Rural Disease Knowledge

Anthropological and Historical Perspectives

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Christos Lynteris

The arrival of plague in Argentina in 1899 had an important impact on the development of public health and its entanglement with nation-building and the country's integration into the global capitalist market. Unfolding in the two-year period that saw an explosive spread of the Third Plague Pandemic beyond China and India, as well as the first introduction of the disease into the Americas, Argentina's first plague outbreak took place between September 1899 and April 1900 in Rosario, a port city well connected not only with international ports, but also with key grain-producing provinces in the Argentinian hinterland.[1] Soon plague would appear in the country's capital too, with the first cases in Buenos Aires being retrospectively identified as occurring in December 1899 and associated with the grain trade, a prolific sector of the national economy at the time.[2]

In his examination of the Rosario and Buenos Aires outbreaks of 1899–1900, Myron Echenberg has stressed how public health authorities' initial reluctance to report and intervene reverted to a draconian approach that included a wide array of measures such as quarantine, rat poisoning, sanitary cordons, disinfection, and serotherapy.[3] Following the initial epidemics, and faced with recurring outbreaks of the disease in Buenos Aires, during the first two decades of the twentieth century, plague control became nested within a much larger "modernized utopian vision for a sanitary state"; a project that rhymed with entanglements of public health modernization and nation-building in other South American countries.[4] This vision was tied, on the one hand, to the centralization of public health authority and, on the other, to problematizations of and interventions on urban space on the bases of what David Barnes has called a sanitary-bacteriological synthesis, with the National Department of Hygiene (Departamento Nacional de Higiene de Argentina, DNH, est. 1880) playing a key role in both processes.[5]

Following the global shift of attention to rats as part of efforts to understand and stem the Third Plague Pandemic, anti-plague operations in Argentina also focused on these animals, which in turn "encouraged a renewed sense of the city's environment as an infected terrain".[6] Becoming the target of socially and technologically complex campaigns of eradication, the rat emerged as

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a charismatic epidemic villain whose study and eradication bridged a wide array of social groups, from lofty scientists to white-male groups of ratter dog handlers to entrepreneurs involved in marketing the latest fumigation apparatuses.[7]

At the same time, the 1899–1900 outbreaks fostered scientific interest in plague among the medical elite, members of which had studied the disease even before it arrived in Rosario.[8] Echenberg has stressed the importance of the extensive and detailed analysis of the outbreaks provided by Drs Luis Agote and Arturo Medina in their 1901 report to the DNH.[9] This was the first comprehensive examination of a plague outbreak in South America, which also evinced a systematic engagement with contemporary literature on plague from across the globe, including studies of rats as propagators of the disease. Although it rejected the *sine qua non* role of rats in the dissemination of plague, the report placed considerable emphasis on the presence of these animals in grain depots where, it was argued (repeating framings of the propagation of plague first established in British India five years earlier) rats found refuge in gunny bags in which they could be subsequently transported over land, spreading plague to new locations.[10]

Yet it would take another sixteen years (until 1916) for systematic bacteriological examinations of rats to begin in Buenos Aires.[11] Moreover, despite this laboratory work, only a trickle of theses and articles were published following the end of the 1899–1900 epidemics. A new wave of scientific interest on plague appeared around 1925. This time, it would no longer be focused on Argentina's big urban trade centers, but rather on the country's hinterland, in particular the central pampa and the Northwest highlands, where disease outbreaks had become a regular phenomenon. This chapter examines this shift of scientific attention from plague in urban centers to Argentina's agrarian settings. Rather than being simply a transposition of well-established frameworks of plague, developed in relation to urban outbreaks in Argentina and abroad during the peak of the Third Plague Pandemic (1897–1910), these studies quickly attained an epistemic autonomy, posing unique questions and arriving at novel questions and bold – and in some cases highly contested – answers.

In this chapter, I will show the ways in which the novelty and appeal of this approach revolved around the development of a new notion, that of "rural plague", which came to demarcate not simply plague in rural locations, but plague maintained among non-human animals in settings at the borderline between nature and culture, and spreading to humans without the role (and in some maximalist framings even the existence) of rats. Productively positioned beyond the epistemic and spatial certainties surrounding urban plague (or plague in "culture") and those developed abroad on sylvatic plague (or plague in "nature"), the notion of "rural plague" presents the examination of rural disease knowledge with key questions: How did this new configuration of plague impact the ways rural and agrarian fauna were rendered scientifically intelligible? How did it invest interspecies interactions and spaces with

epidemiological meaning in the absence of clearly identifiable disease vectors, as diseases like malaria had hitherto afforded? And in which ways did "rural plague" bring together rural economies and ecologies in a project of hygienic modernity that belonged to neither frameworks of urban sanitation nor those of tropical medicine?

The Emergence of "Rural Plague"

Several small outbreaks of plague were recorded between 1900 and 1920 in Argentina's central pampas and Northwest provinces. The appearance of plague in the Argentinian hinterland was initially attributed to the introduction of the disease from the country's main maritime and riverine ports (Buenos Aires, Rosario, Santa Fe) by means of railway-borne rats, which were believed to be transported in flour- and grain-carrying burlap bags and to be attracted further by grain depots around provincial train stations.[12] While not ignoring the role of fleas in the transmission of plague, scientific publications and public health pamphlets continued to frame rats as infective agents of foodstuff and merchandise through which humans were supposedly infected.[13] This focus is not surprising given the long-standing war against the rat in Argentina and the emphasis placed by the Ministry of Agriculture on rats, which followed North American approaches in declaring them to be "the worst animal plague in the world" on account of the destruction of crops, such as sugar cane and grain.[14] Studies on plague in Argentina additionally assumed that rats could function as reservoirs of plague.[15] A highly contested notion in the context of the Third Plague Pandemic, rats' ability to maintain plague across inter-epidemic/epizootic periods was assumed to occur by means of the animals developing "chronic plague", an elusive but productive clinical category that had been developed by experts on plague over the preceding decades.

