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Rinderpest and the Origins of International Cooperation for Disease Control

In May of 1921, representatives of forty-three countries met in Paris for the first International Conference on Epizootic Diseases of Domestic Animals.[1] Rinderpest brought them there. The infamous cattle plague had been of limited concern in Europe for decades, following a successful continental effort to drive it out of circulation via strict quarantines and cull and kill policies, but recent events had put the disease back in the spotlight. The previous summer, several zebu cattle on their way from India to South America died in holding in the quarantine stables in Antwerp. No one suspected rinderpest, so the stables were not disinfected before being filled with a shipment of North American cattle who were promptly sold to an abattoir in Ghent where they came into contact with a number of German cows on their way, not to butchering, but to farms throughout Belgium. Rinderpest traveled with them, eventually spreading to 222 farms, many close to the French border. The French government quickly closed its border to all animals and animal products and it did successfully keep rinderpest out, but it was an unnerving episode. It was also compounded by the news that Bolshevik troops had carried

[1] The official account says that "43 nations, États ou Dominions" were represented at the conference and lists delegates from the following places: Germany, the United States, Argentina, Austria, Belgium, Brazil, Bulgaria, Chile, Denmark, Ecuador, Spain, Finland, France, Great Britain, Ireland, the Union of South Africa, Australia, Canada, New Zealand, Greece, Haiti, Hungary, Italy, Japan, Morocco, Monaco, Norway, Paraguay, the Netherlands, Peru, Poland, Portugal, Romania, Yugoslavia, Sweden, Switzerland, Czechoslovakia, and Tunisia (Ministère de L'Agriculture, Républic Francaise, *Conférence Internationale pour L'Étude des Épizooties, Paris, 25–28 Mai 1921* [Paris: Imprimerie Nationale, 1921], 6–10).

rinderpest into eastern Poland with them when they invaded in July of 1920. The virus infected over 6,500 cattle, lingering longer than the troops, who were soon driven out. European governments moved quickly to help: Denmark sent veterinarians and money; France sent veterinarians and anti-rinderpest serum. Others offered aid as needed. Conference attendees in Paris the following May declared that they "can not do otherwise than note with satisfaction this spontaneous manifestation of solidarity which presents a timely demonstration of interest of a joint action of the civilized nations against the dangers that threaten the animal populations."[2]

Interest in "joint action" was a hallmark of the period. The post–World War I era saw the creation of a new international system that gave rise to an astonishing number of both governmental and nongovernmental international agencies.[3] The new League of Nations rested at the center of it. The League, as its first undersecretary-general wrote, "provides not only for the centralization and coordination of international machinery but for its orderly and systematic development."[4] The League created an "orbit" that drew nations, individuals, foundations, institutions, organizations, empires, and more into closer conversation and cooperation with each other than anything previously seen in the world. The Paris meeting was part of that new system and it resulted in the development of new international machinery for the control of animal diseases.[5]

The delegates at the 1921 Paris meeting called for "an international bureau" for "the campaign against infectious animal diseases." The campaign to which they referred was the general one of humans against the pathogens that attacked their livestock. They were trying to make it more organized and more successful. They wanted a bureau charged with collecting and publicizing information about epizootic disease and how

[2] "International Conference on Epizootic Diseases in Domestic Animals." *Journal of the American Veterinary Medical Association* 60, 13:1 (October 1921): 124–138. For the most detailed account of the meeting, see Ministère de L'Agriculture, Républic Francaise, *Conférence Internationale pour L'Étude des Épizooties, Paris, 25–28 Mai 1921*. Paris: Imprimerie Nationale, 1921.

[3] Sluga, Glenda. *Internationalism in the Age of Nationalism*. Philadelphia: University of Pennsylvania Press, 2013, 63; Iriye, Akira. *Global Community*. Berkeley: University of California Press, 2002: 9–36.

[4] Raymond Fosdick quoted in Mazower, Mark. *Governing the World: The History of an Idea*. New York: Penguin Press, 2012, 148.

[5] Clavin, Patricia and Jens-Wilhelm Wessels, "Transnationalism and the League of Nations: Understanding the Work of Its Economic and Financial Organization." *Contemporary European History* 14:4 (November 2005): 465–492.

to control them, promoting experiments and investigations "relative to the pathology or prophylaxis" of such diseases "wherever they may be occasion to resort to international cooperation," and studying and sharing "international plans and agreements" about sanitary regulations. They were particularly concerned about rinderpest, which is the disease that had brought them all there in the first place.[6]

Participants particularly urged support for "everything relating to the experimental study of rinderpest," because "prophylaxis of rinderpest is rendered difficult and uncertain by our lack of knowledge on a number of questions." That lack had not seemed so important in the past, but now the disease that had been "believed relegated to the Asiatic and African continents, has reappeared in these latter times in Europe and has reached South America." These new outbreaks had reaffirmed what European governments had discovered at the end of the nineteenth century: eliminating rinderpest required "an organized veterinary service and an administrative organization enabling rigorous application of prophylaxis measures." That was theoretically possible everywhere, but it was certainly not the reality everywhere. By the 1920s, with the notable exceptions of the Soviet Union and China, rinderpest dwelled primarily in imperial spaces and primarily traveled along imperially created trade networks. But those networks connected more than just empires – they connected the globe. And the "requirements of quarantine," which rinderpest's existence anywhere along those networks demanded, "constitute a heavy charge on commerce." Prophylaxis measures in both sanitary and biological form promised a tantalizingly cheaper option, provided the virus would cooperate with their efforts. There was reason to think that it might.[7]

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By 1921, humans had a long, intimate history with the disease rinderpest. Their struggles with it had played a critical role in shaping both how humans understood disease in general and their expectations of what their governments should do about it. Michel Foucault famously argued that the idea that the end of government should be "to improve the condition of the population, to increase its wealth, its longevity, and its health" arose in Europe in the eighteenth century.[8] It was not a coincidence that

[6] "International Conference on Epizootic Diseases in Domestic Animals," 124–138.
[7] Ibid., 127–136.
[8] Foucault, Michel. *Security, Territory, Population: Lectures at the Collège de France, 1977–1978*, ed. Michel Senellart, trans. Graham Burchell. New York: Picador, 2007, 105.

that idea emerged at the same time as a transformation in thinking about disease and contagion. Rinderpest played a critical role in that development. It would also not be a coincidence that the human quest to control disease took a decidedly international turn during the 1920s – one that questioned the utility of the essential nationalism of the existing paradigm. There, again, rinderpest helped to drive the change, primarily by being so troublesome.

Exactly how long it had been so troublesome has been a subject of some debate for a while. Ancient records from around the globe are full of reports of horrific plagues of cattle bearing descriptions that fit with modern descriptions of rinderpest outbreaks, but it is impossible to make a definitive diagnosis centuries later. They could have been outbreaks of rinderpest or the handiwork of other pathogens that may or may not still exist today.[9] Recent molecular clock analyses of RPV (the virus that causes rinderpest) and its relationship to its closest relative, MeV (the virus that causes measles), have brought more clarity to the discussion. Researchers have learned that MeV and RPV – some strains of which are up to 70.50 percent similar[10] – likely arose in an environment where humans and cattle lived in very close proximity to one another: "probably the cattle herds of Central or Southern Asia some 10,000 years ago at the time of domestication of wild aurochs." In the beginning, the two viruses were perhaps one that could infect both species, because they seem to have diverged from each other sometime around 1000 CE, mutating into MeV and RPV.[11] The science is speculative, but intriguing, and it has not gone unnoticed by historians.

Based on extensive research into livestock and human disease in medieval Europe and the recent findings about the divergence between MeV

[9] For the most complete overall history of rinderpest, see Spinage, C.A. *Cattle Plague: A History*. New York: Kluwer Academic/Plenum Publishers, 2003. This 700-page wonder is, as Gordon Scott dubbed it in his introduction, "A Veritable Rinderpest Encyclopaedia."

[10] Barrett, Thomas, Ashley C. Banyard, and Adama Diallo, "Molecular Biology of the Morbilliviruses," in *Rinderpest and Peste des Petits Ruminants*, ed. Thomas Barrett, Paul-Pierre Pastoret, and William P. Taylor. Amsterdam: Elsevier, 2006, 31–56.

[11] Furuse, Yuki, Akira Suzuki, and Hitoshi Oshitani. "Origin of Measles Virus: Divergence from Rinderpest Virus between the 11th and 12th Centuries," Short Report, *Virology Journal* 7:52 (2010); Wertheim, Joel O. and Sergei L. Kosakovsky Pond. "Purifying Selection Can Obscure the Age of Viral Lineages." *Molecular Biology and Evolution* 28:12 (December 2011): 3355–3365. See also, Pomeroy, Laura W., Ottar N. Bjørnstad, and Edward C. Holmes. "The Evolutionary and Epidemiological Dynamics of the Paramyxoviridae." *Journal of Molecular Evolution 66* (2008): 98–106; Roeder, Peter, Jeffrey Mariner, and Richard Kock. "Rinderpest: The Veterinary Perspective on Eradication." *Philosophical Transactions of the Royal Society* 368:20120139 (2013): 1.

and RPV, the historian Timothy P. Newfield has recently proposed that the plagues of 569–570 CE and 986–988 CE "testify to the outbreak of an MV-RPV ancestor that caused mass mortality in cattle and people." Centuries later, Newfield sees evidence of RPV existing on its own, wreaking havoc in the early fourteenth century via a panzootic that stretched across Asia and Europe.[12] The historian Phil Slavin agrees, arguing that the suspected RPV panzootic is "the missing link between the two other great ecological crisis of the fourteenth century, the Great Famine [1314–1322] and the Black Death [1348–1351]." It had devastating consequences. The cattle plague "seems to have created a prolonged 'protein famine' among humans, lasting for about a dozen years." If it did so, he asked, "is it possible that it also … made them easily susceptible to the plague some thirty years later?"[13] RPV and *Yersinia pestis* may have unwittingly worked together to make the fourteenth century one of the most infamous in history.

