

Plague in Portugal¹

Between the local and the global (1700-1899)

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When presenting breakthrough discoveries about plague or synoptical accounts of old and contemporaneous plague pandemics, the doctor Ricardo Jorge often stressed a few particularities of Portugal regarding this disease. The country was one of the first European kingdoms to become free from it at the end of the 17th century,² when the disease started an apparent process of retrocession from the Mediterranean basin that would be completed in the second half of the 19th century. Nonetheless, Portugal had the fate of being impacted by an important outbreak when the plague returned to the West at the dawn of the 20th century, in Porto in 1899. Ironically, according to Jorge, this time plague spread from China and India, two places that had stronger connections with other European ports, including Lisbon itself, when compared with Porto. Yet, this return did not reach the magnitude of older epidemics, and despite other small outbreaks in the following years, the plague

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² Before its return in 1899, the last plague outbreak in Portugal dated from 1680 (Fernandes Alves, 2005).

was controlled in Portugal. On the other hand, for the first time in history, it sailed to the Americas and other regions never touched by it before, becoming a truly global scourge (Jorge, 1927, p. 1105, 1933, p. 7).

Although he used history as a rhetorical tool, Jorge was not a professional historian. Therefore, in describing the apparent retrocession of plague from the Mediterranean and its return to Portugal in 1899, Jorge had a very concrete and present project. He aimed to convince his colleagues that the “old” and the “new” plague were identical, and only the hygienic habits of European populations had changed over time, which could explain why the disease did not take ground in the Old Continent after touching Porto in 1899 (Jorge, 1933).

In the past decades, historians have examined the history of plague in Portugal, discussing this subject not only as a question of hygiene, but also as a social and cultural phenomenon. *Grosso modo*, the recent literature on plague in Portugal might be divided into three main groups: firstly, works dealing with medieval and early modern plague outbreaks, at times influenced by Foucauldian explanations and discussing how they unsettled but specially accelerated the concentration of power in the hands of the Portuguese Crown (Abreu, 2006; M. J. da M. Bastos, 2009); secondly, studies focusing on quarantine measures implemented between the 17th and 19th centuries against plague and other infectious diseases such as cholera, which stressed that these measures reinforced the statical power and fostered new international relationships between Portugal and its neighbors (Garnel, 2009; Abreu, 2018a, 2018b); And, finally, examinations of the 1899 Porto plague outbreak, with special attention to the role of Jorge in identifying the presence of plague in the city, the social reactions against the *cordon sanitaire* implemented by the central authorities, and how this outbreak heralded a period of hygienic modernization in Portugal (Fernandes Alves, 2005; Echenberg, 2007; Almeida, 2014; Costa, 2018a).

Albeit important and rich, the main deficiency of this literature was that it posed no challenge to national and Eurocentric perspectives, since the scale deployed in most of these works covers only Portugal or Western Europe. Even when the Mediterranean basin is the subject, we are often informed by what Portugal and other European countries thought about the Muslim countries and the Ottoman Empire, with rare exceptions discussing the other side of the story. Moreover, works dealing with plague outbreaks on the Portuguese possessions during the Third Plague Pandemic (1894-1959) are still exceptional, as are analyses of how knowledge about the disease circulated between these Portuguese colonies, Portugal, and other European empires.³

Jorge's reasoning provides useful insights precisely in view of this lacunae, since he took the plague as a global phenomenon. I propose to examine two connected global shifts in the history of plague that can be particularly illuminated by looking from the point of view of Portugal: firstly, the geographical shift, stressing how the locus of plague infection – whether imagined or real – passed, according to the Portuguese empire, from the Mediterranean to China and India; secondly, the shift in knowledge production, discussing the passage from a narrow sphere of circulation of knowledge on plague,⁴ centered on the Mediterranean basin, to a wider sphere connecting Europe and Asia.

By examining these two shifts, I intend to dialogue with the main ideas of this edited volume: empires and cities. On the one hand, the changes in terms of fear and

³ An outstanding exception is (Bastos & Saavedra, 2006).