Possibly achieving a symbolic boost by the otherwise moot 1919 call made by Juan Capurro, the short-lived new director of the DNH under Hipólito Yrigoyen's government, for "the total extinction of plague in the country", and certainly fostered by the creation of a Plague Section in the Bacteriological Institute of the DNH under the directorship of Leopoldo Uriarte that same year, plague studies became more frequent and systematic by the mid-1920s.[16] However, twenty-odd years after the introduction of plague into the country, rats were not the only animals framed as implicated in the Argentinean hinterland. Already in 1923, an article co-authored by Uriarte allowed for the possibility of rodents other than rats being involved.[17] Uriarte singled out in particular the "cuis", an animal that is often translated as "guinea pig" in English but in fact includes several species of cavy rodents.[18] Entertaining the possibility that several rodents in the region were susceptible to plague and could lead to "the formation of more or less constant epizootic foci", Uriarte mentioned *Cavia aperea* (the Brazilian guinea pig), which was first observed in Argentina by the Spanish military engineer and naturalist

Félix Manuel de Azara y Perera in one of the foundational works on the natural history of South America.[19]

Four years later, Uriarte would return to the question of rural rodents in a report on plague in Argentina. Appearing originally in French with an international scientific audience in mind, then in Spanish translation, the report was composed in response to the Office International d'Hygiène Publique's request (1924) for "information on the fauna of the rodents and their cutaneous parasites involved in the spread of plague".[20] While it focused mainly on rats, the report also alerted readers to the fact that "there are many species in the Argentinian regions that have sometimes been visited by the plague".[21] Uriarte stressed the lack of studies on epizootics among such animals – or indeed of a complete and proper taxonomy – and the urgent need for these in light of the potential consequences of plague spreading from rats to "the rodents of the American forest", which it could transform to "foci of plague in perpetuity".[22] Evincing good knowledge of what the Portuguese plague-expert Ricardo Jorge had coined "sylvatic plague" – in other words, plague occurring in "wild" or natural settings – as distinct from urban rat-borne plague, three examples were summoned for global comparison: tarbagans (Siberian marmots) in Manchuria, ground squirrels in California, and wild rodents in the South African veldt.[23] Uriarte announced that, similarly in Argentina, plague affected *Cavia aparea*, with animals of this species testing positive for the disease. While this was the first bacteriologically backed claim of the animal's ability to carry the disease, its exact provenance remains elusive in Uriarte's report. Yet it is safe to assume from Uriarte's narrative that it related to the study of cuises conducted by Dr Pablo Arata, a professor of microbiology at the University of Cordoba – which though never published, would come to serve as the "original study" of cuis-related plague in medical literature.

Having received the stamp of approval from Argentina's most prominent and internationally recognized plague expert, investigations on plague among rodents other than rats would subsequently enter the halls of the National Academy of Medicine. At the public session of the academy held on 16 June 1928, Dr Alois Bachmann (a member of the academy with previous experience in malaria control and director of the Bacteriological Institute between 1921 and 1924) addressed the medical elite of Buenos Aires by drawing attention to the cuis.[24] Stressing the need to go beyond rats, and citing international research on plague among different rodent species, he urged his audience to support the study of rodent epizootics in rural Argentina, and in particular on the cuis's ability to transmit plague to humans, comparing it with the tarbagan in Manchuria and the spermophilus ground squirrel (*suslik*) in the Volga area. "Human plague", Bachmann declaimed, "is the result of the underground work of the epizootic, which little by little augments the virulence of the microbe and extends the invasion".[25] Judging from the frequency with which it would be thereafter mentioned in plague-related scientific works, and the role of a breakthrough attributed to it, it is

safe to assume that Bachmann's talk caused a stir among the medical elite of the country, especially in respect to its call for the "elimination of the natural reservoirs of the virus", which in his opinion required the establishment of local laboratories for the study of rodent reservoirs and their ectoparasites, as well as a legislative framework for plague prophylaxis.[26]

María Silvia di Liscia has shown how the extension of sanitary and bacteriological interventions to rural populations in Argentina formed a project shared by both conservative and radical governments in the first three decades of the twentieth century, which more often than not involved processes of pathologizing rural localities and modes of habitation.[27] Scientific interest in "rural plague" should be seen as part of this broader framing. On the one hand, this maintained what Adriana Alvarez has identified as a nexus of constitutive "asymmetries" between urban and rural "disease, dying and healing" in Argentina, with rural and urban plague being distinct epistemic and biopolitical entities necessitating different scales of public health attention and investment.[28] On the other hand, it assumed agrarian landscapes and lifeways to be not simply spatially, but also culturally, distant from the coastal metropoles. The project for their "hygienic transformation", through the combination of what di Liscia has described as "portable instruments" (vaccination campaigns, mobile laboratories, sanitary trains) and "permanent structures" (province-based labs, permanent disease-focused teams and committees) of public health, was largely modelled upon anti-malarial campaigns in preceding decades under Malbrán's and José Penna's DNH direction.[29]

These approaches would be pronounced in a programmatic paper presented by Bachmann four years after his first lecture at a public session of the National Academy of Medicine, on 20 July 1932, which would solidify the term "rural plague" in the epidemiological literature in Argentina.[30] Titled "Necessary Change in the Orientation of Anti-Plague Prophylaxis", the paper used a systematic review of information about plague in non-rat rodents in the Argentinian countryside as a support for a fundamental shift in plague prevention policy. Bachmann speculated that, probably due to the war against rats in urban centers, plague had left Argentina's cities and ports and had in turn now "infected the cuis, which until now escapes all action and maintains the cause of the epidemic, the plague bacillus, sheltered from the struggle" that humanity has so far focused upon the rat.[31] Discussing the diversity of the "rural endemic" of plague across its main geographic manifestations on the globe, he stressed the need for local data on potential "reservoirs and active vectors [*vectores vivos*] that have many local habits, that respond to climatic conditions, etc."[32] Being well versed in international literature, Bachmann recognized that in some cases human infection from wild rodents occurred through ectoparasites while in others it was via an intermediary animal, which connected a rural focus with rats in populated areas. Having clearly read the growing literature on plague in the veldt, Bachmann gave an example from South Africa. There, he argued, exists "a