Newfield's and Slavin's suspicion that RPV was responsible for the fourteenth-century outbreak rests primarily on the "striking similarity" between its epizootiology and those of "what are commonly thought to be outbreaks of rinderpest in the eighteenth and nineteenth centuries."[14] Scholars know much more about those outbreaks, which were diligently recorded, particularly in Europe, by scientists and by government officials who had been tasked to do something about the devastation.

The effort kept them busy; rinderpest was a challenging opponent. Between 1709 and 1800, the virus claimed an estimated 200 million of

[12] Newfield, Timothy. "Human-Bovine Plagues in Early Middle Ages." *Journal of Interdisciplinary History* 45:1 (Summer 2015): 1–38; Newfield, Timothy P. "A Cattle Panzootic in Early Fourteenth-Century Europe." *Agricultural History Review* 57 (2009): 155–190. See also Newfield, Timothy P. "Early Medieval Epizootics and Landscapes of Disease: The Origins and Triggers of European Livestock Pestilences, 400–1000 CE," in *Landscapes and Societies in Medieval Europe East of the Elbe*, Sunhild Kleingärtner, Sébastian Rossignol and Donat Wehner, Papers in Mediaeval Studies 23. Toronto: Pontifical Institute of Mediaeval Studies, 2013, 73–113 and Newfield, Timothy. "A Great Carolingian Panzootic: The Probable Extent, Diagnosis and Impact of an Early Ninth-Century Cattle Pestilence." *Argos* 46 (2012): 200–210.

[13] Slavin, Philip. "The Great Bovine Pestilence and Its Economic and Environmental Consequences in England and Wales, 1318–50." *The Economic History Review* 65:4 (2012): 1240, 1263. See also, DeWitte, Sharon and Philip Slavin. "Between Famine and Death: England on the Eve of the Black Death – Evidence from Paleoepidemiology and Manorial Accounts." *Journal of Interdisciplinary History* 44:1 (Summer 2013): 37–60 and Campbell, Bruce M. S. "Nature as Historical Protagonist: Environment and Society in Pre-Industrial Britain." *The Economic History Review* 63:2 (2010): 281–314.

[14] Newfield. "A Cattle Panzootic," 188.

Europe's cows.[15] Observers noted its arrival with despair: some infected cattle "bellowed, took flight and were extremely restless"; others "died as if struck by lightning." The majority "looked so pitiful, held their heads low, their languishing eyes were filled with tears, and from their nostrils and mouth came mucus and saliva." They "were often attacked by diarrhoea with foetid matter of various colours and usually died during the first week, racked with coughing."[16] Shared knowledge about its movement via an expanded print culture encouraged the development of new theories of contagion in response. A doctor in Augsburg wrote in 1713 that the disease "had proceeded by degrees from Hungary toward the Danube, attacked our territory and produced great destruction to beasts." This was not, he insisted, "caused by any foulness in the atmosphere, but the contagion of oxen brought from infected countries." This was "patent, because it first attacked those pastures adjoining the foreigners, and altogether spared those cattle to which no infected animals had approached, and which had been immediately separated from any in the same herd that were infected."[17] Such observations encouraged official action to control its spread.

Pope Clement XI, frustrated about extensive losses in his own herds, asked his personal physician, Giovanni Maria Lancisi, for a solution. Lancisi recommended that all sick animals be immediately killed and their bodies buried in quicklime. To prevent future outbreaks, he called for strict quarantines: "All roads and by-paths should be carefully guarded, so that no ox or dog be allowed to enter the country. Any animal so entering should be forthwith destroyed and buried."[18] Lancisi published his response in 1715. It included an account of the disease in Latin and instructions for controlling it in Italian, so that more people could read it. Despite disagreement with some of his cardinals, the Pope eventually acted on Lancisi's recommendations, turning them into official edicts. The disease disappeared in the Papal States within nine months, an outcome that did not go unnoticed by other European governments.

[15] Scott, G. R. "Rinderpest Virus," in *Virus Infections of Ruminants*. Z. Dinter and B. Morein. Amsterdam: Elsevier, 1990, 343.

[16] Lancisi quoted in Jean Blancou, *History of the Surveillance and Control of Transmissible Animal Diseases*. Paris: OIE, 2003, 162.

[17] Schröck, Lucas (he also went by Schröckius) quoted in Spinage. *Cattle Plague*, 105–108. Spinage spells his name as "Schroëckius." Contagion was by no means a universally accepted idea at the time. For more on this, see Romano, Terrie M. "The Cattle Plague of 1865 and the Reception of 'The Germ Theory' in Mid-Victorian Britain," *Journal of the History of Medicine* 52 (January 1997): 51–80.

[18] Lancisi quoted in Spinage. *Cattle Plague*, 110.

FIGURE 1.1 "God strikes the Netherlands with rinderpest."
Print by Jan Smit, published by Steven van Esveldt and Jacob Maagh, Amsterdam, 1745. *Courtesy of the Rijks Museum.*

Laws, edicts, rulings, and ordinances that restricted cattle sales across borders, enforced quarantines, required the compulsory slaughter of infected animals, their burial in lime (with their hides still attached), the disinfection of their living quarters, and more became the norm throughout Europe. Those who failed to comply risked fines, physical punishment, and sometimes even death.[19]

Rinderpest's enormous cost encouraged the creation of much stronger state intervention – at the highest levels of government – in the maintenance, movement, and trade of cattle. It also made the pursuit of medical knowledge about disease a high priority for the state. In 1762, in the

[19] Spinage. *Cattle Plague*, 241–262; Wilkinson, Lise. "Rinderpest and Mainstream Infectious Disease Concepts in the Eighteenth Century." *Medical History* 28 (1984): 130–131; Brantz, Dorothee. "'Risky Business': Disease, Disaster and the Unintended Consequences of Epizootics in Eighteenth- and Nineteenth-Century France and Germany." *Environment and History* 17 (2011): 35–51; Koolmees, Peter A. "Epizootic Diseases in the Netherlands, 1713–2002," in Brown, Karen and Daniel Gilfoyle *Healing the Herds*. Athens: Ohio University Press, 2010, 25; Hünniger, Dominik. "Policing Epizootics," in *Healing the Herds*, 76–87. For more information on treatments during the 1745 epidemic, see Smith, Major-General Sir Frederick. *The Early History of Veterinary Literature and Its British Development*, vol. II. London: Ballière, Tindall and Cox, 1924, 47–62.

aftermath of the particularly terrible epidemic of 1742–1760, the French government provided funding to set up the first college of veterinary medicine in Europe. Over the following twenty years, many other governments did the same, as rinderpest returned again to ravage the continent between 1768 and 1786, eager to find ways to better defend and protect their borders.[20] They found philosophical as well as economic reasons to do so. Johann Peter Frank insisted in his 1786 work, *A System of Complete Medical Police*, that "It is one of the foremost tasks of the state to prevent persons or animals, goods, and all objects to which or whom contagions cling, from entering the country."[21] That national effort had clear international implications, because, in Europe, the disease always came in from somewhere else, specifically Russia.

Rinderpest was rampant in China and Russia and usually entered Europe via the massive cattle trade that passed through the Austrian-Hungarian Empire. Europeans were eating more beef and they wanted the cows, but not the rinderpest that regularly came with them.[22] The advent of the railroad in the middle of the nineteenth century exacerbated the problem, promising to directly link the cattle of the east with the markets of the west. The looming threat led to the first international (though still European) conference of veterinary surgeons in Hamburg in 1863. Participants primarily debated quarantine lengths. It was a technical debate waged by technical men: they were not diplomats and they were not making international law. They were simply trying to

[20] Youde, Jeremy. "Cattle Scourge No More: The Eradication of Rinderpest and Its Lessons for Global Health Campaigns." *Politics and the Life Sciences* 32:1 (Spring 2013): 45; Spinage, *Cattle Plague*, 133–150; van Veen, Tjaart W. Schillhorn. "One Medicine: The Dynamic Relationship between Animal and Human Medicine in History and at Present." *Agriculture and Human Values* 15 (1998): 115–120.

[21] Frank quoted in Harrison, Mark. "Disease, Diplomacy and International Commerce: The Origins of International Sanitary Regulation in the Nineteenth Century." *Journal of Global History* 1:2 (2006): 201–202.