⁴ Debates on the circulation of knowledge are burgeoning in the field of history of science. Circulation can mean, at times, a simple geographical displacement of a scientific instrument, a book, or an idea. But in a deeper sense, it can relate to the emergence of new knowledge because of movements beyond national borders. In this chapter, I use the word circulation in this second sense. On the circulation of knowledge, see, among others (Fan, 2012; Raj, 2013; 2017; Gänger, 2017).

knowledge about the disease were invariably linked to the European expansion towards Asia. Imperial formations not only provided an infrastructure of transport that spread diseases (McNeill, 1998; Echenberg, 2007; Harrison, 2013), but also shaped and conformed the circulation of knowledge on these scourges, an assumption that resonates with broader discussions on the history of science (Raj, 2010b). On the other hand, cities were the scene of the major plague outbreaks since the Middle Ages, and, as I will highlight at the end of the chapter, the place where new knowledge on microbiology could emerge.

The proposed scope of this chapter can give rise to at least two main criticisms. On the one hand, it can appear as a contradiction in terms to examine two global phenomena, such as the spread of plague and the global production of knowledge on it, while paying attention to a particular place, i.e., Portugal. Nonetheless, any historical examination of knowledge production in a single location is not in opposition to a global history of science. Indeed, as shown by a burgeoning literature, it was precisely in specific spaces positioned at the crossroads of local and global dynamics — mainly imperial cities in the Americas and Asia — that modern science emerged (Cañizares-Esguerra, 2017; Raj, 2010a). On the other hand, the epistemological problem of the nature of plague over the centuries, or in other words, whether the pre-microbiology plague was the same as the post-microbiology plague. This question is part of a broader philosophical debate between realist and constructivist approaches, evidenced by two classic accounts, in the case of plague. The first is William McNeil's *Plagues and Peoples*, which took medieval and modern plague outbreaks as being caused by *Yersinia pestis* and used contemporaneous knowledge to explain the emergence and spread of the disease through time. The second is Andrew Cunningham's chapter "Transforming Plague", which argued, instead, that Alexandre Yersin transformed the plague's identity when describing the plague bacillus for the first time, in 1894,

because from then onwards the disease was no more linked to its symptoms – the buboes – but to laboratory evidence (Cunningham, 1992, p. 234). Cunningham concluded that historians cannot ascertain whether plague epidemics before 1894 were caused by the same bacillus or were spread by the same mechanisms discovered in the 20th century (Cunningham, 1992). In this chapter, I do not intend to produce any synthesis of these approaches, or to defend one against the other. I acknowledge McNeil and Cunningham’s powerful insights as well as the tensions between their arguments. Instead, I will consider as plague what the involved actors considered as such, without stating whether the outbreaks before and after 1894 were caused by the same microorganism or not.

The chapter starts at the dawn of the 18th century, when the plague began to be framed as an external problem to Portugal. It discusses how plague transmission was explained, which sanitary measures were applied to avoid its importation from the Mediterranean, and which knowledge circulated on the disease in that area. Then, the chapter turns to the first decades of the 19th century and examines an “epidemiological transition,” represented by the apparent disappearance of plague and the emergence of cholera as the main global scourge. However, this situation changed again, and the chapter examines the beginning of the Third Plague Pandemic in China, and how it affected the Portuguese Empire in Asia. Finally, the text focuses on the Porto outbreak of 1899 and investigates how new microbiological knowledge constructed in Asia about the treatment and prevention of plague circulated and was slightly transformed in Portugal.

A foreign but constant menace (1700-1820)

From the perspective of early 20th-century actors, such as Jorge, the plague started a process of retrocession from Europe and the Mediterranean basin from the 17th century onwards (Jorge, 1933, pp. 7–10). However, this retreat was not linear, and the late 17th and 18th centuries sometimes witnessed violent epidemics, like those of London (1665), Marseille (1720–1722), Messina (1743), and Moscow (1771). During this period, Portugal, just like its European neighbors, strengthened sanitary regulations to avoid importing plague from contaminated places, imposing quarantines, isolation, and prohibiting the importation of some merchandise suspected of transmitting the disease (Chircop & Martínez, 2018). These measures were anchored in a deep-rooted belief that plague was a contagious disease transmitted by direct contact with sick people or by indirect contact, for instance, with contaminated merchandise. Nonetheless, as remarked by Abreu, the decision to apply such measures was also informed by political calculations, which at times, even though targeted against foreign places, sought to tip the balance of power in Portugal (Abreu, 2018a).

