Disease landscapes beyond the "Spanish flu" pandemic: temporal patterns, re-centered narratives (1889-1970s)

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"C'est par l'accent que l'histoire met sur le changement et sur les différences ou écarts affectant les changements qu'elle se distingue des autres sciences sociales et principalement de la sociologie", argued Paul Ricoeur in his classic study *La mémoire, l'histoire, l'oubli*[1]. We could add to this that change —the passage from one collective situation or circumstance to another— would constitute not only the most specific object of history, but also a major impetus for historians to do research and, in general, for the development of historical science. As Reinhart Koselleck pointed out in *Future Pasts. On the semantics of historical time*, changes produce a "penetration [rupture] of the horizon of expectations" (taking these as "the future made present") that inevitably leads to a "restructuring of the space of experiences" (taking these as "the past made present")[2]. Each generation of historians would, thus, feel compelled from the changes occurring in its present to rewrite history in order to re-imagine collective destiny (and vice versa).

1. Paul Ricoeur. *La mémoire, l'histoire, l'oubli* (Paris: Seuil, 2000), 232. Dossier editors' translation: "History distinguishes itself from other social sciences, especially sociology, by its emphasis on change and on the differences or gaps resulting from changes".
2. Reinhart Koselleck, *Futures past. On the semantics of historical time* (New York: Columbia University Press, 2004), 262. https://voidnetwork.gr/wp-content/uploads/2016/09/Futures-Past.-On-the-Semantics-of-historical-time-by-Reinhart-Koselleck.pdf, accessed on December 1, 2024.

For the editors of this special issue, the recent experience of the Covid-19 pandemic has resulted in an urge to revisit the past of human diseases and, more specifically, of pandemics. In fact, their interest in the subject long predated to that event. In the case of Francisco Javier Martínez, it occurred, on the one hand, as part of his research on the relationship between medicine and imperialism, which led to publications on cholera, plague and yellow fever in contemporary Spanish overseas possessions such as Cuba the Philippines and Morocco[3]. On the other hand, it developed in relation to the study of modern quarantines (broadly understood to include also non-health aspects) that he has promoted from the *Quarantine Studies Network* (QSN) launched in 2014[4]. With regard to Matheus Alves Duarte da Silva, his first interest for plague and pandemics arose from research on the history of the foundation and first years of two main Brazilian laboratories — Fiocruz and Butantan. Believing that the official history of these two institutions was exaggeratedly edulcorated, Duarte da Silva investigated how they emerged amidst both a global crisis provoked by the Third Plague Pandemic (1894-1950) and global polemics on the efficacy of anti-plague sera and vaccines[5]. Moreover, he studied how these institutions managed to carve their place in the emerging scientific context of microbiology by circulating their inventions with India and Western Europe[6].

During the Covid-19 pandemic and after its officially declared end, both editors have continued their parallel work on this field. Martinez imparted seminars and lectures, contributed to collective volumes such as *Cuarenta*

3. Francisco Javier Martínez, *La otra Guerra de África. Cólera y conflicto internacional en la olvidada expedición militar de Francia a Marruecos en 1850* (Ceuta: Archivo Central de Ceuta, 2010); " 'L'année de la peste': santé publique et impérialisme français au Maroc autour de la crise d'Agadir", *Mélanges de la Casa de Velázquez*, 44-1 (2014), 251-273; "Not a polar island: yellow fever, Spanish medical research and the struggle for scientific and political hegemony in late nineteenth century Cuba", *Història, ciências, saúde. Manguinhos*, 24, 4 (2017), 1125-1146.
4. John Chircop, Francisco Javier Martínez (eds.) *Mediterranean quarantines, 1750-1914. Space, identity and power* (Manchester: Manchester University Press, 2018). For more information on the QSN activities, see: https://eahmh.org/networks/, accessed December 3, 2024.
5. Dilene Raimundo do Nascimento, Matheus Alves Duarte da Silva,"'Não é meu intuito estabelecer polêmica': a chegada da peste ao Brasil, análise de uma controvérsia, 1899", *História, Ciências, Saúde-Manguinhos*, 20, Suppl 1 (November 2013): 1271-1285;
6. Matheus Alves Duarte da Silva, "Quand la peste connectait le monde: production et circulation de savoirs microbiologiques entre Brésil, Inde et France (1894-1922)" Thèse de Doctorat, EHESS, 2020; From Bombay to Rio de Janeiro: the circulation of knowledge and the establishment of the Manguinhos laboratory, 1894-1902", *História, Ciências, Saúde-Manguinhos*, 25 (2017): 639-657.

