Russian community physicians feared a return of the 1892 epidemic and were apprehensive that the next epidemic might be worse.

Stolkind charged that the government diverted attention from adverse social conditions and the war with Japan by creating a *Verdummungs-system* (system of stupefaction or dumbing down). During the 1880s the government started increasing taxes on basic necessities such as kerosene, matches, sugar and other provisions and received billions of rubles. These taxes led to a failure of the harvest in 1891 and a 20% increase in mortality among the population as opposed to the previous ten-year average. Meanwhile, the Russian budget grew by 9.1 % while the budget in England rose by only 2.4% and in France 2.8%.¹³⁴ The Russian government allocated 1,045 million rubles for the population in 1893, and by 1904 had risen only to 2,178. Meanwhile, spending for the war amounted to approximately two billion rubles, while the government spent only 170 million (less than 10% of the military expenditure) on “cultural concerns” such as education, improving local ways of communication, services and utilities, and the dispensation of justice.¹³⁵ Meanwhile, the number of students in the universities fell. Mediocre and “unprincipled” professors could be bought for a sufficient sum of money or other compensation. Academic directors and teachers often performed police-related duties. Stolkind blamed Konstantin Pobedenotsev (1827-1907), the director of the Holy Synod since 1880, for fostering an atmosphere in which the government did not view education as a necessity. Even church-parish schools operated within a sphere of “crude ignorance--devoid of activities related to religion.”¹³⁶ The tutor of Alexander III, Pobedenotsev held great influence over him and his son, Nicholas II, supporting monarchial power and Russification of minorities.

Stolkind observed that the Ministry of Enlightenment (Education) spent twenty-one kopeks per individual while at the same time its counterpart in England spent the equivalent of two rubles and eighty-four kopeks per person. The war diverted attention from these internal problems.¹³⁷ Noting that cholera epidemics were already underway in Persia and Asia, he expressed the need for physicians to take steps to protect themselves from cholera riots.¹³⁸ Russian community physicians were obviously displeased with the government, and although

¹³² Ibid,

¹³³ Ibid, 170.

¹³⁴ Ibid, 170 and 171.

¹³⁵ Ibid, 170.

¹³⁶ Ibid, 171. Widely detested by liberals, Pobedenotsev was the target of at least one assassination attempt and retired later that year. For more information see Robert Byrnes, “Conservative Thought Before the Revolution,” in Theofanis Stavrou, *Russia Under the Last Tsar* (Minneapolis, Mn.: University of Minnesota Press, 1969); and Konstantin Petrovich Pobedenotsev, *Reflections of a Russian Statesman* (Ann Arbor Mi.: University of Michigan Press, 1964).

¹³⁷ Ibid, 172.

¹³⁸ Ibid, 174.

their articulation of the connection between social conditions, culture, and disease was vague, they did point out how social and cultural ills such as famine and a lack of education caused cholera.

Conclusion

We can conclude that Russian physicians were highly competent professionals that interpreted cholera epidemics according to their training, observations, and expertise. The tsarist government's indifference to adverse social and economic problems played a role in causing cholera to flourish. Before Russian physicians could educate the population, they first needed to enlighten the monarchy, which unfortunately proved impossible. Russian community physicians emphasized preventive medicine over treatment and their philosophy was well suited for a large, mostly rural country. Improving economic and sanitary conditions and habits, and making sure people were properly fed ultimately accomplished as much as laboratory bacteriology to combat cholera epidemics. During the New Economic Policy the leading Soviet physicians, almost all former members of the Pirogov Society, emphasized alleviating famine and improving sanitary education of the public. Christopher Davis has concluded that increased food consumption in the USSR, in conjunction with improved "hygiene, health education, and preventive medicine" succeeded in lowering "the rates of virtually all infectious diseases," between 1923 and 1927. Reported cases of smallpox in the USSR dropped from 46 to 15 thousand and malaria from 5.7 to 3.7 million.¹³⁹ The Soviet government increased spending on public health: from 140.2 million rubles in 1923-24 to 384.9 in 1926-27.¹⁴⁰ For political reasons, Soviet physicians tried to separate themselves from Tsarist public health, but they used, and undoubtedly improved upon, methods that had deep tsarist roots. Plagued by inadequate water supplies and sewage systems, they adopted a method of waste removal and emergency response to epidemics that had origins in the nineteenth century and had improved over the years, particularly during World War I. While their protests against the government in 1905 did little to promote cooperation, and their articulation of the problem at times left much to be desired, they brought important facts to light that ultimately helped control cholera.

By 1905, bacteriologists and hygienists in Russia were using the common cognitive foundation of the chemical research schools to form their approach to cholera. They did not completely understand the connection, but knew that the cholera vibrio, when combined with adverse environmental and social conditions, caused epidemics to develop. They instinctively felt, with good reason, that they could not prevent the vibrio from penetrating their borders. With meager spending on public health, construction of new waterworks and sewer systems was unrealistic. Accurately viewing humans as part of the ecosystem, Russian physicians concentrated on "breeding grounds" and tried to prevent germs from passing between people and the environment. Soviet physicians ultimately opted for a system of environmental controls that followed the routes of transportation and trade. They cleaned up train stations and wharves, educated the population, and conducted mass vaccination campaigns, and also used contagionist measures such as isolation of carriers and disinfection. This system of environmental,

¹³⁹ Christopher Davis, "Economics of Soviet Public Health, 1928-1932: Development Strategy, Resource Constraints, and Health Plans," in *Health and Society in Revolutionary Russia* John F. Hutchinson and Susan G. Solomon eds. Bloomington: Indiana University Press, 1990, 147-148.

¹⁴⁰ Ibid, 148.

contagionist, and social controls proved successful. Despite the chaos caused by social revolution, by 1905 a nascent infrastructure for success against cholera was present.

Geo-epidemiology, economic and social disparities, and the unequal degree of threat that a cholera epidemic might develop within various countries makes the history of the disease an unreliable tool in gauging social progress. Russian physicians used their training to form an advanced understanding of the etiology of cholera and how epidemics developed to control the disease. Considering that they were combating a multi-causal and imperfectly understood disease in a large, socially diverse country with wide open borders, late industrial and railroad development, the most extensive river network in the world, and inadequate financial support, Russian physicians' struggle against cholera proved to be an admirable accomplishment.