An important symbol of this framing of plague is a 1695 royal decree on the measures to be applied in Portugal to avoid importing the disease. The document stated the necessity of imposing sanitary cordons at the border if plague appeared in Spain, requiring soldiers to fire at any person trying to enter Portugal. Likewise, it decided on a series of measures against ports situated in infected areas, such as the Barbary Coast, seen as a perpetual plague threat.⁵ It thus established the necessity of creating health passports to be delivered by the authorities living in those ports. However, the royal decree acknowledged the possibility that the ships

⁵ This assumption, which combined epidemiological and religious anxieties, stayed broadly present in the European imagination and legislation long after the 18th century (Chiffolleau, 2012).

carrying valid passports could nevertheless carry infected passengers or objects, as they might have departed their ports right at the beginning of an epidemic. Consequently, it imposed that Health Officers should interview the crews to reconstruct the ship's journey and ascertain any death that might have occurred onboard or whether some people were showing signs of buboes (*tumores*), a common symptom of plague. As soon as their presence was confirmed, passengers and merchandise⁶ would be sent to the lazaretto to undergo a quarantine (*Regimento do Provimto da Saúde para o Porto de Belém*, 1695).

The rules set up in 1695 to avoid the importation of plague were applied in several moments of the 18th century (Abreu, 2018a), as stated in correspondences issued by British diplomats based in Lisbon, mentioning that commercial and war ships that departed from infected places were inspected and, at times, forced to stay in quarantine in the Tagus before being admitted to the port of Lisbon (*Letter from the Portuguese Secretary of State to Earl of Galway*, 1709). Although the Barbary Coast continued to be framed as the main region of concern for Portuguese authorities, containment measures were also imposed against ships coming from Corsica, Morea, France, and Dantzig, to name a few (*Letter from the Consul Burnet to the Secretary of State*, 1720).

The epidemic crises in the Mediterranean and Europe were also a moment of fluid scientific exchanges about the plague. Five years after a major outbreak in the Sicilian city of Messina, in 1743, the *Tratado sobre os meyo de preservação da peste*, compiled by Pedro Villela, was published in Portugal by royal ordination. Villela was not interested in the clinical and therapeutic aspects of plague, given that he was not a doctor but a magistrate. Therefore, his first goal was to propose sanitary legislation that should be imposed to prevent

⁶ Among the products to be put in isolation, or whose importation could even be banned during times of plague, the royal decree listed copper, wax, therapeutic drugs, silk, leather, and cotton and its derivatives.

plague importation. Vilela's suggestions continued to target people and merchandise coming from infected places – an assumption reinforced by contemporaneous outbreaks in Marseille and Messina – especially cloth made of “wool, linen, and cotton, because [they] more easily receive and conserve the spikes [*spículos*] of infected air.” Those goods had to be put in isolation and exposed to air and sunlight (Villela, 1748, p. 8). Likewise, Villela imagined what could happen if the disease arrived in any Portuguese city, basing his advice on old and contemporaneous accounts of plague. Since the air was the principal vehicle by which plague spread in a city, the government should focus on purifying measures, such as lighting bonfires, cleaning the streets, and removing beggars, dogs, and cats from the center,⁷ because they could “catch” the contagium in their fur (Villela, 1748, pp. 11–15). He also recommended placing the sick and potential patients in isolated hospitals, as well as disinfecting their houses with different essences and destroying the furniture of those who had died (Villela, 1748, pp. 48–55).

By the end of the 18th century, another treaty was published in Portugal, intitled *Advertências dos meios que os particulares podem usar para preservar-se da peste, conforme o que tem ensinado a experiência principalmente da peste de Marselha em 1720, de Toulon em 1721, e de Moscou em 1771*. It was attributed to Alexandre Antônio das Neves Portugal, of the Portuguese Royal Academy of Sciences. Given that the country had been free from plague for more than a century, the proposals suggested by Neves Portugal were mostly based on foreign contemporaneous experiences and the knowledge extracted from them.⁸ *Advertências* reached

⁷ There is no mention of rats in the treaty.