historias para una cuarentena (2020)[7], published articles on bacteriology and epidemics[8], and co-edited a special issue on interdisciplinary approaches to quarantines[9]. Duarte da Silva joined the University of St Andrews as a postdoctoral research fellow in the Wellcome Trust-funded project *The Global War against the Rat and the Epistemic Emergence of Zoonosis* in September 2020. In this project, he investigates how anti-rat campaigns led to the invention of spatial and ecological concepts, such as disease reservoirs, sylvatic plague, and rural plague. He has co-edited the special issues "Rethinking the History of Microbiology" (*History and Philosophy of the Life Sciences*, 2025) and "Disease Reservoirs: Anthropological and Historical Approaches" (*Medical Anthropology*, 2023), as well as the books *Beyond Science and Empire: Circulation of Knowledge in an Age of Global Empires (1750-1945)* (Routledge, 2023) and *Rural Disease Knowledge: Anthropological and Historical Perspectives* (Routledge, 2024).

This shared interest finally led the editors to meet at the 11th European Spring School of History of Science *Pandemic pasts, pandemic futures. Sources, histories, imaginations* held in Mahón (Spain) on May 5-7, 2022[10]. At that meeting, a mixed session of oral and poster presentations was organized, whose goal was to demand more attention for "diachronic" or temporal aspects of pandemics against the overwhelming predominance of "synchronic" analyses, i.e., their consideration from all kinds of social, economic, political, cultural, gender, colonial, or environmental perspectives. Diachronic reflections on pandemics have not been entirely absent during and after Covid-19, though have rarely constituted an object of research in itself. Some authors, for example, have implicitly traced a pandemic "genealogy" by revisiting great

7. Francisco Javier Martínez, "Epidemias y guerras (I): el cólera en la Guerra de África (1859-1860)" and "Epidemias y guerras (II): el tifus en la Guerra del Rif (1921-1927)", en Ricardo Campos, Enrique Perdiguero, Eduardo Bueno (eds.) *Cuarenta historias para una cuarentena. Reflexiones históricas sobre epidemias y salud global* (Madrid: SEHM, 2020), 54-65.
8. Francisco Javier Martínez, "Bacteriology and nation in the Philippines: the Municipal Laboratory of Manila, 1887-1898", in María Dolores Elizalde (ed.) *Transforming the 19th century Philippines* (Madrid: Polifemo, 2022), 355-396.
9. Francisco Javier Martínez, Celia Miralles-Buil (eds.) "Matters of containment. Material approaches to the handling of threats in the modern world", *SHS Web of Conferences*, 136 (2022), accessed on December 3, 2024 https://www.shs-conferences.org/articles/shsconf/abs/2022/06/contents/contents.html
10. The program is available at: https://schct.iec.cat/11th-european-spring-school/, accessed on November 30, 2024.

pestilential explosions of the past[11], only in some cases explicitly pointing to the existence of a modern sequence of "once-in-a-century pandemics" that would have included the plague of Marseille, the first cholera pandemic, the influenza of 1918-1920, and the Covid-19 pandemic[12].

Other historians have taken as their starting point Charles Rosenberg's influential analysis in his 1989-article "What is an epidemic? AIDS in historical perspective". In it, Rosenberg claimed that epidemic outbreaks old and new followed a recurrent "dramaturgy" of four phases or acts: "progressive revelation", "managing randomness", "negotiating public response" and "flat and ambiguous" ending[13]. For the medievalist Monica H. Green, however, analyses of pandemics should move beyond the "pandemic arc", i.e. the acute episode or outbreak. In her opinion, this would show that yesterday's "tropical diseases", today rebranded as "global diseases", would be nothing more than pandemics of a more or less remote past that have persisted in the most disadvantaged regions of the planet due to the lack of solidarity and funding from the more developed countries[14]. Similarly, Nükhet Varlik has argued that pandemics "do not end", since diseases that "emerge" at a given moment persist over time without seldom or ever being eliminated[15]. For Alexandre