complex mechanism of transmission, where the plague of rural rats [*ratas de campo*] is carried to the city by the intermediary of a 'laucha' [literally a small mouse, with Bachmann here probably referring to the multimammate mouse] that has the custom of nesting in the caverns of big rodents, both in the countryside and in the city"; Bachmann stressed, "it is them that carry and spread the infection from one place to another", with rats then spreading it to humans.[33] Returning to plague in Argentina, Bachmann stated that, "We do not know with what intensity [plague] has infected the cuis, and what is the extent of the epizootic".[34] He urged the scientific community to investigate why there was no plague in other regions where these animals lived.[34] While he admitted that continuing deratization was essential for the control of plague in the country, Bachmann also declared the method insufficient for stopping rural plague, as it did not tackle the "permanent source" of the disease in the countryside, which he assumed to be rural rodents.[35]

Rural Plague Studies in Mid-1930s Argentina

Bachmann's call to action needs to be read in the context of the first national law against plague in Argentina, passed on June 1934, which while also targeting "other rodent reservoirs of plague" for destruction, in practice exclusively focused on rats and deratization.[36] Law No. 11.843, "Profilaxis de la Peste", was aptly subtitled "Plague prophylaxis and obligatory deratization in all the territory of the Nation". By the end of the decade, this law would see the institution of a series of "plague brigades" across provinces under the auspices of the DNH, as well as the application of regional and mobile labs to the examination of the disease. More than simply being an administrative step to infection control, however, Law No. 11.843 signaled an ontological transformation of plague in Argentina into an "autochthonous disease".[37] In other words, "plague has ceased to be an exotic disease brought from distant ports; it has conquered the interior of the country and no longer needs overseas contributions to hover over us".[38] Although outbreaks of the disease remained small, with few victims, the establishment of plague in the country's rural areas – for example, in the Province of Jujuy – had given rise to a fear that it could eventually and suddenly surge – leading, in the words of the country's leading authority on malaria control at the time, Carlos Alberto Alvarado, to "a hecatomb of unforeseeable consequences".[39]

As Juan Pablo Zabala and Nicolas Fecundo Rojas note in their examination of the Bacteriological Institute of the DNH, in Argentina, the scientific study of infectious diseases and the development of public health measures against them should be seen as relatively autonomous spheres of practice.[40] Zabala and Rojas show that, following important reforms to the DNH in 1916, scientific research gradually became decoupled from epidemic events and urgencies in the country – something also obvious twenty years later in the lack of synchronization between, on the one hand, an increasingly non-rat-focused study of rural plague and, on the other hand, the

almost exclusively rat-focused legislation and practical public health apparatus developed on the ground. Characteristically in 1936, decree no. 92767 of Law 11.843 no longer mentioned rodents other than rats, while dedicating several pages to fumigation and ratproofing measures and methods.[41] However, where the scientific output on plague differs from the broader picture of the study of infectious diseases is that, in the 1930s, investigations on rural plague were far from routine. By contrast, even while they were never developed by the *par excellence* institute dedicated to the study of zoonotic diseases in the Argentine countryside, La Misión de Estudios de Patología Regional Argentina (MEPRA – see also Chapter 5 in this volume), they marked a heated and internationally significant contribution to the study of plague.[42]

This was, I argue, because the emergence of the notion of "rural plague" allowed for a relative autonomy both from well-established urban, rat-focused framings of the disease and from the emergent field of sylvatic plague. The autonomy provided in this case was both epistemological and ontological, insofar as it relied both on developing new ways of knowing plague and on the positioning of "rural plague" in between the sphere of "culture" (cities, modernity, industry) and the sphere of "nature" (jungles, deserts, Indigenous populations) as these were constructed in technoscientific narratives at the time. This meant that "rural plague" could be studied autonomously from, or by freely combining elements of, urban-focused sanitary-bacteriological approaches to infectious diseases, and tropical medical ones. It was furthermore an autonomy fostered by the fact that, by contrast to plague studies solidly fixed in the urban or in the "natural" terrain, which took as their subject unique animals (rats in the former, and marmots, gerbils, or ground squirrels in the latter, depending on the location of sylvatic plague), "rural plague" lacked a clearly identifiable or agreed-upon host animal, with the development of the concept relying more on shifting inter-rodent relations and the spaces where such relations occurred, and less on a stable zoonotic protagonist or a specific zoonotic space, as was the case with sylvatic plague in contemporary literature.[43]

The mid-1930s saw the publication of several significant studies on the question of plague in Argentina's Northwest and central pampa provinces, which progressively marked an increase in the epistemic autonomy of "rural plague". Some of these studies continued to focus on rats and grain warehouses as the source of plague outbreaks among humans.[44] Others, by contrast, took Bachmann's advice for an investigation of non-rat rodents seriously. Between 1934 and 1935, the head of the hygiene section of DNH's Bacteriological Institute, José María de la Barrera, published three studies of plague outbreaks that pointed at the potential role of other rodents. The first, on a plague outbreak in Cañada Honda y Ramallo (Rio Primero), in the north of Córdoba Province, in November 1928, noted the lack of rats or rat epizootics in the area.[45] While the fact that simultaneous infections took place in distant places drew suspicion to local rodents, these were said to have had no contact with humans. In the second study, de la Barrera

examined an outbreak (affecting only one person) in Bahia Blanca in August 1934.[46] Research in this case revealed that two cuis species, *Microcavia australis* and *Galea m. negrensis*, were extraordinarily abundant in the area, forming communities proximal to human habitations but not inside them, with no cavies found near the house of the single plague victim of this outbreak. No human use of skins or meat of the animals was ascertained. While cuises seemed possible sources of the outbreak, the research concluded that the low percentage of the animals found infected indicated that transmission was not easy. In other words, the cavy rodents were a possible, but far from ideal, source of human infection.