[22] Appuhn, Karl. "Ecologies of Beef: Eighteenth-Century Epizootics and the Environmental History of Early Modern Europe." *Environmental History* 15:2 (April 2010): 268–287. For more information on rinderpest in Asia during this period, see Spinage. *Cattle Plague*, 447–449, 488–492; Barwegen, Martine. "For Better or Worse?" in *Healing the Herds*, 97; Kishi, Hiroshi. "A Historical Study on Outbreaks of Rinderpest during the Yedo Era in Japan." *The Yamaguchi Journal of Veterinary Medicine* 3 (1976): 33–40; Pastoret, Paul-Pierre, Kazuya Yamanouchi, Uwe Mueller-Doblies, Mark M. Rweyemamu, Marian Horzinek, and Thomas Barrett, "Rinderpest – An Old and Worldwide Story: History to c. 1902," in *Rinderpest and Peste des Petits Ruminants*. ed. Thomas Barrett, Paul-Pierre Pastoret and William P. Taylor. Amsterdam: Elsevier, 2006, 95–100; Yamanouchi, Kazuya. *Sizyo Saidai no Densenbyo, Gyueki*. Tokyo: Iwanami Shoten, 2009.

decide on the best measures to recommend to their national governments.[23]

Europe's veterinary surgeons were far from alone in their effort to find agreement across national lines. The massive expansion of trade and travel in the nineteenth century benefited a number of diseases, including ones that attacked humans. Concerns about the spread of plague and cholera inspired the first International Sanitary Conference in Paris in 1851. Each of the twelve attending nations (all European except for the Ottoman Empire) sent a physician and a diplomat.[24] The 1851 sanitary conference and the ones that followed it, like the 1863 veterinary conference, framed their concerns as the defense of Europe against dangerous Asian diseases. The threat was deemed real enough to inspire some cooperation across national lines, but of a decidedly limited nature. Participant nations saw each other as commercial competitors and they resisted signing treaties that they perceived harmful to their trade strategies, but they did work together more often to try to halt the spread of disease in Europe, and those efforts bore fruit.[25]

In 1871, the Austrian government hosted an international conference in Vienna on rinderpest control. Delegates came from Belgium, Great Britain, Germany, France, Hungary, Italy, Romania, Russia, Switzerland, Serbia, and Turkey. Their final report, "Principles for an International Regulation for the Extinction of the Cattle Plague," was widely circulated following the conference. Extinction, they argued, demanded organized action: communication "by telegraph direct" of every outbreak "as quickly as possible" to "neighboring countries and also to those countries which have expressed a wish for it"; an "arrangement of veterinary matters" in each country to support a "speedy extinction of the cattle plague" should it break out; government compensation

[23] Harrison, Mark. *Contagion: How Commerce Has Spread Disease*. New Haven: Yale University Press, 2013, 215.

[24] Bynum, W. F. "Policing the Heart of Darkness: Aspects of the International Sanitary Conferences." *History and Philosophy of the Life Sciences* 15:3 (1993): 425–427; Harrison, Mark. "Disease, Diplomacy and International Commerce: The Origins of International Sanitary Regulation in the Nineteenth Century." *Journal of Global History* 1:2 (2006):197–217.

[25] Huber, Valeska. "The Unification of the Globe by Disease? The International Sanitary Conferences on Cholera, 1851–1894." *The Historical Journal* 49:2 (June 2006): 453–476. See also, Nagata, Naomi. "International Control of Epidemic Diseases from a Historical and Cultural Perspective," in *Networking the International System*. M. Herren. Switzerland: Springer International Publishing, 2014, 73–88; Howard-Jones, Norman. "Origins of International Health Work." *British Medical Journal* 1 (May 6, 1950): 1032–1046.

to livestock owners whose animals are killed in the act of suppressing an outbreak; and the immediate disinfection of "all objects whatsoever" that were involved with the transportation or care of suspected infected animals. These first four principles were followed by lengthy fifth and sixth ones that prescribed very specific sanitary requirements necessary for ending an outbreak. The participants, the English delegate explained, had to balance the desire "to protect and facilitate commerce as much as possible" with the necessity of repressing rinderpest, "a scourge so powerful and accompanied by results so terrible." It was not an easy task, but it was one that ultimately worked.[26]

The last rinderpest outbreak in Britain, in 1877, was in a shipment of cattle imported from Hamburg. Two hours after it landed, British veterinary authorities were informed by German authorities that rinderpest had just been identified in the stables in Hamburg where the cattle had stayed. Veterinarians quickly examined and isolated the new stock. Meanwhile, Belgium, France, Denmark, and Holland placed an immediate ban on the importation of cattle, hides, and beef from Germany.[27] The increased veterinary surveillance, communication, and quick action in case of an outbreak demonstrated in 1877 would force rinderpest out of circulation in Europe over the course of the next two decades. At the exact same time, however, European imperial expansion dramatically expanded rinderpest's global presence. While driving rinderpest out of their own fields and stables, they spread it to other places.

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The Philippine archipelago experienced its first serious rinderpest outbreak in late 1886, likely in cattle shipped in to feed Spanish authorities.

[26] "Principles for an International Regulation for the Extinction of the Cattle Plague" and "Translation of the Appendix to the Debates of the International Conference at Vienna, Exposé by the English Delegate," in *The Report of the Veterinary Department for 1872*. London: Prince George Edward Eyre and William Spottiswoode, 1873, Appendix, 26–29 in *Parliamentary Papers*, The House of Commons and Command, 26; Spinage. *Cattle Plague*, 299–300.

[27] Spinage. *Cattle Plague*, 203–209. The emphasis on meat is important. Advances in processing and shipping had spurred the growth of the trade in frozen and canned meat, which were easier to control than the trade in live animals, but there were still strong fears of rinderpest spreading through infected meat and hides (Koolmees, "Epizootic Diseases in the Netherlands," 33). For more on these reforms in Britain, see Perren, Richard. "Filth and Profit, Disease and Health: Public and Private Impediments to Slaughterhouse Reform in Victorian Britain," in *Meat, Modernity, and the Rise of the Slaughter House*, Paula Young Lee. Durham, NH: University of New Hampshire Press, 2008, 127–150.

The disease spread rapidly. A witness reported that "at the highest point of these problems . . . the cadavers infested the air and the rivers."[28] It was, the historian Ken De Bevoise wrote, "arguably the single greatest catastrophe in the nineteenth-century Philippines." The mortality rate was afterward commonly cited to have been 90 percent. Rivers became clogged with dead animal bodies to the point that they were no longer navigable. Carabao (domestic water buffalo) were the hardest hit, being particularly vulnerable to the disease. Deprived of their draft animals, farmers were forced to reduce the size of their fields. They ate less and repaid fewer of their debts. Meanwhile, deprived of their preferred meal of cattle, mosquitoes bit more humans, spreading malaria as they went.[29]

Tragically, the Philippine case proved not to be an exception, but the rule. The same outbreak that terrorized the archipelago would also terrorize most of Africa. In the final decades of the nineteenth century, rinderpest added pain and suffering to people who were already shouldering a disproportionate burden of it, victims of disasters that were, like the rinderpest panzootic, both "natural" and man-made.[30] They were not, in that sense, just the victims of rinderpest or of famine but victims of imperialism itself. The connections were not unnoticed at the time: "In some respects," Frederick Lugard cynically noted, after observing rinderpest's passage through East Africa, the disease "has favored our enterprise. Powerful and warlike as the pastoral tribes are, their pride has been humbled and our progress facilitated by this awful visitation. The advent of the white man had else not been so peaceful."[31] Rinderpest, like imperialism, was, of course, anything but peaceful. It was devastating.

[28] Doeppers, Daniel F. "Fighting Rinderpest in the Philippines, 1886–1941," in *Healing the Herds*, 110–111, 113. Ken De Bevoise argued that it arrived in 1887, perhaps in the bodies of carabao imported from Indochina "for breeding purposes" (De Bevoise, Ken. *Agents of Apocalypse*. Princeton: Princeton University Press, 1995, 159).

[29] De Bevoise, *Agents of Apocalypse*, 158–160.

[30] Mike Davies has dubbed these combinations of events the "Late Victorian Holocausts." These were, he argues, the result of "natural" disasters (most notably droughts caused by "an exceptional intensification of El Niño activity") combined with imperial machinations that massively increased human vulnerability. "The total human toll of these waves of drought, famine and disease could not have been less than 30 million victims," he argues. "Fifty million might not be unrealistic." They died "at the precise moment (1870–1914) when [their] labor and products were being dynamically conscripted into a London-centered world economy." That process of conscription played a central role in the death toll (Davis, Mike. *Late Victorian Holocausts*. London: Verso, 2002, 6–11, 14).

[31] Lugard quoted in Kjekshus, Helge. *Ecology Control and Economic Development in East African History* . London: James Currey, 1977, 1996 impression, 131.

Rinderpest appears to have first arrived in Africa via a shipment of Russian cattle to Alexandria in 1841. Over subsequent years, the disease claimed 90 percent of Egypt's cattle, along with large numbers of buffalo, sheep, and goats. It remained enzootic in Egypt, but did not cross its borders to infect the rest of the continent, in part, it seems, because Ethiopians imposed quarantines against northern cattle when they knew of sickness.[32] These sanitation efforts could work against the endemic, milder forms of rinderpest that existed in Egypt, but were powerless in the face of a strain of RPV that Italian forces brought from India to Massawa, in present-day Eritrea, in 1887.[33]

The Ethiopian historian Richard Pankhurst interviewed survivors decades later who were still shaken by the horror. Alaqa Lamma Haylu ("an old man in his nineties whose remarkable memory helped to establish the chronology of the outbreak") recalled that it began in the rains of 1888. He fell ill for three days and when he got up he "found that all of the cattle were dead." His father, who had owned some 300 cattle, was left with one heifer. A French traveler reported in early 1889 that "a terrible epizootic murrain has carried off all the cattle." An Italian observer estimated that rinderpest killed 90 percent of Ethiopia's cattle and later reports corroborated the claim. Rinderpest infected buffalo, sheep, goats, and numerous wild ungulates – any animal in which it could gain footing. The Emperor Menelik alone lost 250,000 head. He worried, "if the oxen disappear there will be no more grain, and if there is no more grain there will be no men." He ordered everyone to pray, but to no avail. Famine came. "The chief cause of the famine," Alaqa Lamma Haylu remembered, "was the death of cattle." Plagues of locusts and caterpillars also descended on the country, gobbling up what could be harvested. Little was left to go around. A missionary reported in 1890: "Everywhere I meet walking skeletons and even horrible corpses, half eaten by hyenas, of starvelings who had collapsed from exhaustion." Millions died. An Italian diplomat wrote in December of 1890 of the land between Harar and Addis Ababa: "Previously, the country was inhabited; there were very beautiful fields of durra and barley, numerous herds of cattle, sheep and goats, and whole area had an atmosphere of abundance and prosperity. At present, it is one

[32] Spinage. *Cattle Plague*, 497–498; Pankhurst, Richard. "The Great Ethiopian Famine of 1888–1892: A New Assessment." *The Journal of the History of Medicine and Applied Science* (April 1966): 99–100.