11. Cindy Ermus, *The great plague scare of 1720. Disaster and diplomacy in the eighteenth-century Atlantic world* (Cambridge: Cambridge University Press, 2022); Maria Silvia di Liscia, "Dying in the great plagues: the cholera and yellow fever epidemics in Buenos Aires in the 19th century", *Història, ciência, saúde. Manguinhos*, 29, 2 (2022), 587-589; María Isabel Porras-Gallo, *La gripe española, 1918-1919* (Madrid: Libros de la Catarata, 2020).
12. Howard Phillips. "'17, '18, '19: religion and science in three pandemics, 1817, 1918, and 2019", *Journal of Global History*, 15, 3 (2020), 434-443; Denis Goulet. *Brève histoire des épidémies au Québec: du choléra à la COVID-19* (Montréal: Editions du Septentrion, 2020); Heiner Fangerau, Alfons Labisch, "Du choléra au corona", *Pour la Science*, February 22, 2021 https://www.pourlascience.fr/sr/histoire-sciencesdu-cholera-au-corona-21401.php, accessed on February 20, 2023; Isacar Bolaños, "Pandemics in Ottoman History: Plague, Cholera, and Influenza", *Origins. Current events in historical perspective*, September 2020 https://origins.osu.edu/connecting-history/pandemics-ottoman-plague-cholera-influenza-covid?language_content_entity=en, accessed on February 20, 2023.
13. Charles Rosenberg, "What is an epidemic? AIDS in historical perspective", *Daedalus*, 118, 2 (1989), 1-17.
14. Monica H. Green, "Emergent diseases, re-emerging histories", *Centaurus*, 62, 2 (May 2020), 234-247.
15. Nükhet Varlik, "'How do pandemics end? History suggests diseases fade but are almost never truly gone", *The Conversation* (October 14, 2020) https://theconversation.com/how-do-pandemics-end-history-suggests-diseases-fade-but-are-almost-never-truly-gone-146066, accessed on December 3, 2024. It should be added that some pandemics do not end because wild animals become infected, thus creating wild or sylvatic reservoirs of impossible extinction, as showed in this special issue by Duarte da Silva in the case of plague in Brazil.

Wenger, Laurence Toutous-Trellu and Christian Bonah, the high toll that "never-ending infectious diseases" continue to exact upon the world's most vulnerable populations would mostly be due to social and political factors rather than to their biological or clinical complexity[16].

Another starting point has been the equally influential "epidemiological transition" model proposed by Abdel Omran in 1971. According to this author, the most developed countries would have entered, from the mid-twentieth century, a phase of predominance of morbidity and mortality due to "degenerative and man-made diseases" that would have meant a radical depart from the preeminence of infectious diseases in two previous, multisecular "ages" of "famine and pestilence" and "receding pandemics"[17]. Both this and other "triumphalisms" of public health were already questioned by Ebola outbreaks and the HIV/AIDS pandemic in the 1970s and 1980s, which led to the paradigmatic shift of the Emerging Infectious Diseases (EID). Historians have also addressed the controversial aspects of both triumphalist visions of public health and the EID framework, before, during and after Covid-19. Thus, Frank M. Snowden's millenary overview of *Epidemics and society. From the Black Death to the present* was justified in that 'epidemic diseases deserve attention because their history is far from over', thereby discarding the 'exaggerated optimisms' of recent decades[18]. A similar idea, albeit much more limited in its time span, lies behind Mark Honigsbaum's *The pandemic century. A history of global contagion from the Spanish flu to Covid-19*[19], as well as in renewed criticisms of "eradicationism" and its short-sightedness in taking infectious diseases as ecological realities derived from the unavoidable human coexistence, sometimes beneficial, sometimes harmful, with microorganisms.