De la Barrera's third study examined an outbreak in August 1934 during which a child contracted and died of the disease in a hamlet 40 kilometers away from Estación Fortín Uno (Lihuel Calel, La Pampa).[47] De la Barrera described cavy nests near the house of the affected family and an epizootic of the animals in August 1934: "their cadavers were found on the opening of the nests or in their proximity".[48] Repeating epidemiological tropes long established in describing rats and marmots, he stated that living cuises bore visible signs of illness "slow and staggering/wobbly gait" (*marcha lente y tambaleante*) but bore no strange-looking fur.[49] Although de la Barrera confirmed the susceptibility of the animals to plague, and the transmissibility of plague between cuises (*Microcavia australis*) by means of fleas through bacteriological experiments, he admitted that the means of plague spreading from these animals to humans remained elusive. With cuises never entering homes, the introduction of the animals to human habitations was left to dogs and cats, as well as to children intending to play with them. De la Barerra provided no empirical evidence of either of the above means of introduction; in all probability, he was here simply repeating another well-established trope in Third Plague Pandemic literature, with children's play being particularly pronounced in scientific works on marmot-derived plague outbreaks in Manchuria and Mongolia.[50] Far from being unaware of the lack of evidence linking cuis epizootics to human cases, de la Barerra concluded his study by stressing that great lacunas in the knowledge of rural plague rendered any explanation conjectural.

If de la Barrera's third study also fleetingly mentioned the grey leaf-eared mouse *Graomys griseoflavus*, commonly grouped together with other rodent species under the name *pericote*, a mid-1930s study by another prolific researcher of plague in the Argentinian hinterland, Enrique Savino – who had prior international experience on plague prophylaxis as an envoy of the Pan American Health Organization (PAHO) – would usher this small rodent onto the main stage of "rural plague".[51] Savino undertook this investigation on rural plague in Leventué, in the Territorio de la Pampa, as a result of an outbreak in El Carbón with four human victims. During his investigation, Savino encountered abundant Graomys mice in the hills of the region. Referring to the animals as "rats", Savino noted that these mice preferred to make their nest in the hollows of the caldénes, the emblematic trees of the

pampa. Locals, who called the animal "la trepadora", the climber, recounted that in that year its numbers were exceptional. The national press quickly noticed this new angle and presented the Graomys mouse, in the context of a discussion on rural plague, as a "wild rodent, an arboreal field rat of the countryside", establishing an image of the animal as a sort of a dangerous hybrid; a middle ground between nature and culture whose elusive character further contributed to it as a silent menace.[52] Numbers reportedly peaked in May, coinciding with the corn harvest, and were followed by a great epizootic among Graomys mice in the fields and hills. If by the time Savino visited the area Graomys mice cadavers were not always easy to find, he eventually managed to locate some in fields. He proceeded to test twenty-one Graomys "rats" and one cuis, of which only two Graomys and the cuis tested positive for plague. In the end, only one in four human cases was directly attributable to Graomys mice, as the victim was working in the hills axing down the caldénes where Graomys mice lived. Here we have the first attempt to configure this animal as directly involved in a human outbreak of plague.

The mid-1930s studies were immediately well received by both high-science and practical-science leaders of the country. For his part, the newly appointed head of the Sección Norte de Profilaxis de la Peste, Carlos Alberto Alvarado, in an otherwise rat-heavy response to minister Antonino López Iriarte on the state of plague and anti-plague measures, stressed that, having been introduced by the railway into the Argentinean hinterland, plague had

> entered the fields and today it is an autochthonous problem, linked no longer to traffic, but to the local and permanent conditions of each region, and the virus does not only exist in domestic rats, but also and perhaps principally in voles and other wild rodents.[53]

Alvarado would proceed to organize anti-plague brigades in the provinces of Jujuy, Salta, Santiago del Estero, and Catamarca, aimed at stemming the growing threat of the disease in the Northwest of the country through the use of dogs, fumigants, poisons, and traps for rats as well as rodents, taking California's plague control program as a model.[54] The same year, 1935, Uriarte would co-author a study with the leading Bolivian bacteriologist and plague expert Nestor Morales Villazón on plague in "agrarian rodents" in Argentina, which stressed the lack of taxonomic clarity and revealed that not all cuises in the affected regions belonged to the *Cavia aperea* species, casting doubt on whether the animals hitherto identified as carrying plague were indeed of that species.[55] Arguing that the three species potentially playing a role in the spread and maintenance of plague in the Argentinian countryside were *Microcavia australis*, *Galea musteloides*, and *Graomys griseoflavus*, and giving data from experiments they conducted themselves on the susceptibility of Graomys mice to plague, Uriarte and Morales Villazón would map plague outbreaks in the Argentinian provinces between 1920 and 1934. They thus identified previous instances when epizootics among rural rodents

had been recorded and such animals examined, and speculated that plague among rural/agrarian rodents (*roedores campestres/agrestres*) began in 1919, probably via a railway-borne introduction of infected rats.