[33] There may have been a separate outbreak in Egypt at the same time, which also played a role in the origins of the great pandemic of the late 1880s and 1890s (Spinage. *Cattle Plague*, 521).

of continuous desolation." Decades later, these were still remembered as the *Kefu Qan* or Evil Days.[34] And they were not confined to Ethiopia.

Rinderpest moved south and west, consuming East Africa. A European stationed in Tanganyika wrote in 1892, "all trade in cattle has come to a standstill . . . and will most likely not reach pre-plague dimensions within the next 10–15 years. There are now hardly 100 head of cattle left in all of Unyanyembe from the former herds of 30–40,000." The Masai were particularly devastated. "Abandoned villages were, almost without exception, the only trace I found of the Masai people," a German traveler observed the same year. "All of their cattle have been wiped out."[35] And it was not just cattle that were dying. A British officer visiting Lake Mweru (on the border between present-day Zambia and the Democratic Republic of the Congo) in the fall of 1892 reported, "Here enormous quantities of game have died." The banks were covered with the bodies of buffalo as well as pookoo and lechwe, varieties of antelope. "Dead and dying beasts were all around."[36] Wild animals helped RPV move along different paths than just the human-controlled market routes, furthering its expansion. Frederick Lugard, who followed the disease through Uganda in the early 1890s, reported in 1893, "The enormous extent of the devastation it has caused in Africa can hardly be exaggerated. Most of these tribes possessed vast herds of thousands on thousands of cattle, and of these, in some localities, hardly one is left; in others, the deaths have been limited to perhaps 90 per cent." Others agreed, tending to estimate a death toll of 95 percent.[37]

The damage was catastrophic. Cattle provided African families with milk, meat, and labor in the fields. Their hides provided clothing, mats, and shoes. Their dung provided the main source of domestic cooking fuel. It could not be replaced, because colonial officials made wood-gathering illegal, hoarding it for their building programs. But cattle provided more than just subsistence to African pastoralists, they "stored the entire wealth of the family and the society in moveable property which increased over

[34] Pankhurst. "The Great Ethiopian Famine of 1888–1892," 100–115; Pankhurst, Richard. *Economic History of Ethiopia, 1800–1935*. Addis Ababa: Haile Sellassie I University Press, 196, 216–220; Marcus, Harold G. *The Life and Times of Menelik II* . Oxford: Clarendon Press, 1975, 135–137; Spinage. *Cattle Plague*, 500–506. The American visitor Robert P. Skinner wrote of the great pandemic in his 1906 account of a trip to Ethiopia, "It was estimated that not more than 7 or 8 percent of the animals of the country were saved" (Skinner, Robert P. *Abyssinia of Today*. New York: Longmans, Green & Co., 1906, 195–196).

[35] Kjekshus. *Ecology*, 128–129.

[36] Spinage. *Cattle Plague*, 518.

[37] Kjekshus. *Ecology,* 130.

the years."[38] Cattle were capital. Rinderpest destroyed "a complex and inter-woven social, political and economic system" when it destroyed herds.[39]

The Zambezi River confined the virus for several years, probably because of an absence of a lively cattle trade across the river and because the area was thick with tsetse flies (which also helps explain the minimal trade). Rinderpest finally made it across in early 1896 and spread swiftly southward from there, following the main trade routes, which quickly became clogged with dead bodies. "Hundreds of carcasses lay here and there, on the roadside or piled up in the fields," a French missionary wrote in 1897. "More than nine hundred wagons loaded with merchandise, without teams or drivers, stood abandoned along the Bulawayo road.... Never within the memory of men had such a thing been seen." Another traveler despaired that "the whole country is but a charnel-house of dead rinderpest oxen." As they had in the north, mortality rates climbed over 90 percent. Panicked farmers pressured government officials to stop the spread, but that was, of course, far easier asked for than accomplished.[40]

Local officials turned first to quarantines and then added slaughter, costly moves that angered many and heightened tensions between white and black farmers, who blamed each other for the disease.[41] The Cape Colony government, for example, declared a ban on the entry of cattle from any place north of the Molopo River (posting police along the river to enforce it) and announced that all infected cattle inside the Protectorate would be immediately shot. Not surprisingly, "stamping out" policies started with African, not European-owned herds. Fences were built, cattle

[38] Phoofolo, Pule. "Face to Face with Famine: The BaSotho and the Rinderpest, 1897–1899." *Journal of Southern African Studies* 29:2 (June 2003): 503; Phoofolo, Pule. "Epidemics and Revolutions: The Rinderpest Epidemic in Late Nineteenth-Century Southern Africa," *Past & Present* 138 (February 1993): 116.

[39] van Onselen, C. "Reactions to Rinderpest in Southern Africa 1896–97." *The Journal of African History* 13:3 (1972): 484. For more on this, see Homewood, Katherine. *Ecology of African Pastoralist Societies*. Oxford: James Currey, 2008.

[40] Phoofolo, "Face to Face," 504, 511; Spinage, *Cattle Plague*, 525.

[41] Racism dictated the way whites in southern Africa understood the progress of the disease. One of the Cape Colony veterinarians wrote in 1902 of the epizootic: "There is abundant evidence to show that the natives were the main cause of transporting the infection" (Hutcheon, Duncan. "Rinderpest in South Africa." *Journal of Comparative Pathology and Therapeutics* 15:4 [December 31, 1902]: 307). For more on this, see Phoofolo, "Epidemics" and Ballard, Charles. "The Repercussions of Rinderpest: Cattle Plague and Peasant Decline in Colonial Natal." *The International Journal of African Historical Studies* 19:3 (1986): 421–450.

were shot, carcasses were burned, but rinderpest still came, prompting governments to alter their strategy. Prophylaxis policies that had worked in Europe were not working in Africa, but there was another option: biological prophylaxis.[42]

By the late 1890s, the "germ theory" revolution pioneered by Louis Pasteur and Robert Koch was well underway.[43] Eager for new answers, the Cape Colony government asked Koch, then the head of the Institute for Infectious Diseases in Berlin, to come to Africa to help them find a prophylactic inoculation for rinderpest. No one knew what kind of microbe caused the disease, but Koch was undaunted. After all, he wrote, "we know the microbe of neither small-pox nor of rabies, and yet we have succeeded in devising prophylactic inoculations against both diseases dependent upon the fact that infective material can be weakened and converted into a so-called vaccine in the one case by passage through the animal body, in the other by drying."

Koch turned to these techniques first, passaging rinderpest in antelopes, donkeys, mules, dogs, eagles, pigeons, chickens, rabbits, mice, guinea pigs, dogs, and a secretary bird to no avail. He had some luck with goats and pigs, but the process was slow and expensive as he needed fresh animals for every passage. He tried drying infected blood, reliquefying it with water, and then injecting it into animals to prevent the disease. Drying the blood did seem to kill the pathogen, but injections of it did not protect cattle from subsequent infection. Passaging and drying were not, however, the only possibilities. Other germs, he noted, "can be

[42] For more on the tension between veterinary "stamping out" methods and the use of vaccines, see Sunseri, Thaddeus. "The Entangled History of Sadoka (Rinderpest) and Veterinary Science in Tanzania and the Wider World, 1891–1901." *Bulletin of the History of Medicine* 89 (2015): 92–121. See also, Gilfoyle, Daniel. *The Many Plagues of Beasts*. Saarbrüken, Germany: VDM Verlag Dr. Müller, 2009, 112–138; Mack, Roy. "The Great African Cattle Plague Epidemic of the 1890's." *Tropical Animal Health and Production* 2:4 (December 1970): 210–219; Phoofolo, "Epidemics," 141; Spinage, *Cattle Plague*, 525–570. For a detailed history of the effort to battle rinderpest in Namibia, see Miescher, Giorgio. *Namibia's Red Line: The History of a Veterinary and Settlement Border*. New York: Palgrave Macmillan, 2012.