Finally, there has been much discussion around the classic question of the "lessons of history", which ultimately reveals the opposition between those who believe that historical events in the present are absolutely new with respect to the past and those who consider that there is a repetition from which

16. Project "Neverending infectious diseases", Université de Genève https://neverending.unige.ch/, accessed on December 1, 2024.
17. Abdel R. Omran. "The epidemiologic transition. A Theory of the Epidemiology of Population Change". *The Milbank Memorial Fund Quarterly*, 49, 4 (October 1971), 509-538.
18. Frank M. Snowden, *Epidemics and society. From the Black Death to the present* (New Haven and London: Yale University Press, 2019), 3.
19. Mark Honigsbaum. *The pandemic century. A history of global contagion from the Spanish flu to Covid-19* (London: WH Allen, 2020).

useful learnings could and should be made for future preparedness. Hence, from the early days of Covid-19 some authors such as Guillaume Lachenal and Gaëtan Thomas claimed that "we have never been here before"[20], while others such as Koen Vermeir considered the opposite[21]. The debate took on a different form in publications dealing with the collective oblivion and, in particular, the lack of "*lieux de mémoire*" that have characterized major pandemic episodes in contrast to other catastrophes such as wars. Those who blamed this recurrent tendency for the failure of societies to have adequate preparedness against epidemics were opposed by those who considered that the collective memory of pandemics has been preserved and transmitted in legislation or institutions, blaming the surprise effect on other factors such as the changing nature of "emerging" diseases or social crisis that impair or deactivate the mechanisms of collective response[22].

Scarce as they might have been, we believe these approaches are very relevant for the history of medicine. The first main goal of this special issue is, thus, to articulate an original diachronic proposal of our own. Its theoretical foundation has been ultimately built upon Koselleck's reflection on modern history as a discipline that "is only able to recognize what continually changes, and what is new" because "experiences [are] repeatable", that is, because there exist "long-term formal structures in history which allow the repeated accumulation of experience"[23]. It is these structures that "must be discovered and investigated if historical experience is to be transformed into historical science"[24]. On this basis, we consider that Charles Rosenberg's "dramaturgy", with whose criticisms we absolutely agree, still contains a valuable element: the identification of a periodically recurring temporal structure. That the materialization of epidemic outbreaks does not take place as a chaotic or random succession of events, but as a regular sequence of phases, would

20. Guillaume Lachenal, Gaetan Thomas, "COVID-19: When history has no lessons", *History Workshop* (2020, March 30) http://www.historyworkshop.org.uk/covid-19-when-history-has-no-lessons/, accessed on February 25, 2024.
21. Koen Vermeir, "Doing history in the time of Covid-19", *Centaurus*, 62, 2 (May 2020), 219-222.
22. Guy Beiner, "Introduction: The Great Flu between Remembering and Forgetting", in Guy Beiner (ed.) *Pandemic Re-Awakenings: The Forgotten and Unforgotten 'Spanish' Flu of 1918-1919* (Oxford: Oxford University Press, 2021), 1-48.
23. Koselleck, 2004, 275.
24. Íbídem.

ultimately allow for the cumulative study of such outbreaks in different historical periods[25].

However, beyond Rosenberg's "restricted" temporal pattern of acute outbreaks (across all the spectrum from the local epidemic to the global pandemic), we propose the existence of an "extended" dramaturgy of what could be called "disease landscapes"[26]. We define these as medium-term[27] configurations of medical and health views on human diseases, as well as of the social interventions and cultural representations that are collectively elaborated to deal with them. The passage from a disease landscape to the one that succeeds or displaces it would be marked by a pandemic outbreak of exceptional scale, both in its biological features (enormous mortality and morbidity, rapid spread, very wide geographical extension) and in the collective responses (medical and sanitary measures, disruptions in social life, emotional reactions). Like a full stop that ends one sentence and gives way to the following, a large-scale pandemic would signal the entry into a new historical period. Although we would better conceive it as a "point of no return", such as in the take-off of an airplane. Not a spatial spot, located at the beginning of the runway, but a point in time in the course of the take-off process: the moment at which the plane can no longer stop and must go ahead and leave ground[28].