⁸ Coherent with the Academy's mission of reuniting modern and ancient knowledge, *Advertências* was accompanied by a 16th-century plague treaty, *Recompilação das cousas que convem guardar-se no modo de preservar a cidade de Lisboa*, by Tomas Alvarez and Garcia de Salzedo, from where Neves Portugal expected his readers to extract some useful knowledge.

great popularity and was republished eleven times by 1801. Such interest suggests that, until this date, the Portuguese public did not consider plague to be a disease of the past but a potential risk that could return anytime. The last European epidemics listed in the treaty's title had surely played a role in keeping this fear alive, as did the news of plague epidemics throughout the march of the Napoleonian army during the campaign of Egypt and Levante. In any case, the book continued to describe plague as a contagious disease transmitted by the touch of "sick people, their rags, or infected cloths." Most of the measures proposed by the author were not new and continued to focus on avoiding potential contact with infected people and goods, by means of quarantines, isolation, and disinfection of merchandise (Neves Portugal, 1801, p. 7).

Shortly after this publication, at the very beginning of the 19th century, "macro-parasitism," rather than micro-parasitism, became the main scourge of Portugal. The country would live nearly twenty years of social and economic turmoil following the French invasion and the transfer of the crown to Brazil in 1807. Popular unrest against the invader until its expulsion, the Porto Revolution of 1820, the Brazilian independence two years later, and the liberal wars from 1828 to 1834 provoked perhaps as many societal and economic losses as any previous epidemic. In this ravaged country, it was no longer plague, but cholera, that would become the main cause of sanitary apprehension in the following decades.

An apparent epidemiological transition (1820-1893)

From the perspective of Portugal and other Western European countries, the first half of the 19th century was marked by an "epidemiological transition." Despite plague remaining an international menace at least until 1851,

cholera gradually substituted it as the most feared scourge (Chiffolleau, 2012; Garnel, 2009). An endemic disease in the Ganges Delta whose main symptoms are violent diarrhea and dehydration, cholera started spreading around the world in the 1820s. These first “pandemics,” — though the word did not exist at the time — are often presented by historians of medicine as a collateral consequence of the increasing British presence in India (Chiffolleau, 2012; Harrison, 2006). However, Portugal was a colonial power in Asia far before the British, and the Portuguese seemed to have been plagued by pathological manifestations similar to cholera since the 16th century, which cost the lives of many officers and clergymen sent to the *Estado da Índia* (C. Bastos & Saavedra, 2006, p. 218). In spite of this previous contact with what could arguably be cholera, it only became a real threat upon its arrival to Porto in 1833, after killing thousands in Paris, London, and other European capitals. This first outbreak in Portugal provoked severe economic and social disruptions, and more deaths than the civil war (Almeida, 2014, p. 694). In May 1855, cholera returned, following a similar path to the first outbreak: it affected Porto and the north before reaching Lisbon and the Algarve. The next year, another outbreak started in Lisbon, from where the disease sailed to Madeira Island (Almeida, 2011, pp. 1064–1065).

It is commonly assumed that the cholera epidemics in Europe opposed the medical schools of contagionists and anti-contagionists. The first believed that cholera, like the plague, was spread by inter-human contact or infected objects. Therefore, the measures adopted should be like those implemented or advocated to stop plague in the 18th century, such as quarantines. Anti-contagionists, on the other hand, supported that cholera symptoms were caused by corrupted airs — the miasmas — emanating from swamps, industrial areas, and slums. This alternative position criticized restrictive measures, such as quarantines and isolation, seen not only as useless but as an attack against

the liberties of movement and commerce. Instead, anti-contagionists sustained politics centered on miasma emanations, such as suppression of wetlands and better urban sanitation (Heaman, 1995).