Seen as "notoriously" prone to travel and migration, rats were suspected to have subsequently infected rural rodents directly – most probably cuises, with which they were said to maintain "promiscuous" relations – or indirectly through rat parasites infesting merchandise (e.g. grain bags). Plague was then assumed to have spread continually between agrarian rodents over many years. This was the first time a chronology of rural or agrarian plague in Argentina was attempted, and where a map was used to attribute further objectivity to the new epidemiological notion of "rural plague". While Uriarte and Morales Villazón agreed that it was necessary to stop the slow and progressive march of plague among agrarian rodents, they were reluctant to talk about "reservoirs" (instead they used the term "persistence of the epizootic") as resistance to the disease was considered to be a requirement for an animal to function as a "reserve" or "depository" of plague; by contrast, all three key species were believed to be highly susceptible to plague.[56]

De la Barrera's Thesis and Uriarte's Wrath

If by the mid-1930s studies on "rural plague" had been unable to provide a conclusion on the role of rodents other than rats in the series of small outbreaks of the disease in the central pampa and Northwestern regions of Argentina, in March 1936 an article took a leap of faith to advance a strong position on the subject.[57] In this seventy-one-page, richly illustrated article, simply titled "Peste rural", de la Barrera decried in very strong terms what he described as the "obsession" with rats, which he argued had led to lack of attention to other rodents. Not shying away from an open confrontation, de la Barerra turned against his own patron and accused Leopoldo Uriarte of not allowing international experience with non-rat rodents displace his rat-centered focus regarding plague. While Uriarte and company were holding to a Pasteurian orthodoxy, a "plague impregnation of the countryside" (*impregnacion pestosa del campo*) had been taking place.[58] Aimed at consolidating the notion of "rural plague", de la Barrera offered a review of rodents that were potentially involved in its spread and maintenance in Argentina. While not providing any new significant information, the article was instrumental in suggesting that an intermediary small animal was required to explain the simultaneous epizootics among cuis populations in locations as far away from one another as 100 kilometers or separated by obstacles such as the Colorado River, whose bridge and cable car could not be passages for cavies.

As the case of the multimammate mouse already discussed illustrates, the idea of intermediary species, both for the infection of distant populations of wild rodents susceptible to plague and as a wild rodent–human bridge, was not new. The animal that could potentially fill both roles in the case of "rural

plague" in Argentina was, in de la Barerra's reading, the Graomys mouse, which he called "the long-tailed rat". De la Barerra was fascinated by the nesting habits of this animal and its propensity to occupy birds' nests, but also its attraction by loggers' huts (*toldos*) for food and shelter. The latter was particularly important as cuises had been established to never enter inhabited human dwellings. Returning to Savino's study of plague in Leventué, de la Barrera argued that logging, which formed a key part of the local economy, was prone to bringing humans in touch with Graomys mice. While de la Barrera had expressed interest in logging in the context of his earlier plague studies, this was the first time this was framed in terms of a rodent–human relation.[59] Noting the recent increase in forest exploitation in the region, de la Barerra returned to a theme he had previously developed – the poor working conditions in place – to argue that loggers could have become exposed to plague-carrying Graomys mice both while working outdoors and while being inside their *toldos*. De la Barrera concluded his study by arguing that plague appeared episodically in many wild or subdomestic rodents. While he was not able to confirm the existence of an "endemic, which chronic forms, pestis minor, etc.", he argued that the existence of "enzootic plague … among wild rodents" rendered domestic deratization incapable of being an adequate solution to the problem of rural plague.[60]

Uriarte's response was immediate, furious, and systematic. On a general level, he challenged the practical value of collecting ever more information about wild rodents that may be susceptible to plague. By contrast to knowledge about rats, which led to practical solutions of great preventative value such as ratproofing, knowledge of wild rodents had very little practical value if such animals could not be eradicated. Uriarte also cast doubt on the scientific validity of studies of rural plague, stressing the lack of statistical sets and what he saw as a prevailing, faulty epidemiological reasoning, as no study had been able to establish as a fact that any human infection in Argentina had resulted from contact with wild rodents, or which animal had been the source of human outbreaks in rural settings. Uriarte then directly attacked de la Barrera's 1936 article with understandable vehemence, given that he had both supported his earlier publications and had been one of the first scientists to show interest in plague among wild rodents in Argentina. Clearly upset by de la Barrera's "obsession with rats" turn of phrase (a point to which he returned time and again in his response), Uriarte retorted that while his nemesis presented mere speculation as proof in relation to rural plague, the international medical community, including luminaries such as the prominent Pasteurian Émile Roux, were "obsessed" with rats for good reason, given both the clear proof of rat-to-human infection, and the immense prophylactic value of rat-centrism, something that could not be said in relation to agrarian rodents. However, at least in public, de la Barrera appeared unconcerned by Uriarte's attack and would soon publish an article where he consolidated his thesis about rural plague and the Graomys mouse – whose role, he claimed, "replaces the domestic" rat.[61] Graomys mice were thus said

to be not only frequently present inside human dwellings, but also "frankly domestic" animals.[62]

Rural Plague Solidified (1937–1945)

The fact that it was de la Barerra's thesis rather than Uriarte's objection that carried the day is evident in its endorsement in unequivocal terms by the effective Minister of Health of the country, Miguel Sussini, in an article where he claimed that, "Rural and sylvatic plague is a biological and sanitary reality of great interest in our country".[63] Sussini framed rural plague as an "essentially autochthonous" disease, distant from population centers and communication lines, covering "great expanses with a pestigenic epizootic with such an intensity that it appears as if no agrarian rodent could escape the scourge".[64] Whereas he recognized that, in this context, human outbreaks are "just an accident in an extensive sylvatic drama", with humans being no more than sentinels of wild rodent epizootics, the minister also stressed the epidemiological importance of such cases of human plague.[65] These, he noted, tended to manifest in pneumonic (and hence contagious) form, thus making the extension of rat-proofing methods to encompass other, agrarian rodents an urgent goal of rural anti-plague sanitation (*saneamiento antipestoso rural*).