[43] See Paul de Kruif's 1926 classic, *The Microbe Hunters*. For criticisms of that narrative, see Latour, Bruno. *The Pasteurization of France*. trans. Alan Sheridan and John Law, Cambridge: Harvard University Press, 1988; Cunningham, Andrew and Perry Williams, *The Laboratory Revolution in Medicine*. Cambridge: Cambridge University Press, 1992; Worboys, Michael. "Was there a Bacteriological Revolution in Late Nineteenth-Century Medicine?" *Studies in History and Philosophy of Biological and Biomedical Sciences* 38:1 (2007): 20–42; Cohen, Ed. "The Paradoxical Politics of Viral Containment; or, How Scale Undoes Us One and All." *Social Text* 106 29:1 (Spring 2011): 15–35.

weakened by treatment with chemicals" or via "the use of serum obtained from animals which have acquired immunity by having the disease." He tried those options as well.[44] In the end, after two months of testing, and the valuable assistance of other scientists, Koch ended up recommending that the Cape Colony inject healthy cattle in noninfected areas with gall (more commonly called bile) from an infected ox.[45]

Koch was forced to cut his efforts short, ordered by the German government to join an expedition to study bubonic plague in India (he would also look at rinderpest there, bringing his bile technique with him), but work continued in southern Africa, in part because of the limited success of his findings.[46] Experiments in the field with bile inoculation in the spring of 1897 yielded disappointing results: rinderpest regularly broke out following inoculation and about 80 percent of the cattle slaughtered for bile failed to produce any. Local scientists ended up recommending the "serum-simultaneous method" instead, which involved injecting infected cattle blood on one side of the animal and serum (blood plasma with the clotting factors removed) on the other side.[47] The blood–serum

[44] Koch, Robert. "Prof. Robert Koch's Berichte über seine in Kimberley ausgeführten Experimentalstudien zur Bekämpfung der Rinderpes." Special reprint of *Deutschen Medicinischen Wochenschrift*, numbers 15 and 16 (1897): 7–13; Koch, Robert. "Special Report to the 'British Medical Journal' by Professor R. Koch on His Research into the Cause of Cattle Plague." *The British Medical Journal* 1:1898 (May 15, 1897): 1245–1246.

[45] Koch, Robert. "Prof. Robert Koch's Berichte über seine in Kimberley ausgeführten Experimentalstudien zur Bekämpfung der Rinderpest." Special reprint of *Deutschen Medicinischen Wochenschrift* numbers 15 and 16 (1897): 1-15; Miescher, *Namibia's Red Line,* 26–30; Spinage, *Cattle Plague*, 426–427. "Koch's bile method," Spinage noted, "was really simply an improvement of a method already developed by some farmers in the Transvaal known as the Waterberg or Grobler method" (429). The bile method distracted him from his work on combining serum with blood: "This mixture acted much more satisfactorily, but just at that time Koch had discovered the efficacy of bile obtained from sick animals, which he considered both safer and more effective than serum" (Hutcheon, "Rinderpest in South Africa," 315). For more on this research, see Gilfoyle, *The Many Plagues of Beasts*. Saarbrüken, Germany: VDM Verlag Dr. Müller, 2009, 119–129.

[46] Lingard, Alfred. "Preliminary Notes on Rinderpest: Experiments Commenced at Imperial Bacteriological Laboratory by Professor Robert R. Koch, 4th to 15th June 1897," (August 5, 1897); sent to the author by Kazuya Yamanouchi. See also, Pastoret et al., "Rinderpest – an Old and Worldwide Story: History to c. 1902," 95–97; Spinage, *Cattle Plague*, 437.

[47] Gilfoyle, Daniel. "Veterinary Research and the African Rinderpest Epizootic: The Cape Colony, 1896–1898." *Journal of Southern African Studies* 29:1 (March 2003): 143–144; Mack, "The Great African Cattle Plague," 215–216; [Anonymous.] "An Immunising Serum against Rinderpest," *The British Medical Journal* 2:1925 (20 November 1897):1517; Spinage, Cattle Plague, 433.

mixture worked in the sense that it appeared to provide immunity, but it was a far-from-ideal method. The mixture was laborious to make, had a short shelf-life ("as brief as nine days in warm weather"), created a live infection that could provoke a rinderpest outbreak in a virgin population, and, most importantly, allowed for the transference of other kinds of microbial infections. It lacked purity. Rinderpest was far from the only creature that liked to make its home in cattle blood, and inoculators sometimes unwittingly spread other pathogens.[48]

Neither the blood and bile method nor the serum-simultaneous method were ideal, but they did help. Daniel Gilfoyle's research has demonstrated that "mortality rates among cattle in individual districts and areas roughly correlated with the degree of veterinary activity and inoculation."[49] Unfortunately, that activity correlated very closely with the skin color of the humans who owned the cattle. White farmers tended both to have greater access to inoculation and to be more willing to subject their uninfected cattle to it, as they did not have the same reasons to distrust government-sponsored veterinarians as their black counterparts did. "In consequence black-owned stock in Natal fell by 77 percent in 1897, compared to a decrease for white-owned stock of 48 percent."[50] Such discrepancies were also no doubt due in part to African farmers' tendency to communally graze livestock and European farmers' tendencies to fence their herds, but the evidence, Gilfoyle concluded, "suggests that inoculation, however contested in its development and practice, modified the course of the rinderpest epizootic at the Cape."[51] Prophylaxis inoculation was certainly not perfect, as the 48 percent mortality rate testified, but it did help in the fight against the virus.

It also helped encourage enhanced inter-imperial coordination against rinderpest. At the first Pan-African Veterinary Conference in 1903, officials recommended the liberal use of the serum-simultaneous method, with a back-up reliance on Koch's bile method if the serum was not readily

[48] Taylor, William P., Peter L. Roeder, and Mark M. Rweyemamu, "History of Vaccines and Vaccination," in *Rinderpest and Peste des Petits Ruminants*, ed. Thomas Barrett, Paul-Pierre Pastoret, and William P. Taylor. Amsterdam: Elsevier, 2006, 223–225; Hutcheon, "*Rinderpest in South Africa*," 322–323.

[49] Gilfoyle, "Veterinary Research," 151. "Veterinary services were, however, largely allocated to European pastoralists, while the African-occupied areas of the colony were assigned a low priority" (Gilfoyle, 153).

[50] Campbell, Gwyn. "Disease, Cattle, and Slaves: The Development of Trade between Natal and Madagascar, 1875–1904." *African Economic History* 19 (1990–1991): 113.

[51] Gilfoyle, "Veterinary Research," 151.

available.[52] These efforts – combined with strict legal prophylaxis measures – eliminated rinderpest from South Africa by 1905, but the virus remained endemic in East Africa, transforming much of what had long been prime pastoral grazing land into "tsetse-infested bush and woodland inhabited only by wild animals." The veterinary framework was far weaker in East Africa than it was in South Africa: too weak to get rid of rinderpest.[53] It was a common problem in the imperial periphery.

By 1900, it was understood that successful animal disease control depended on a strong, active national veterinary service able to rigorously apply both sanitary and biological prophylactic measures combined with regular communication about outbreaks with trading partners. The United States created the Bureau of Animal Industry within the Department of Agriculture in 1884 to manage its livestock disease control. The bureau immediately built "the first significant microbiological laboratory in the United States." By 1905, it also had the power to impose quarantines on cattle moving between states and in and out of the country.[54] This kind of control, coupled with the fact that the United States (along with Canada) was a net exporter rather than importer of cattle, helped to ensure that rinderpest never broke out in North America. It was, however, a serious problem in its Philippine colony. A similar situation existed throughout the globe: the metropole no longer suffered from regular outbreaks, but its colonial peoples did. Governments readily turned to science at home with expanding expectations about what the state *should* do and expanding confidence in what it *could* do, given recent technological advances in a wide number of fields. Increasingly, however, key figures in imperial administration began calling for similar action throughout their empires, convinced that they could be turned into more economically profitable holdings. Such efforts focused specifically on the expansion of export agriculture, which made rinderpest a key target for attack in imperial holdings around the globe.[55]

[52] Mack, "The Great African Cattle Plague," 216.

[53] Reader, John. *Africa: The Biography of a Continent*. New York: Vintage, 1997, 592; Brown, Karen. "Tropical Medicine and Animal Diseases: Onderstepoort and the Development of Veterinary Science in South Africa 1908–1950." *Journal of South African Studies* 31:3 (September 2005): 513–529.

[54] Olmstead, Alan L. "The First Line of Defense: Inventing the Infrastructure to Combat Animal Diseases." *The Journal of Economic History* 69:2 (June 2009): 334. See also Olmstead, Alan L. and Paul W. Rhode. *Arresting Contagion: Science, Policy, and Conflicts over Animal Disease Control*. Cambridge, MA: Harvard University Press, 2015.

[55] Hodge, Joseph. *Triumph of the Expert: Agrarian Doctrines of Development and the Legacies of British Colonialism*. Athens: Ohio University Press, 2007, 56.

When Japan annexed Korea in 1910, it began immediately working on the construction of "an immune belt" along the border of China to keep rinderpest out. Officials used the serum-simultaneous method to do it, constructing a massive serum manufacturing institute in Busan. The institute opened in 1911 under the direction of Chiharu Kakizaki, who was already working on trying to find a better method of biological prophylaxis.[56] Researchers in Turkey had discovered in 1902 that the pathogen responsible for rinderpest was a virus, which was an important step forward in knowledge about the microbe, but what governments really wanted was vaccines.[57] Kakizaki turned to chemicals to make one, inactivating a mixture of infected cattle blood and spleen with glycerin. Korean cattle injected twice with the mixture were immune (for a while) to subsequent injections of infected blood.[58] Kakizaki had created the first rinderpest vaccine.