Nevertheless, as argued by Garnel, this binary position never existed in practice, and all countries adopted a variety of measures – depending on their geographical position, the violence of the epidemic, and other factors – that eventually combined contagionist and anti-contagionist positions (2009, p. 232). In Portugal, as in other parts of Europe, cholera became rapidly associated by the medical and political elites with the working class and poverty, and accusations of lack of hygiene were commonly coupled with moral denunciations. Some insisted on the necessity of better sanitation in the slums and on fighting against alcoholism and prostitution among the poor. But contagionist-informed measures were also applied. When Porto registered cases of cholera in 1855, Lisbon imposed a sanitary cordon to contain the outbreak, and no boat could depart from the city before staying in isolation. Fairs and markets were also prohibited because they reunited many people in a single place. Those measures drew strong criticism, especially in Porto. In this city frankly associated with the liberal cause, the press and local elites were commonly against measures decided by Lisbon, instead supporting anti-contagionist approaches (Almeida, 2011). Anyway, it is worth noting that the strategies usually suggested to fight plague in Portuguese cities throughout the 18th century came to fruition at this moment, when trying to stamp out cholera.

In parallel to these national approaches, the European powers and the Ottoman Empire met several times in the 19th century on international sanitary conferences. Starting in 1851, when plague was still a possible menace in the Mediterranean, these conferences aimed to reach an international agreement on sanitary legislation to prevent the spread of cholera to Europe while mitigating commercial disruptions caused by quarantines, isolation, and

importation bans. Plague, after 1851, was no longer seen as a menace thanks to its disappearance from the Mediterranean. The main object of discussion at the sanitary conferences was the annual peregrinations to Mecca, feared as a likely focus of cholera. This apprehension went in hand with the increasing presence of European powers in Muslim regions throughout the 19th century (Chiffolleau, 2012, 2016). The measures to prevent the importation of cholera into Europe were strongly debated, opposing contagionists and anti-contagionists, represented respectively by France and Great Britain, in the international arena. Despite being its oldest ally, Portugal never completely supported the quarantine-free position of Great Britain and aligned with France several times to back rigorous measures against infected places (Garnel, 2009). The first sanitary convention, signed only in 1892, set a compromise between these two antagonistic positions by insisting more on disinfection and reducing the time of quarantines. In 1897, a new sanitary conference was summoned. Nonetheless, it dealt no more with cholera but with plague, a disease that had shortly returned to the center of political discussions in Europe (Proust, 1897).

From Hong Kong to Porto (1894-1899)

The spread of plague at the end of the 19th century — later christened the beginning of the Third Plague Pandemic — started in Hong Kong in 1894. From this British colony, the disease sailed to India in 1896, touching first Calcutta (present-day Kolkata) and then other parts of the British Raj. In later years, Bombay (present-day Mumbai), then the capital of the Presidency of the same name and a major economic hub, became the epicenter of the global plague pandemic (Arnold, 1993; Catanach, 1988; Chakrabarti, 2012, Chapter 1). Following new maritime routes aboard fast

steamships, the disease spread from India all around the world, returning to the north of Africa and reaching, for the first time, the Americas and Australia (Echenberg, 2007). In Western Europe, despite a few cases in London and Marseille, and a laboratory accident in Vienna, Portugal was the first country to deal with a plague epidemic of considerable proportions in its mainland territory (Jorge, 1899).

Nonetheless, before returning to the metropolis in 1899, the plague crossed the Portuguese Empire, a point seldom acknowledged by historians of the Porto outbreak. According to official reports and scientific works by José Gomes da Silva (1895, pp. 22–23), the Portuguese doctor in charge of the Macau sanitary services, the disease arrived in this colony as early as March 1895, being first identified in a Chinese man coming from Hong Kong, just on the other side of the Pearl River estuary. This case soon gave place to an outbreak, which lasted until July 1895 and killed more than one thousand people, mostly Chinese. Without the violence of this first eruption, from 1896 to 1898 plague outbreaks were annually reported in Macau; again, the port of Hong Kong, along with those of Canton (present-day Guangzhou), was pointed out by Gomes da Silva as the probable source of the infection (Silva, 1898a, 1898b).