Whereas Sussini did not altogether dismiss the role of rats in rural plague, de la Barrera must have received the minister's article as a confirmation of his thesis.[66] In one of the most detailed studies published by him, he presented his investigation on a pneumonic plague outbreak in Finca Santa Teresa in Mendoza, where infection was attributed to skinning cuises, which had experienced great mortality in the region.[67] Presenting a map of the finca marking the presence of rats, cavies, and Graomys mice, de la Barrera provided an argument that once again – like his discussion of logging – brought together a problematization of the local economy and ecology. This, he argued, was a well-cultivated area, and while cultivation was the "most powerful weapon for the extinction of wild fauna" in and around a farm, it also provided ample nourishment as canals led to abundant vegetation that was not destroyed by cultivators as it held irrigation canals together.[68] This vegetation, he continued, provided nourishment and shelter to rodents – especially to cuises, which were becoming increasingly understood as versatile animals that, although sedentary, could equally inhabit cultivated fields and high-altitude semidesertic environments in great numbers.[69] De la Barrera thus brought economic and ecological framings of plague together in a way that rhymed with the broader approach to identifying "dangerous foci" through the application of notions about a " 'healthy' and 'tidy' environment", as discussed by Mirta Fleitas in her work on the history of public health in Jujuy.[70] Through this framework, some crops were identified as a "powerful attraction to some species: such are the potato fields, which, at the time of maturity, are invaded by Graomys" and other rodents, while "the

homemade and small-scale drying of the fruit (pear, peach and grape), the piling up on the roofs of fruits" and ears of corn, as well as keeping corn in sheds near the house, were blamed as further attracting rodents to the house and its annexes.[71]

While up until that point all publications, including those by de la Barrera, had stressed that cuises were not hunted for their meat or skin, this new study argued the opposite:

> The use of leather has been tried in Mendoza where around 10 cents per skin were paid. We were not able to enter into a relationship with the collectors to learn about the fate of the hides, the success of their industrialization and the importance of the trade. But not only did we see dry hides and the traps used in some ranches, but we also verified how, despite the campaign to prevent it, hunting continued during the epizootic.[72]

At the same time, whereas eating cuises had been so far described as a custom among Toba/Qom Indians, it was now recognized as being "very widespread, not only among the poor but also among the well-off who find its roast meat tasty".[73] As for the Graomys mouse, de la Barrera stressed again its promiscuous nesting habits, claiming that "of all the data on the Graomys's habitat the most interesting is on its relative domesticity", with nests found on house roofs and many Groamys mice caught in traps inside houses: "The proximity of the Graomys to human habitations and its permanence inside them is a datum of the highest value from the point of view of the epidemiology of human plague."[74] This created a potent image of rural rodents as nature/culture mediators whose ambiguous status regarding this ontological dichotomy made them all the more epidemiologically suspicious.

Arguing against the "classic" and "too often repeated" concept that "plague is a disease of rats", de la Barrera stressed that three factors advised against this doctrine: first, the fact that there were rural areas in Argentina where, in spite of exhaustive search, no rats were found, but winter repetitions of sylvatic epizootics were in place; second, that the rural rodents examined and found to carry plague did not carry rat fleas; and third, that in no case of a plague epizootic among rural rodents were domestic rats affected.[75] De la Barrera must have been aware that his three principles did not exactly correspond to actual evidence. In reality, only a couple of studies involved a thorough search for rats, and even in studies he had conducted himself, rural rodent epizootics sometimes coincided with dead rats found infected with plague. Archival evidence, moreover, suggests that, at least in some cases, the bacteriological examination of rodents manifesting an epizootic that did not affect rats in rural areas of the country provided ambiguous differential results, not allowing for a clear decision on whether the cause of the disease in the affected rodents was plague.[76]

Moreover, in a later, unpublished manuscript, de la Barrera recounted the many technical difficulties involved in his plague-related fieldwork over the

years, and the often-retrospective method of collating and interpreting evidence.[77] Nonetheless, de la Barrera asserted confidently that rural plague was "independent of murine infection" and that rodent plague "epizootics are manifestations of Elton's law, [i.e.] consequences of an *enzootic state of the same species*".[78] In other words, while he was not able to identify the mechanism of interepizootic maintenance of plague among rural rodents, he assumed epizootics to be a population self-limitation mechanism, following the precepts of Charles Elton's framing of plague in his broader examination of animal ecology, "when the increase of the species surpasses certain limits".[79] Being "temporary manifestations of a permanent enzootic, conserved across interepizootic periods by rare acute forms", the fluctuation in rural rodent epizootics of plague in Argentina was attributed to seasonally fluctuating flea indexes among the key species involved: *Microcavia*, *Galea*, and *Graomys*.[80] Did these species exchange plague bacilli, with some – like the cuises – functioning more like reservoirs, and others, like the Graomys mice, behaving more like intermediary hosts? Although de la Barrera's description of rural plague was never so neat or clearly defined, it contributed to a broader interest in the pathogenic relations between rural rodents in Argentina, with the leading zoologist on the topic, José Yepes, speculating about the convivial and proximal living patterns between different cuis species and between *Microcavia* and *Graomys*, parasite exchange in and out of nests, and its potential impact in the spread and maintenance of plague.[81]

By 1939, the idea of rural rodents such as cuises harboring plague had been well established in the Argentinian press, with de la Barrera becoming the poster-boy of Argentina's "battle against bubonic plague", posing like so many other plague fighters before him for the cameras: a "mystic" of science in his field-lab where, he claimed, he was able to live in his "proprio gran elemento": "studying, researching, trying to unravel unknowns that cannot be revealed in the comfort of city laboratories".[82] If, at the same time, the focus on plague prophylaxis on a regional level and the "*campaña antipestosa*", which applied Law 11.843 on a national level, remained exclusive to rats, de la Barrera's thesis would soon be reflected in international scientific literature on plague. Its impact was particularly felt in the influential study on "Plague in the Americas", published in the *PAHO Bulletin* in 1940 under the section "rural plague in Argentina", which did not, however, exclude the periodic reintroduction of plague from rats into rural rodent populations as a possibility.[83] Regardless, de la Barrera would continue to define "rural plague" in Argentina as a phenomenon where plague affects "wild rodents in regions where domestic rats are not abundant and where not only do they play no role in the transmission to man, but have not even been reached by the infection".[84] The claim was as bold as it was arbitrary. This was because, first, abundant rats had been found in several cases of "rural plague" and, second, both prior and subsequent studies encountered plague-infected rats and rat epizootics.[85] In just one paper, published in 1942 in the relatively inaccessible proceedings of the National Congress on Endemic-Epidemic Diseases, did de

la Barrera recognize that what he called the "purity" of rural plague (i.e. its autonomy from rats) was only relative.[86]