Japanese officials saw the potential right away. At the time, its Manchuria colony was the third largest producer of cattle in the world, behind only the United States and Australia, but it ranked "first in the number of cases of livestock diseases." Rinderpest was one of the most troublesome. Although focused on the industrial development of the region, Japanese authorities had also been trying to modernize farming in Manchuria for years, importing new species of plants and breeds of livestock, creating experimental farms, and building agricultural research stations, laboratories, and scientific institutions. In the aftermath of Kakizaki's discovery, they added another. In 1925, the South

[56] Knight, R. F. and C. G. Thomson, "Brief Report on the Veterinary Institutes of Japan," *Philippine Agricultural Review*.4 (March 1911): 111–118; Hunter, James A. "The Rinderpest Epidemic of 1949–50 Taiwan (Formosa)." *Chinese-American Joint Commission on Rural Reconstruction, Animal Industries Series,* No. 1. Taipei: February 1951; sent to the author by Kazuya Yamanouchi; Yamanouchi, Kazuya. "Scientific Background to the Global Eradication of Rinderpest." *Veterinary Immunology and Immunopathology* 148 (July 15, 2012): 2; Kishi, "A Historical Study on Outbreaks of Rinderpest During the Yedo Era in Japan," 33–34; Kakizaki, Chiharu, Shunzo Nakanishi, and Takashi Oizumi, "Experimental Studies on Prophylactic Inoculation Against Rinderpest, Report III." *Journal of the Japanese Society of Veterinary Science* 5:4 (1926): 221–280; Kakizaki, Chiharu, Shunzo Nakanishi, and Junji Nakamura, "Experimental Studies on the Economical Rinderpest Vaccine." *Journal of the Japanese Society of Veterinary Science* 6:2 (1927): 107–120.

[57] Nicolle, M. and Adil-Bey, "Etudes sur la peste bovine. Troisième mémoire. Expériences sur la filtration du virus." *Annales de l'Institut Pasteur* 16 (1902): 56–64; Özkul, Türel and R. Tamay Başagac Gül, "The Collaboration of Maurice Nicolle et Adil Mustafa: The Discovery of Rinderpest agent." *Revue de Médicine Vétérinaire* 159 (2008): 243–246.

[58] Kakizaki, Chiharu. "Study on the Glycerinated Rinderpest Vaccine." *Kitasato Archives of Experimental Medicine* 2 (1918): 59–66.

Manchuria Railway Company built the Cattle Disease Research Institute in Mukden. The research facility soon began producing hundreds of thousands of units of inactive vaccine for widespread use around the region. Subsequent mandatory vaccinations under the direction of a mobile veterinary corps reduced the rate of infection.[59]

Japan profited first from Kakizaki's vaccine, but he published his research in English in 1918, which meant that other nations could profit as well. That act spoke to the growing scientific internationalism of the day – a spirit of cooperation that helped to shape the international society of the 1920s and 1930s. New possibilities of biological prophylaxis, however, would likely not have resulted in greater cooperation in disease control if the diseases themselves had not continued to prove a problem. Influenza was by far the deadliest, but it was two simultaneous outbreaks of different diseases in Poland – one that affected humans and one that affected cattle – that helped inspire the creation of new international bureaucracy for disease control.[60]

The effort to better regulate international quarantine agreements about human diseases had resulted in 1907 in the creation of the Office International d'Hygiène Public in Paris. The Office "provided a modest but consistent forum for discussion of contagious disease."[61] In 1920, however, "typhus and relapsing fever epidemics originating in Russia spread into Poland, and threatened western countries." The Council of the League of Nations ordered a medical commission immediately to Poland to investigate. Its members promptly reported back that "the eradication of typhus in the areas described appears to us … to be a question of international importance" and quarantines would not be enough. "Measures taken at the frontiers of other countries can diminish the danger," they argued, "but they cannot obviate it altogether." Poland needed immediate sanitary action, but it did not have the bureaucracy to do it. The League responded with assistance and with the creation of a Health Organization in July 1921.[62]

[59] Perrins, Robert John. "Holding Water in Bamboo Buckets," in *Healing the Herds: Disease, Livestock Economies, and the Globalization of Veterinary Medicine*. ed. Karen Brown and Daniel Gilfoyle. Athens: Ohio University Press, 2010, 195–208.

[60] On influenza, see Barry, John M. *The Great Influenza: The Epic Story of the Deadliest Plague in History*. New York: Penguin Books, 2004.

[61] Sealey, Anne. "Globalizing the 1926 International Sanitary Convention." *Journal of Global History* 6 (2011): 433.

[62] Fitzgerald, J.G. "An International Health Organization and the League of Nations." *The Canadian Medical Association Journal* 14:6 (June 1924): 532; Pottevin, Dr., TH. Madsen, and R. Norman White, "Typhus and Cholera in Poland: The Action of the

This sense of the outdatedness of relying on quarantines in the age of sanitary and biological prophylaxis also led to the Paris conference on animal diseases that May. Participants had even been disturbed by the threat of disease coming from the same place: Russia via Poland. The "rinderpest invasion of Russia in Europe and its spread to regions invaded by the Bolshevist armies could be foreseen as an inevitable consequence of the disorganization of administrative services and particularly the sanitary police," participants acknowledged. "On the other hand, the introduction of the contagion by the commercial route had seemed unlikely." And, yet, rinderpest had also broken out in Antwerp. The combination of the two outbreaks "demonstrate[d] the necessity of a more complete study of epizootic diseases."[63] Many of the nations participating in the 1921 meeting had been at the Vienna meeting of 1871, for this was still a European-centered internationalism, but there were critical differences in the tenor of the conversation. In 1871, discussions about animal disease control centered on quarantines, sanitation, and cull-and-kill policies. In 1921, "the campaign against infectious animal diseases" focused on prophylaxis methods and encouraged more study of the diseases themselves. Participants also stressed the necessity of creating better control all over the world as opposed to just in Europe. Internationalism was becoming more international *and* more inter-imperial.[64]

In 1924, twenty-eight nations signed the agreement creating the Office International des Epizooties or OIE: the Argentine Republic, Belgium, Brazil, Bulgaria, Denmark, Egypt, Spain, Finland, France, Great Britain, Greece, Guatemala, Hungary, Italy, Luxemburg, Morocco, Mexico, the Principality of Monaco, the Netherlands, Peru, Poland, Portugal, Rumania, Siam, Sweden, Switzerland, the Czechoslovakia Republic, and Tunisia.[65] Some were imperial powers; most were not. That fit with what was happening throughout the League of Nation's growing orbit. The League fostered the creation of European-dominated international

League of Nations," *The Lancet* (December 4, 1920): 1159–1160; Boroway, Iris. *Coming to Terms with World Health: The League of Nations Health Organization 1921–1946*. Frankfurt am Main: Peter Lang, 2009, 41–76.

[63] "International Conference on Epizootic Diseases in Domestic Animals." *Journal of the American Veterinary Medical Association* 60, 13:1 (October 1921): 127–128.

[64] Knab, Cornelia. "Infectious Rats and Dangerous Cows: Transnational Perspectives on Animal Disease in the First Half of the Twentieth Century." *Contemporary European History* 20:3 (August 2011): 292–295.

[65] International Agreement for the Creation of an Office International Des Epizooties in Paris (January 25, 1924); available at http://www.oie.int/en/about-us/key-texts/basic-texts/international-agreement-for-the-creation-of-an-office-international-des-epizooties/.

machinery, but it also opened the door to more truly global cooperation. As Susan Pedersen has persuasively demonstrated, the League was both "a key agent in the transition from a world of formal empires to a world of formally sovereign states" and a "harbinger of global governance."[66] OIE membership would grow throughout the 1920s and 1930s to include up to forty-four member states, a list that included colonies and mandates, and, notably throughout the 1930s, the Soviet Union, Japan, and Germany. The organization brought veterinary experts together regularly for meetings and published a monthly *Bulletin* of meeting notes and information about outbreaks, sanitary measures, and disease research. The OIE also helped facilitate the transfer of limited amounts of financial assistance to laboratories in countries that needed support. The organization could not make its member nations follow up on its recommendations, but it did put pressure on them to do so by making their efforts or lack thereof international public knowledge. In this effort, it would be assisted somewhat by the creation of a series of veterinary subcommittees under the umbrella of the League's Economic and Financial Organization that operated between 1928 and 1939.[67]

Above all, the OIE and the League's New Health Organization (LNHO) together helped to persuade more countries to invest more time and money on disease control at the national, imperial, regional, and international levels. They received some essential help in that effort from scientists, because new discoveries in biological prophylaxis options throughout the 1920s and 1930s encouraged government investment in the quest for disease control through technical advances as opposed to just through continued quarantines and regulations. This was particularly true for the two diseases that had most directly inspired the creation of the LNHO and OIE in the first place: typhus and rinderpest.

The League sent aid to Poland to help it keep typhus from spreading. It also sent Harvard bacteriologist Hans Zinsser to Russia to study the epidemic at the source. Both efforts bore fruit: typhus did not keep moving

[66] Pedersen, Susan. "Empires, States, and the League of Nations," in *Internationalisms: A Twentieth Century History*, ed. Glenda Sluga and Patricia Clavin. Cambridge: Cambridge University Press, 2017, 116 and "Back to the League of Nations." *The American Historical Review* 112:4 (October 2007): 1092. See also, Pedersen, Susan. *The Guardians: The League of Nations and the Crisis of Empire*. New York: Oxford University Press, 2015; Gorman, Daniel. *The Emergence of International Society in the 1920s*. Cambridge: Cambridge University Press, 2012; Mazower, Mark. *No Enchanted Palace: The End of Empire and the Ideological Origins of the United Nations*. Princeton: Oxford University Press, 2009.