Soon after the Macanese outbreak, the plague reached Portuguese India, when cases were reported in Damão in February 1897 (Pinto, 1899). For the British authorities, the Damão outbreak was probably caused by the strong commercial and societal links that tied the Portuguese enclave to the Bombay Presidency, where the epidemic was going rampant. This observation was based mainly on the discovery of initial cases among sailors who visited the busy port of Karachi (present-day part of Pakistan) (Haffkine & Lyons, 1897, p. 2). The hypothesis of contamination coming from Bombay ports and villages would find an echo in the Portuguese administration and inform its sanitary decisions. In 1898, Damão authorities unsuccessfully tried to isolate the enclave from Bombay by establishing posts of control

and disinfection (Pinto, 1899, pp. 3–4). This proximity also allowed scientific exchanges between the Portuguese enclave and the British colony, especially in the form of an anti-plague vaccine invented in Bombay, at the end of 1896, by the Russian-born microbiologist Waldemar Haffkine. In the first months of 1897, it was supplied to Damão and used in almost one-third of its population of 10,000 souls. This experience, one of the first of its kind, allowed some positive conclusions about the efficacy of this vaccine, as the mortality among the uninoculated in Damão was far superior to that among the inoculated (Haffkine & Lyons, 1897).

After touching the Asian colonies, plague continued its march over the Portuguese Empire debarking at Lourenço Marques (present-day Maputo), Mozambique, in January 1899. Luckily, the outbreak was rapidly contained. Nonetheless, the disease would reappear in other villages on the Mozambique coast and countryside in later years. Again, Portuguese actors pointed out that Bombay, along with other British ports in the Indian Ocean, were the probable source of the disease's arrival to their African Empire (Jorge, 1935, p. 28).⁹ In sum, the geographical range for the menace of plague changed in these initial years, since the Mediterranean was no more its endemic place, changing instead to China and India, partly as in the case of cholera.

Despite these previous outbreaks across the Empire, the return of plague to Portugal took many actors by surprise (Jorge, 1899, p. XI). By June 1899, the first cases of a suspicious disease were observed in Porto on dockworkers, most of them Spaniards. The investigations carried out by Jorge, then the Porto Health Service chief, between July and

⁹ Portuguese colonies on the African Atlantic coast, such as Angola and Guinea-Bissau, escaped this first pandemic wave, and were only contaminated in 1921. This time, the cause was not found in British ports but in a ship coming from Lisbon, in the case of Angola, and in people traversing the border with Senegal, in the case of Guinea-Bissau (Jorge, 1935, pp. 23–24).

August, allowed him to attest first clinically and then by bacteriological examination that the plague had returned after centuries of disappearance (Jorge, 1899, p. XII–XIII). The professional background of the first cases indicated that the origins of this outbreak were likely linked to maritime commerce. However, an important point puzzled Jorge and several other actors: why was Porto was the entrance of plague in Europe, rather than a Mediterranean port or even Lisbon? As Jorge pointed out in his reports, in the weeks before the first cases, no ship had arrived in Porto from “India, China, Mauritius, or any other region where an epidemic has recently occurred or is now occurring.” Commercial links with these places could only be retraced indirectly. Indeed, merchandise exported from them – hemp, tea, and rice, to name a few – arrived just before the outbreak but came in ships departing from European ports, mainly British ones, which were free from plague and, therefore, had proper health letters. This observation led Jorge to wonder whether the merchandise, despite a long time of latency, was acting as a “vector of plague,” potentially undermining contemporaneous political and scientific notions that goods should be given free circulation if embarked on a port considered free of plague (Jorge, 1899, p. 34).

The Portuguese Government faced the Porto outbreak with measures dating from the 18th century and before. It decided to isolate the sick, clean the streets, and destroy houses and furniture touched by plague victims (Jorge, 1899, p. 30). In addition, it imposed a *cordon sanitaire* maintained by the Army, stopping any communication with the external world. Suspecting Lisbon’s economic and political interests rather than sanitary concerns to be behind that decision, and faced with inflation and unemployment, the Porto population revolted against the measure, without success (Almeida, 2013, 2014; Costa, 2018b, pp. 171–172). In the international arena, European representatives based in Portugal and foreign scholars sent there to study the disease condemned the cordon as a disproportionate measure

unable to achieve its goals (Lettre du Ministre de France à Albert Calmette, 1899).