Conclusion

The emergence of "rural plague" as a concept and epidemiological framework in Argentina between the 1920s and the 1940s was an epistemic process that engulfed major scientists in fierce debates over the nature of plague and the priorities of plague-related science. Maintaining a relative autonomy from both rat-focused studies of urban plague and from framings of sylvatic plague, studies arguing for the existence of "rural plague" in Argentina progressively came to frame an economic–ecological nexus, including various rodent species as well as agricultural activities and rural lifeways as responsible for this phenomenon. Rurality in this case played a key role as a middle ground – ontologically situated between nature and culture – where interspecies relations were defined neither by relations of direct antagonism (as between rats and humans) nor by relations of intimacy and dependence (as, for example, between marmots and Mongols or Buryats in Inner Asia). Neither "vermin" nor integral parts of a "natural economy", the rodent species involved in "rural plague" remained ambiguous animals, in terms of both their relations and contact with humans, and their actual epidemiological roles in an equally ambiguous form of plague.

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Notes

1 Echenberg, *Plague Ports*. Estimates of the number of people infected and killed by the outbreak vary across reports.
2 The epidemic ended in May 1900. Echenberg, *Plague Ports*; Agote and Medina, *La peste bubonique dans la Republique Argentine et au Paraguay*.
3 Echenberg, *Plague Ports*.
4 Engelmann, "Fumigating the Hygienic Model City", 361; Amador, *Medicine and Nation Building in the Americas, 1890–1940*. For a key source on the development of plague control in Buenos Aires, see Penna and Madero, *La administración sanitaria y assistencia pública de la ciudad de Buenos Aires*, *Vol. 1*.
5 Barnes, *The Great Stink of Paris and the Nineteenth-Century Struggle against Filth and Germs*; Armus, *The Ailing City*; Zabala and Rojas, "El Instituto Bacteriológico de Argentina"; Veronelli and Correch, *Los orígenes de la salud pública en la Argentina*, *Vol. 2*; Biernat, "Continuidades y rupturas en el proceso de centralización de la administración sanitaria argentina (1880–1945)".
6 Engelmann, "Fumigating the Hygienic Model City", 363.
7 Ibid. On the notion of the epidemic villain, see Lynteris (ed.) *Framing Animals as Epidemic Villains*.
8 A team led by Carlos Malbrán, Argentina's leading bacteriologist, was the first to have diagnosed plague in the Paraguayan capital, Asunción (September 1899); Echenberg, *Plague Ports*. The controversy over the bacteriological diagnosis of the outbreaks played a catalytic role conferring DNH's directorship to Malbrán; Zabala and Rojas, "El Instituto Bacteriológico de Argentina".
9 Echenberg, *Plague Ports*; Agote and Medina, *La peste bubonique*.
10 Ibid., 51, 100. On such framings of rats in India, see Lynteris, "In Search of Lost Fleas".
11 Uriarte and Villazón, "La profilaxis contra la peste bubónica".
12 Echague, *Peste bubónica*. Lozano, "Peste bubónica en Salta".
13 See, for example, Consejo Provincial de Higiene, *Precauciones contra la peste bubónica*. This reflected earlier approaches to the rat as an "epidemiological dividual" that generally had been replaced by a rat/flea-only perspective in most contexts by 1910; Lynteris, "In Search of Lost Fleas".
14 Ministerio de Agricultura de la Nacion, *Plaga de ratas y ratones, su extirpación*; see also Lantz, *House Rats and Mice*.
15 Echague, *Peste bubónica*; Uriarte and Gonzalez, *Infección pestosa en un roedor silvestre*.
16 Uriarte, "La profilaxis antipestosa y la ensenanza popular", 191.
17 Uriarte and Gonzalez, *Infección pestosa en un roedor silvestre*. Ruperto Quiroga had also mentioned the animal in his 1920 thesis on plague, but had dismissed its role. See Quiroga, *La peste bubónica en la República Argentina*.
18 For a discussion of cavies in Argentina, see Yepes, "Epítome de la sistema de los roedores argentinos"; Yepes, *Roedores enemigos del campo*.
19 Uriarte and Gonzalez, *Infección pestosa en un roedor silvestre*, 5. de Azara, *Voyages dans l'Amérique Méridionale Vol. 1*, 314–316.
20 Uriarte, "Sobre profilaxis de la peste bubónica"; Uriarte, "Breves antecedentes para el estudio de la peste bubónica", 765.
21 Ibid., 766.