Disease landscapes would follow a recurrent temporal pattern much longer in duration than the acute outbreak of the pandemic marking its "take off". Similarly to Rosenberg's, its dramaturgy would be articulated in four phases. In the "phase of uncertainty", prior to a great pandemic outburst, views would begin to appear that would question or alter the disease lands-

25. Obviously, this study is also made possible by the regularity of their "synchronic" dimensions. The history of medicine has shown, for example, how epidemics and pandemics do not randomly affect the population of a given society but affect worst those segments most vulnerable due to political, socio-economic, gender or ethnic inequalities. In short, they are framed by society's structures and hierarchies. Rosenberg's approach shows that epidemics and pandemics are no less framed by temporal patterns.
26. This concept is normally used in epidemiology to describe the general panorama of diseases in a given society or geographical area (local, regional or global), i.e. in Helen Hazen, Peter Anthamatten, *An Introduction to the Geography of Health* (London and New York: Routledge, 2012), 32.
27. By using "medium-term" we mean that it is neither of short duration like an outbreak (a few months or a few years), nor is it *longue durée* of a several or many centuries.
28. As defined for example in: Robert N. Winter, "Point of no return", *Technology* [blog] (June 21, 2020) https://robert.winter.ink/point-of-no-return/ accessed on November 30, 2024.

cape developed and consolidated in previous decades. After the pandemic, a "construction phase" would begin in which —slowly and with difficulty, with some breakthroughs and many more failures and dead ends— the scientific, sanitary, social and cultural views on which a new disease landscape will be established would begin to crystallize. This would be followed by a third "consolidation phase" in which significant progress would be made in the development of these views, including significant advancements in the medical understanding of certain diseases and their management by sanitary administrations. Finally, in the "climax phase" the new disease landscape would show its full-fledged features[29].

Our proposal of temporal patterns is coupled in this special issue with a second main goal: to (re)center the history of pandemics and of their scientific study. The historiography in English on pandemic diseases post-1880 has been commonly centered on actors trained in and institutionally linked to the Pasteur Institute, such as Alexandre Yersin, Waldemar Haffkine, and Paul-Louis Simond[30]; on Robert Koch and his collaborators, like Shibasaburo Kitasato working at the Infectious Disease Institute in Berlin[31]; or on British doctors educated in metropolitan institutions and then dispatched to India and other parts of the British empire[32]. In other words, most of this historiography has been articulated around actors somehow connected to spaces of knowledge in what today we would call the "Global North", although

29. The theoretical proposal that has been sketched here and will be fully developed in a separate forthcoming publication.
30. Ilana Löwy, 'From Guinea Pigs to Man: The Development of Haffkine's Anticholera Vaccine', *Journal of the History of Medicine and Allied Sciences* 47, 3 (1992): 270-309; Andrew Cunningham, 'Transforming Plague: The Laboratory and the Identity of Infectious Diseases', in *The Laboratory Revolution in Medicine*, ed. Andrew Cunningham and Perry Williams (Cambridge: Cambridge University Press, 1992), 209-247; Simon Schama, Foreign Bodies: Pandemics, Vaccines and the Health of Nations(London: Simon & Schuster, 2023); Christos Lynteris, 'In Search of Lost Fleas: Reconsidering Paul-Louis Simond's Contribution to the Study of the Propagation of Plague', *Medical History* 66, 3 (July 2022): 242-263.
31. J. Andrew Mendelsohn, '"Like All That Lives": Biology, Medicine and Bacteria in the Age of Pasteur and Koch', *History and Philosophy of the Life Sciences* 24, no. 1 (2002): 3-36; Shiori Nosaka, 'Inventing with Bacteriology: Controversy over Anti-Cholera Therapeutic Serum and Tensions between Transnational Science and Local Practice in Tokyo and Berlin (1890-1902)', *History and Philosophy of the Life Sciences* 46, no. 4 (December 2024): 41, https://doi.org/10.1007/s40656-024-00639-1.
32. David Arnold, *Colonizing the Body: State Medicine and Epidemic Disease in Nineteenth-Century India* (Berkeley: University of California Press, 1993); Pratik Chakrabarti, *Bacteriology in British India: Laboratory Medicine and the Tropics* (Rochester: University of Rochester, 2012).

some of these same actors were actually carrying out research in the "Global South". To challenge this historiographical approach, it is important to emphasize that our goal is to re-center rather than to de-center pandemic narratives. This distinction is essential as we do not intend to affirm that every place on Earth would have the same heuristic potential to challenge canonic accounts and construct new stories. Instead, the places in which this special issue recenters the focus are among those where we judge new narratives could best emerge. In adopting the idea of re-centering, we are taking stock of recent discussions in the global history of science, namely the works of Kapil Raj, Chien-Ling Liu, and ourselves, who have insisted on the methodological and empirical gains of "relocating", i.e., of changing the focus of historiographical analyses from Europe to actors and institutions based in the "Rest"[33].