Plague in Porto: circulation and construction of microbiological knowledge (1899)

Whilst the Porto outbreak shows that the revolutionary aspects of the emergence of microbiology in the last decades of the 19th century should not be overemphasized, it would be unfair not to acknowledge the practical and intellectual transformations brought by the science of microbes. Paradoxically, these revolutionary aspects are also perfectly exemplified by the Porto outbreak.

According to the historian of medicine Ilana Löwy (2015, p. 239), microbiology was a “technology of hope” whose promises could be summarized in three different points: a) the production of new therapeutic objects; b) the prevention of diseases by means of artificial immunization; and c) the invention of new sanitary strategies targeting the “real” causes of the spread of diseases. Nonetheless, at the turn of the 20th century, these three promises hardly materialized together to face one specific disease, except in the fight against plague. In that case, the possibility of treating and immunizing became possible thanks to the invention of several anti-plague sera and vaccines. Moreover, new sanitary interventions were proposed and applied around the world, focused on destroying rats or preventing the contact between these supposed carriers of plague bacilli and humans (Silva, 2020). In the case of the Porto outbreak, the city played an important role regarding the first two promises, i.e., serotherapy and new techniques of immunization.

Initial attempts to produce an anti-plague serum and vaccine started soon after the identification of the plague bacillus in 1894. In 1895, the Pasteur Institute of Paris announced that its plague vaccine prototype seemed

dangerous to guinea pigs and decided to halt this branch of research, while tests on animals with a therapeutic anti-plague serum, also conducted in the Parisian laboratory, were more successful. To produce it, a certain quantity of living plague bacilli was injected into horses; this induced an immunological reaction, and their blood became full of plague antibodies. Part of their blood was then recovered and transformed into serum, which was later administered to infected patients (Yersin *et al.*, 1895). Yersin first tested this medicine on humans in Canton in 1896, obtaining promising results: out of 26 cases treated with it, only two died (Yersin, 1897b). Meanwhile, towards the end of 1896, Haffkine tried to produce a similar anti-plague serum in Bombay to save its thousands of victims, but he was ultimately unsuccessful. He was luckier in inventing a vaccine by heating a culture bouillon containing the plague bacillus and its toxins. By early 1897, Haffkine started manufacturing and administering it to thousands in Bombay, in other parts of India (in Damão, for instance), and even abroad (Haffkine, 1897, 1903).

These two parallel dynamics met in March 1897 when Yersin — later substituted by the French Pasteurian doctor Paul-Louis Simond — arrived in Bombay. Their mission's official goal was to test the curative powers of the Pasteur Institute serum and ascertain whether the numbers obtained in Canton could be replicated when applied to a much larger epidemic. Nonetheless, the previous positive results were not reproduced in Bombay, where the French obtained a mortality of 60% among their patients (Simond, 1898). The efficacy of the French serum was then rapidly shunned by Indian and British authorities, who decided to support the local production of an anti-plague serum originally invented in Florence and tested in Bombay at the same time as the French serum, known as the Lustig serum (Galeotti, 1899). In addition to testing the curative powers of the French serum, Yersin and Simond also aimed to assess whether this medicine could protect healthy people

against the plague, performing a vaccination with the serum (Yersin, 1897a). The decision put them at odds with Haffkine, sparking a controversy. For the French, Haffkine's vaccine was dangerous: it caused fever, pain and even death among the inoculated because it contained plague toxins. On the other hand, Haffkine considered the prophylactic effects of the French serum to be useless, since the protection it conferred lasted for no more than two weeks, while his vaccine resulted in immunization for at least six months. Bombay authorities aligned with Haffkine, preferring his vaccine over the French serum. However, the French critique would better resonate with European audiences and Haffkine's vaccine was regarded with suspicion there (Silva 2018).