[67] Knab, "Infectious Rats and Dangerous Cows," 295–305.

west and Zinsser helped to discover a great deal more information about typhus and to develop a vaccine against one form of it. His ability to do so, as he readily acknowledged at the time, was because he was in constant contact with other scientists around the world who were working on the same problems. He traveled to Mexico to study an outbreak with colleagues. He carried a strain of Rickettsiae (the bacterium that causes typhus) across the Atlantic in guinea pigs that he smuggled aboard a ship so that he could get that strain to the Pasteur Institute. In his fascinating 1935 book, *Rats, Lice and History*, he celebrated the scientific internationalism that had played such a decisive role in his own career. He wrote,

> while the world is an armed camp of suspicion and hatred, and nations are doing their best, by hook and crook, to push each other out of the world markets, to foment revolutions and steal each other's political and military secrets, – organized government agencies are exchanging information concerning epidemic diseases; sanitarians, bacteriologists, epidemiologists, and health administrators are cooperating, consulting each other, and freely interchanging views, materials and methods, from Russia to South America, from Scandinavia to the tropics.[68]

It was not quite that clear-cut, of course, but the international cooperation that the League encouraged throughout the 1920s and 1930s did lead to real results in the study of diseases, both human and animal. It proved true with typhus and it proved true with rinderpest.[69]

By 1921, rinderpest remained a devastating problem throughout much of Asia, the Middle East, and Africa. Officials fighting the disease relied upon the serum-simultaneous method as their main form of biological prophylaxis: French authorities sent some to Poland in 1920 and the Soviet Union would soon begin a campaign using the serum-simultaneous method that would, with the assistance of strict sanitary prophylaxis

[68] Zinsser, Hans. *Rats, Lice and History*. 1935. New Brunswick, NJ: Transaction Publishers, 2008, 293.

[69] Ibid. See also, Zinsser, Hans. *As I Remember Him: The Biography of R.S.* Boston: Little, Brown and Company, 1940; Olitsky, Peter K. "Hans Zinsser and His Studies of Typhus Fever." *The Journal of the American Medical Association* 115:10 (8 March 1941): 907–912; Lindenmann, Jean. "Typhus Vaccine Developments from the First to the Second World War (On Paul Weindling's 'Between Bacteriology and Virology ...')," *History and Philosophy of the Life Sciences* 24:3/4 (2002): 467–485; Weindling, Paul. "Between Bacteriology and Virology: The Development of Typhus Vaccines between the First and Second World Wars." *History and Philosophy of the Life Sciences* 17:1 (1995): 81–90. For more on the typhus outbreak, see Patterson, K. David. "Typhus and Its Control in Russia, 1870–1940." *Medical History* 37 (1993): 361–381 and Irwin, Julia F. "The Great White Train: Typhus, Sanitation, and U.S. International Development during the Russian Civil War." *Endeavor* 36:3 (2012): 89–96; Allen, Arthur. *The Fantastic Laboratory of Dr. Weigl*. New York: Norton, 2014.

efforts, eliminate rinderpest from Russia by 1928.[70] Kakizaki's successful creation of a vaccine, however, encouraged bacteriologists around the world to continue the effort to find better methods of control. Kakizaki's vaccine was far from perfect; it was the starting point, not the end.

In the Philippines, Raymond Alexander Kelser, a member of the Army Medical Department Research Board, created a viable inactive wet tissue vaccine by subjecting a suspension of infected cattle spleen, liver, and lymph nodes to 0.75 percent chloroform. The final product could fool the immune system into producing antibodies without infection and without risking starting an outbreak where there was not one already. Kelser's vaccine required three separate injections over several weeks and only conferred short-term immunity, but it was far better than the serum-simultaneous method. The Philippine Bureau of Agriculture utilized it in a massive campaign that vaccinated between 200,000 and 300,000 cattle and carabao each year between 1924 and 1931.[71]

Kakizaki's and Kelser's vaccines, and others like them created in the 1920s, worked by using chemicals to destroy the virus's pathogenicity, but not its immunogenicity, which meant that they would still provoke an immune response in the host.[72] The virus was dead in their inactivated vaccine, but its shell (so to speak) remained, still containing the antigens that stimulated the immune system. But, and this was an important "but," inactive vaccines stimulate the immune system at a far lower degree than an actual infection would, which means that they do not provide lasting immunity. They work for a while – long enough to potentially

70 Taylor et al., "History of Vaccines and Vaccination," in *Rinderpest and Peste des Petits Ruminants*, ed. Thomas Barrett et al., 225.

71 Kelser, R. A., S. Youngberg, and T. Topacio, "An Improved Vaccine for Immunization Against Rinderpest." *Journal of the American Veterinary Medicine Association* 74 (1929): 28–41; Shope, Richard E. *Raymond Alexander Kelser: A Biographical Memoir*. Washington, DC: The National Academy of Sciences, 1954, 205–206. Kelser was not the first American to create a rinderpest vaccine in the Philippines. William H. Boyton did so before him, but Kelser's vaccine proved better and more useful. For information about Boyton's vaccine, see Boynton, William H. "Rinderpest, with Special Reference to Its Control by a New Method of Prophylactic Treatment." *The Philippine Journal of Science* 36 (May 1928): 1–35.

72 At the same time as Kelser was doing his work with chloroform, other scientists were discovering that rinderpest could also be inactivated by exposure to toluol, eucalyptol, and formalin (Shope, "Inactivated Virus Vaccine," in *Rinderpest Vaccines: Their Production and Use in the Field*, 1st ed. ed. K.L. Kesteven. Washington, DC: FAO, 1949, 23).

drive the virus out of circulation in a closed community, like an island – but long-term immunity requires repeated injections, which are both costly and time-consuming.

There was, however, another possibility (one that Koch had also tried in Cape Colony): attenuation by the passage of the virus through foreign animal bodies. Attenuated vaccines are mutated forms of the original virus. They were created at that time by injecting an animal not usually infected by the virus with infected blood and seeing if the virus would "take" to the new host; this effort requires multiple passages through different individual animals. If the virus takes, pathogenicity (danger to the original host, in this case cattle and buffalo) is sometimes weakened. The resulting mutated virus is still very much alive and provokes an immune response in the original host, but it ideally either produces a milder sickness or no sickness at all in the process. Attenuation via passaging in living animals is tricky and does not often result in effective vaccines. It ultimately worked in a few select cases with rinderpest because RPV mutates quickly and because it exists as a single immunologic type or serotype.[73] What this means is that antigens do not change as the virus changes, probably because the part of the virus that "the immune system recognizes as an antigen plays an integral role in the function of the virus itself. If it changes shape, the virus cannot survive."[74] Mutations that include mutations of the antigens die off, but mutations that do not touch the antigens can possibly survive. Because the antigens remain unchanged, new mutations will still trigger the same immune response.

[73] RNA viruses are beset by extraordinarily high rates of mutation, the vast majority of which are deleterious. At a basic level, the problem is that RNA replication is far more error-prone than DNA replication, because DNA polymerase proofread for errors and fix them during replication. RNA polymerase has no such ability. It is too small to have it, and it is too small to have it because RNA is too error-prone to support longer genomes (a catch-22 known as Eigen's paradox). In general, RNA viruses have a mutation rate of about one in every thousand base pairs each generation. Most of these are not advantageous for the virus, but some are, and these give the virus strength, helping ensure its survival even in changing circumstances. Mutations can help a virus move into different kinds of cells, even different kinds of species. They can also help a virus evade established immunity in a host, which explains why there are new influenza vaccines every year (Holmes, Edward C. *The Evolution and Emergence of RNA Viruses*. Oxford: Oxford University Press, 2009, 37–46). For more on the genetic makeup of morbilliviruses, see Barrett, Banyard, and Diallo, "Molecular Biology of the Morbilliviruses," 31–56. For a basic introduction to virology, see Crawford, Dorothy H. *Viruses: A Very Short Introduction*. Oxford: Oxford University Press, 2011.

[74] Barry, *The Great Influenza*, 99–100. See also, Pomeroy et al., "The Evolutionary and Epidemiological Dynamics of the Paramyxoviridae," 98–106.

The great benefit (for humans and for cattle) of this particular fact about morbilliviruses goes beyond the ability to create attenuated vaccines for them; immunity to one strain of the virus protects against all strains of the virus, because the antigens are not different. This meant that researchers could share more than just their published research findings with one another. They could also share actual strains of living vaccine, sending them thousands of miles from where they had been created. This mattered a great deal, because creating successful attenuated vaccines is a difficult and time-consuming business. Most attempts to create a vaccine via passaging end in failure, even when the virus is antigen-stable, so being able to share strands that worked was of significant benefit to the effort to combat the virus. Not every vaccine would work as well as another in every case; the pathogenicity of strains of rinderpest, especially attenuated ones, varied widely, provoking different pathogenic responses in different breeds of cattle and buffalo. However, provided an animal survived vaccination with one of the attenuated vaccines (sometimes the virus was still too strong for some breeds), they would be immune to any strain of rinderpest found anywhere on earth for far longer than was possible with an inactive vaccine.