The re-centering appeal of our special issue is twofold. On the one hand, we operate a geographic, institutional, and individual recentering. Instead of writing the history of pandemics from the perspective of the Global North, the special issue moves the focus towards seldom-studied locations such as Iraq, Brazil, Portugal, and Morocco, and investigates the role of actors such as Suleiman Ghazala, Ricardo Jorge, Auguste Trillat, and Marcelo Silva Junior to reshape the epistemology of pandemic diseases. Although not completely forgotten by national and local historiographies, these locations and actors are seldom studied in the English-speaking academia. With this approach, the special issue reveals original problems, controversies, scientific dynamics, and disease landscapes, complexifying more established narratives. Moreover, our re-centering approach has a thematic endeavor. Moving beyond the paradigmatic shift brought by the "Spanish flu", the special issue focuses on two other pandemic diseases —plague and cholera. In early twentieth-century Europe, both scourges were commonly seen by doctors and politicians as a trace of a distant past or symbols of backwardness. However, in several parts of the Rest or Global South, these two pandemic diseases engendered

33. Kapil Raj, *Relocating Modern Science: Circulation and the Construction of Knowledge in South Asia and Europe, 1650-1900* (Basingstoke: Palgrave Macmillan, 2010); Chien-Ling Liu, 'Relocating Pastorian Medicine: Accommodation and Acclimatization of Pastorian Practices against Smallpox at the Pasteur Institute of Chengdu, China, 1908-1927', *Science in Context* 30, 1 (March 2017): 33-59; Matheus Alves Duarte Da Silva and Jordan Goodman, 'Of Rats and Children: Plague, Malaria, and the Early History of Disease Reservoirs (1898-1930)', *History and Philosophy of the Life Sciences* 46, 4 (December 2024): 32.

cognitive, social, and epistemic transformations at times comparable to that provoked by influenza in the Global North.

On this general theoretical background, the four articles that make up this special issue (which should be read together as if they were the chapters of a monograph) aim thus to convey the dramaturgy of the disease landscape marked by the "Spanish flu" and to re-center the narrative of the novel scientific and sanitary approaches that crystallized in the decades around that outbreak on locations, actors and diseases of the Global South. The issue begins precisely at the climax of the previous "dramatic" cycle. Neta Talmud's article "By the rivers of Babylon: the 1889-cholera outbreak in Iraq, production of medical knowledge and the construction of scientific periphery" places us at the heyday of bacteriological theory and the sanitary approaches derived from it. The 1880s saw researchers from many parts of the world join Robert Koch and Louis Pasteur in the reformulation of infectious diseases by identifying their causative germs and elaborating a "germ theory" that served both to explain contagion and to combat it. Thus, when the fifth wave of cholera of the nineteenth century broke out, the disease was, according to Talmud, "understood and fought on a newly crafted paradigm" than that which had been mobilized in previous decades and it did so in an unprecedented number of localities on the five continents, including the Ottoman province of Iraq. Going against the historiographical grain, Talmud places her analysis on this geographic location usually seen as remote and backward, both from the point of view of Europe and the Ottoman Empire. In doing so, her paper reveals the agency of Ottoman doctors to reframe cholera in their own scientific and political terms.