It was right at this moment of controversies and hesitations about microbiology's capacity to stop the plague when the disease arrived in Porto. Given the uniqueness of the event and its importance to European public health, different scientific missions gathered in the city, and Porto became an international laboratory. The Pasteur Institute sent its representatives again, this time Albert Calmette and Alexandre Salimbeni. Their mission, as put clearly by Émile Roux, the vice-director of the French laboratory, was to dismiss the bad publicity around the anti-plague serum in Europe after the mission in India (Roux, 1899). The French brought to Porto an improved anti-plague serum produced in Paris, modified according to the bad results obtained in India: it was produced by injecting dead plague bacilli in the horses and then living bacilli of increasing virulence (Calmette & Salimbeni, 1899). The Portuguese Government established an international commission formed by local doctors, such as Jorge, and foreign scientists to evaluate the therapeutic and prophylactic effects of this new serum on animals. The commission eventually attested the French serum's efficacy not only to treat but also to protect against plague, although considering that this protection seemed to wane after three weeks (Commission Internationale de

Porto, 1899). Partly thanks to these conclusions, Calmette and Salimbeni applied more easily their serum in Porto, treating 142 patients in the Hospital do Bomfim (only 21 died) and using it as a vaccine on more than 600 people (Calmette & Salimbeni, 1899, pp. 893–894 and 903).

The international commission also tested the efficacy of anti-plague vaccines, specially Haffkine's, in Porto. It attested that these vaccines could protect for a longer time than the serum; nonetheless, they could be dangerous due to their method of fabrication. To overcome this problem, Calmette and Salimbeni suggested and tested a third solution on animals, but not on humans, which they called a "mixed vaccination." It consisted in dropping some serum in the vaccine and applying them together; Calmette and Salimbeni imagined that this could overcome the intrinsic problems of both treatments while boosting their efficacy (Commission Internationale de Porto, 1899, pp. 6–8). Although in Portugal the mixed vaccination never went past being a suggestion, the idea found a longstanding application, partly reformulated, as an immunization technique in Rio de Janeiro during plague outbreaks in the first decade of the 20th century (Silva, 2020, pp. 230–237).

Despite the better results of serotherapy and the emergence of mixed vaccination, the Porto plague episode did not solve all problems faced by microbiology in India, and some doubts persisted. However, it showed that the results obtained in Bombay were not necessarily universal and that other possibilities could emerge to treat and protect from plague. The outbreaks in Porto and other places, such as Brazil, would force scholars to explain why the results of therapeutic anti-plague sera in India were so different from other parts of the world. These comparisons produced a rich scientific literature comprising different hypotheses, which spanned from a supposed racial weakness of Hindus *vis-à-vis* the plague to critiques against the sanitary management of plague in the British Empire (Calmette & Salimbeni, 1899;

Choksy, 1923; Lustig & Galeotti, 1901; Simond, 1911). Even though no single answer reached scientific consensus, the Porto outbreak was the first event to trigger this global debate.

After this episode, the plague would reappear periodically in various places around Portugal, such as Porto (until 1915), Lisbon, and the islands, where cases were reported until 1921 (Office International d'Hygiène Publique, 1923, pp. 76–81). Nevertheless, the political and scientific importance of the 1899 outbreak would hardly be surpassed.

Conclusion

This chapter followed two correlated shifts in the global history of the plague from the perspective of Portugal: first, a geographical shift, with the plague passing from a problem situated in the Mediterranean basin, until the first decades of the 19th century, to a global scourge, from 1894 onwards; second, a shift in the production of knowledge about this disease, not only in terms of the emergence of microbiology but also of geographical scope. If the knowledge about this disease circulated within Europe throughout most of the 18th and 19th centuries, from 1894 onwards China and especially India emerged as the preeminent places where innovative microbiological solutions were created, tested, and evaluated. Interestingly, this double emergence of China and India as both feared threats and players in the global production of microbiological knowledge can be observed in Portuguese colonies situated in those two Asian regions and Porto. In addition to being affected by the disease, Porto was also the place where the new anti-plague serum from the Pasteur Institute improved after a failed mission to India, and where the mixed vaccination was proposed as a solution to solve a controversy raised in Bombay.

By reconstructing these shifts and describing them in a long-term, global perspective, the chapter has contributed, first, to expand and disclose the literature about the plague in Portugal, at times confined to a national framework, by showing the articulations between imperial, national and international dynamics. In this chapter, the articulation was described under the lens of the circulation of knowledge, understood here as a heuristic tool to describe the scientific innovation at the crossroads of the local and the global. However, this circulation did not occur in the vacuum, but within bounded global structures – the European Empires – whose materiality could only be observed in situated spaces: both colonial and metropolitan urban settings.

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