22 Ibid., 766. A full taxonomy would be achieved a few years later in Yepes, "Epítome de la sistema de los roedores argentinos"; the article was introduced by Uriarte.
23 While these were already grouped together in international literature as cases of "sylvatic" plague, the term was not used by Uriarte: see Silva, "Between Deserts and Jungles".
24 Bachmann, "Peste bubónica". The talk would also be published as a pamphlet two years later under the same title.
25 Ibid., 135.
26 Ibid., 135.
27 di Liscia, "Del brazo civilizador a la defensa nacional".
28 Alvarez, "Las distintas asimetrías de endermedad, morir y sanar en el interior de la provincial de Buenos Aires en entre los siglos XIX y XX".
29 di Liscia, "Del brazo civilizador a la defensa nacional", 169 and 185; Carter, "State Visions, Landscape, and Disease".
30 Bachmann, "Cambio necesario en la orientación de la profilaxis antipestosa".
31 Ibid., 121.
32 Ibid., 123
33 Ibid., 122. For a history of plague studies on this mouse in South Africa, see Skotnes Brown, *Pests, Knowledge and Boundaries in the Early Union of South Africa*.
34 Bachmann, "Cambio necesario en la orientación de la profilaxis antipestosa", 124.
35 Ibid., 125.
36 Archivo Histórico de la Provincia de Jujuy (Argentina), Expdte. 71 M Año 1934 U.C 547.
37 British Library, EAP375/1/1/207, Anon., "Considerada el Departamento Nacional de Higiene".
38 Archivo Histórico de la Provincia de Jujuy, Expdte. 133 D Año 1934 U.C 534.
39 Ibid. On this anticipatory trope, see also Archivo Histórico de la Provincia de Jujuy, Expdte. 283 C Año 1934 U.C 524.
40 Zabala and Rojas, "El Instituto Bacteriológico de Argentina".
41 Archivo Histórico de la Provincia de Jujuy, Expdte. 224 M Año 1936 U.C 652.
42 Salvador Mazza's correspondence evinces only a small number of exchanges on plague (twelve letters), while members of MEPRA published no research on plague; Biblioteca Central "Juan José Montes de Oca", Facultad de Medicina Universidad de Buenos Aires, Colección Mazza.
43 This also differentiated "rural plague" studies from the vast anti-malarial struggle across the country, or indeed the main bulk of the research conducted by MEPRA at the time.
44 Savino, "Tres brotes pestosos en las provincias de Salta, Jujuy y San Luis".
45 de la Barrera and Arzeno, "Brote de peste en la prov. de Córdoba".
46 de la Barrera and Riesel, "Epizootia de peste en roedores en La Pampa y Rio Negro".
47 de la Barrera, "La peste rural en la pampa, departamento de Lihuel-Calel y Curacó".
48 Ibid., 25.
49 Ibid., 25. On the trope of staggering rats and marmots, see Lynteris, "The Figure of the Staggering Rat"; Lynteris, *Ethnographic Plague*.
50 Ibid.

51 Savino, "Peste rural en el Departamento de Leventué, Territorio de la Pampa"; see also a summary in Savino, "Peste rural en el Departemento de Leventué (La Pampa)" and Savino, "La peste rural en la Pampa, Region de Victorica, Departamento de Leventué". The study is also summarized in the 1936 PAHO Bulletin.
52 British Library, EAP375/1/1/207, Anon., "Considerada el Departamento Nacional de Higiene".
53 Alvarado, "La peste rural en Jujuy", 52.
54 Sierra e Iglesias, *Carlos Alberto Alvarado. Vida y obra*; British Library, EAP375/1/1/207, Anon., "Considerada el Departamento Nacional de Higiene".
55 Uriarte and Villazón, "A proposito de peste en roedores agrestes de la Argentina".
56 Ibid., 206.
57 de la Barrera, "Peste rural".
58 Ibid., 442.
59 For a previous discussion of logging and loggers' working conditions, see de la Barrera and Arzeno, "Brote de peste en la prov. de Córdoba", esp. 333.
60 de la Barrera, "Peste rural", 504, 505.
61 de la Barrera, "La peste rural en la República Argentina" [1937], 481.
62 Ibid., 481. Savino would also describe Graomys as a "peridomestic animal" in a later study; Savino and Goobar, "La peste rural en el department de Rio Seco (Córdoba)", 289.
63 Sussini, "Peste rural en la República Argentina", 816.
64 Ibid., 816.
65 Ibid., 816.
66 Sussini, "Peste rural en la República Argentina".
67 de la Barrera, "Contribución al conocimiento de la peste selvática en la Argentina".
68 Ibid., 435.
69 Yepes, *Roedores enemigos de campo*, 87.
70 Fleitas, *Salud pública en Jujuy durante los gobiernos de la restauración conservadora*, 171.
71 de la Barrera, "Contribución al conocimiento de la peste selvática en la Argentina", 435.
72 Ibid., 438.
73 Ibid., 439.
74 Ibid., 443.
75 Ibid., 452.
76 Archivo Histórico de la Provincia de Jujuy, Expdte. 3580 C Año 1939 U.C. 780.
77 Biblioteca Central "Juan José Montes de Oca", Facultad de Medicina Universidad de Buenos Aires, 7535/206.188. José M. de la Barrera, Roedores y pulgas en la peste rural de la Argentina. Undated typed manuscript deposited on 12 June 1950.
78 de la Barrera, "Contribución al conocimiento de la peste selvática en la Argentina", 444–445.
79 Elton, "The Study of Epidemic Diseases among Wild Animals"; de la Barrera, "La peste rural en la Argentina" [1942], 431; see also de la Barrera, "Estudios sobre peste selvatica en Mendoza".
80 de la Barrera, "La peste rural en la Argentina" [1942], 431.
81 Yepes, *Roedores enemigos del campo*.
82 See collection of news clips on plague and plague prophylaxis in Argentina in the 1930s and 1940s in British Library, EAP375/1/1/207; in particular the

20 September 1939 three-page article by Pablo Vera Sales for *Mundo Argentino* titled "Un medico argentino ha emprendido la batalla contra la peste bubónica", 7–8 and 58, quotes on 58.

83 Mol and O'Leary, *Plague in the Americas*.

84 de la Barrera, "El último brote de peste selvática en Mendoza", 390.

85 Echague, *Peste bubónica*; Savino, "Tres brotes pestosos"; Savino, "Un Nuevo brote de peste en Recreo (prov. de Catamarca)"; Uriarte and Battaglia, "Un brote de neumopeste en Merou (prov. de Entre Ríos) en 1927"; de la Barrera, "La peste rural en la República Argentina" [1937]; de la Barrera, "Contribución al conocimiento de la peste selvática en la Argentina"; Savino, "Casos de peste en la provincia de Jujuy".

86 de la Barrera, "La peste rural en la Argentina" [1942], 431.

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Expdte. 224 M Año 1936 U.C 652 Ministerio del Interior eleva copia decreto Nº 92767 reglamentando la ley 11.843 de profilaxis antipestosa.

Expdte. 283 C Año 1934 U.C 524 Consejo de Higiene comunica que es imposible disponer de cinco peones como se le solicito para proseguir con la campaña antipestosa.

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