Soon afterwards, the return of plague as a global threat in 1894 began to alter the widespread feeling that pandemic threats could be easily controlled by the new science of microbes. Initially, as Matheus Duarte da Silva shows in the second article of the special issue entitled "Towards a complex ecology: an essay on plague history in Brazil (1890s-1970s)", germ theory contributed to the rapid establishment of an explanatory model of the dreaded scourge based on the newly discovered plague bacillus and on the role of the rat-flea duo in its transmission to humans. However, this paradigm was gradually eroded thanks to inputs from other disciplines, such as ecology and zoology, which showed that plague had a so-called sylvatic or wild form, in which a range of wild rodents and their respective ectoparasites were also implicated in plague epidemiology. Centering the focus on Brazil, and mainly in the Northeast part of the country, a region often ignored by historians

of medicine, Duarte da Silva's article shows how plague epidemiology was constantly reshaped, from a human disease transmitted by touch or objects to a disease almost exclusive to wild rodents, in which humans became infected almost by accident. In retracing the different iterations that plague and its ecology assumed in the reasoning of Brazilian doctors, Duarte da Silva argues that these studies contributed to the epistemological emergence of disease ecology in Brazil.

The two other papers of this special issue also start their narrative and analysis in the "phase of uncertainty" prior to the Great Influenza of 1918-1920. In the last one, "The devil's choice: Ricardo Jorge, the 'Spanish flu' pandemic and the pneumonization of plague, 1899-1933", Francisco Javier Martínez insists on the idea that the rat-flea model made plague appear as intellectually and sanitarily tamed in the 1900s (save for those localities in which the interest of public authorities or the available human and technical resources were very deficient, as occurred in British India), a fact which explains the prolonged resistance of the hygienist, plague expert and head of Portuguese public health Ricardo Jorge to abandon it. However, the scientific puzzles and sanitary challenges presented by variants of the disease such as the so-called "pestis minor" and, above all, the pneumonic plague, created cracks in that explanatory framework which became irreparable after the experiences of the great Manchurian plague epidemic of 1910-1911 and the influenza of 1918-1920. The latter proved decisive for Jorge's revision of his medical thinking about plague.

The pivotal role of the bacteriological paradigm was also questioned at that time from an experimental point of view, as Etienne Aoucouturier shows in the third article of the issue "Inventing aerosols: Auguste Trillat (1861-1944) and the medical meteorology of influenza". Specifically, the research carried out by this little-known chemist at the Pasteur Institute in Paris after his entry into that prestigious center in 1905 was focused on demonstrating the compatibility of the centuries-old notion of "miasma" with the microbiological theory that seemed to have buried it forever. In 1913, Trillat argued that the explosive spread of certain diseases could only be explained by the fact that germs exhaled by sick individuals managed to remain suspended in the air and move with it, very rapidly and over considerable distance, to infect other people. After the "Spanish flu", Trillat took influenza as main research object to reshape the understanding of airborne germ transmission so that it would overcome the perceived limitations of

the Pflugge's droplets model. Nevertheless, it was not until many years later, in 1938, that the French researcher coined the key concept of aerosol.

That, prior to the consolidation of this and other new notions, the 1920s and early 1930s had been a "phase of construction" is also visible in Martínez's paper. This author shows how the experience of the "Spanish flu" profoundly shattered Ricardo Jorge's beliefs in the preeminence of bubonic cases in plague outbreaks and the centrality of the rat-flea duo in the disease transmission. Following the pandemic, Jorge began to give more and more importance to inter-human transmission until he made pneumonic plague the key to epidemic explosiveness. He demonstrated this not experimentally, in Trillat's fashion, but with epidemiological reasoning and even with the unlike help of the history of medicine, publishing his main contributions between 1926 and 1934. In was also in the aftermath of influenza, as Matheus Duarte da Silva shows in the second part of his article, that the notion of "sylvatic plague" (also coined by Jorge) dealt another blow to the early twentieth century explanatory model of plague, albeit from an ecological point of view. The new concept, after scattered endorsement from the mid-1930s, would end up having a fundamental weight in the orientation of the anti-plague fight in Brazil and other countries from the 1950s onwards.

In general, when read together, the four articles of this special issue show how pandemics became complex mainly in the Global South between 1880 and the 1970s. From a reductionist explicative model applied to cholera —a water-born germ infecting humans— pandemic diseases became associated with multifarious ecologies, assembling pathogens, animals, humans, and abiotic factors. The discovery and consolidation of this ecological understanding, or the acknowledgement of this degree of complexity of disease landscapes, is the main turning point of the past pandemic era, one that the Covid-19 pandemic may have not shaken but reaffirmed. ▮

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