RPV's antigen stability had more than just scientific consequences; it also had political ones. The biology of the virus encouraged international cooperation in the effort to drive it out of circulation along the globe's economic networks. The fact that newly discovered vaccines *could* be shared helped to ensure that they *were* shared. The disease rinderpest had long encouraged international cooperation in terms of sharing information about outbreaks and enforcing quarantines. During the 1920s and 1930s, RPV's mutability – its "extraordinary biological plasticity," to steal a phrase from Hans Zinsser – encouraged a whole new level of sharing, one that involved not just publishing and communication (although those things remained critically important) but also the actual movement of people and viral strains between laboratories.[75] As the typhus example shows, this type of scientific cooperation was far from limited to rinderpest. What was special about RPV, however, was that it specifically encouraged *inter-imperial* cooperation for largely economic reasons. When Kelser described the importance of his vaccine, it was that "in the Philippine Islands agriculture constitutes the very backbone of the country's resources. Thus, any factor which impedes or in any way

[75] Zinsser used the phrase to describe "filterable viruses" in general (Zinsser, *Rats, Lice and History*, 64).

interferes with agricultural development, to an equivalent extent hinders the economic development of the Islands generally."[76] Sharing information about rinderpest was sometimes framed as a sanitary issue, but it was primarily framed as an economic one, because its victims were valuable livestock.

In the early 1920s, at the Imperial Bacteriological Laboratory in Mukteshwar (then called Muktesar), which the British had created in 1893 to produce anti-rinderpest serum, James Thomas Edwards was trying to solve the problem of the "almost inevitable" simultaneous infection of other pathogens that lurked in the injected blood when using the serum-simultaneous method. Such pathogens created complicating infections that made vaccination even less desirable to cattle owners than it already was. This was a particularly troublesome problem in India, where Hindu owners regularly expressed "antipathy" to the "use of ox blood." They did not want to kill some cattle to protect others. Trying to find a way around both problems, Edwards seized on the idea of an inactivated vaccine "as soon as Kakizaki's researches became known," but failed to find one that worked on local hill bulls.[77]

Frustrated, but not daunted, Edwards went in the other direction and started trying to create an attenuated vaccine by passaging rinderpest through rabbits. He had some success, maintaining direct passage for fourteen months and discovering that the virus "seemed to have suffered a certain degree of degradation of virulence toward cattle" along the way. Unfortunately, before he could get the virus to mutate into a significantly

[76] Kelser, R. A., S. Youngberg, and T. Topacio, "An Improved Vaccine for Immunization Against Rinderpest." *Journal of the American Veterinary Medicine Association* 74 (1929): 29. For more on inter-imperial sharing of medical knowledge in general, see Neill, Deborah J. *Networks in Tropical Medicine: Internationalism, Colonialism, and the Rise of a Medical Specialty, 1890–1930*. Stanford: Stanford University Press, 2012.

[77] Edwards, J. T. "Rinderpest: Some Properties of the Virus and Further Indications for Its Employment in the Serum-Simultaneous Method of Protective Inoculation." *Transactions of the Congress – Far Eastern Association of Tropical Medicine* 3 (1927): 705; Edwards, J. T. "Rinderpest: Active Immunization by Means of the Serum Simultaneous Method: Goat Virus." *Agricultural Journal of India* 23 (1928): 185; Edwards, J. T. *The Problem of Rinderpest in India*. Bulletin No. 199, Imperial Institute of Agricultural Research. Pusa: Calcutta Government of India, 1930: 12; Edwards, J. T. "The Uses and Limitations of the Caprinized Virus in the Control of Rinderpest (Cattle Plague) Among British and Near-Eastern Cattle." *The British Veterinary Journal* 105:7 (July 1949): 211. For more on the creation of the Mukteshwar laboratory, see Mishra, Saurabh. "Beasts, Murrains, and the British Raj: Reassessing Colonial Medicine in India from the Veterinary Perspective, 1860–1900." *Bulletin of the History of Medicine* 85 (2011): 587–619.

lower pathogenicity for cattle, he lost all of his subjects in an epizootic of pasteurellosis. The dead rabbits took the rinderpest strain that had been amenable to passaging in the rabbits with them and his subsequent efforts to repeat the adaptation in new rabbits failed. Edwards was not the first researcher, nor would he be the last, to have difficulty getting RPV to passage consistently in rabbits. The virus rarely mutated into survival in that particular host, but there were other options. He and his team next tried sheep, but quickly moved on to goats and found success. Edwards promptly began inoculating cattle with goat-passaged blood and serum and soon discovered that passage through the goats had attenuated the virus so much that they did not even need the serum to go with it.[78] Additional research by others, who built on what Edwards readily shared in publications and in public lectures, convinced colonial authorities to give up serum altogether and just use the passaged goat blood.[79] Delighted

[78] Edwards, "Rinderpest: Some Properties of the Virus and Further Indications for Its Employment in the Serum-Simultaneous Method of Protective Inoculation," 702–705; Edwards, "Rinderpest: Some Properties of the Virus and Further Indications for its Employment in the Serum-Simultaneous Method of Protective Inoculation," 699–706; Brotherston, J. G. "Rinderpest: Some Notes on Control by Modified Virus Vaccines, II," *Veterinary Reviews and Annotations* 3 (1957): 45–56; Scott, Gordon R. "Rinderpest," in *Advances in Veterinary Science*, v. 9, ed. C. A. Bradley and E. L. Jungherr. New York: Academic Press,1964, 133–134. Edwards actually discovered the extent of the attenuation through an accident. Injections of the goat-passaged strains were always accompanied by injections of serum, just as injections of ox blood were in the field. During one test, however, after the cattle had been injected with the goat-passaged virus, the serum vial was broken, and the subjects did not get the second injection. The injected cattle suffered fevers, mouth lesions, and diarrhea, but they did not develop full-blown rinderpest. The accident did not convince the team to drop serum injections altogether, but did persuade them to use a much smaller dose of serum in the simultaneous injection, a move which further reduced the cost of inoculation (told to the author by Kazuya Youmanouchi, who was told it by Gordon Scott).

[79] In 1930, Major R. F. Stirling, the director of veterinary services in the Central Provinces, began researching the possibility of inoculating cattle with Edwards's goat-passaged virus without serum to great success. The continued use of serum was frustrating, since it cost "over two shillings a head." Stirling had 12 million cattle in his province, so that even inexpensive serum was still costly. He reported later that he got the idea of inoculating without serum when he came across an address Edwards had made at the Conference of the Central Provinces Veterinary Association in November of 1928, which was subsequently published in 1930. Stirling promptly published the results of his own experiments in the field so that others could benefit from them (Stirling, R. F. "Some Experiments in Rinderpest Vaccination: Active Immunisation of Indian Plains Cattle by Inoculation with Goat-Adapted Virus Alone in Field Conditions." *The Veterinary Journal* 88 (1932): 192–204). In 1932, in Madras, P.T. Saunders and Rao Sahib K. Kylasam Ayyar created their own goat-virus strain, later known as Madras No. 1 (Saunders, P. T. and Rao Sahib K. Kylasam Ayyar, "An Experimental Study of Rinderpest Virus in Goats in a Series of 150

with his findings, officials soon began shipping the goat-passaged virus (in the bodies of living goats) to other imperial laboratories in the hope that it would prove as useful against rinderpest in other places.

The Mukteshwar strain arrived at the new Central Veterinary Research Institute in Kabete, Kenya, in 1936. There, R. Daubney, the Director of Veterinary Services in Kenya Colony, was trying to find a vaccine for what he insisted was "economically… undoubtedly the most important disease in tropical Africa and Asia." Daubney, like Edwards before him, had initially tried to create an inactive vaccine along the lines of Kakizaki's and Kelser's, but he was intrigued by the goat-passaging results in India and was eager to try Edwards's strain in the field. The results were disappointing. The strain was too strong for Kenya's indigenous zebus and the colonists' imported European breeds.[80]

Daubney could not use the viral strain, but he could use the research that had created it. He and fellow researcher J. R. Hudson decided to create their own goat-passaged virus. Their final product – Kabete O – came from a highly lethal strain of rinderpest isolated in 1911 in Kenya that researchers had kept alive ever since via passage in cattle in the laboratory.[81] Over several years of extensive testing, they showed that Kabete O proved the best option for caprinization (goat-passaging), even more so than its Indian competitors. Kabete Attenuated Goat vaccine (or KAG, as it came to be known) still caused a fever in almost all vaccinated animals, but the vast majority of domestic African cattle survived. For European breeds, the survival rate was closer to 50 percent, which meant that veterinarians still needed to use an inactive vaccine on them.[82]

Campaigns against rinderpest now employed multiple kinds of vaccines. During an expansive outbreak in East Africa, which was complicated by the presence of immense numbers of wild animals that "were infected throughout wide areas of cattle country," veterinary officials used four treatments: two kinds of chemically inactivated vaccines, the serum-simultaneous method, and KAG. The latter traveled around East Africa in the body of its living goat hosts. One goat could yield "500 to 800 doses of virus infected

Direct Passages." *The Indian Journal of Veterinary Science and Animal Husbandry* 6 (1936):4).

[80] Daubney, R. "Rinderpest: A Résumé of Recent Progress in Africa." *The Journal of Comparative Pathology & Therapeutics* 50 (1937): 405–409.

[81] Ibid., 408; MacOwen, K.D.S. "Virulent Rinderpest Virus (R.B.K.)." *Annual Report Veterinary Service Department Kenya* (1955), 29; Daubney, R. "Goat-Adapted Virus," in *Rinderpest Vaccines*, ed. Kesteven, 8.

[82] Daubney, "Goat-Adapted Virus," in *Rinderpest Vaccines*, 8–9.

blood"; it was an incredibly efficient means of transportation.[83] Defeating rinderpest in this late-1930s epizootic required the vaccination of both indigenous African-owned cattle and imported settler-owned cattle, an act that East African authorities had previously avoided, preferring instead to limit vaccination to settler-owned cattle alone because "the vets believed that rinderpest was useful in limiting the number of cattle owned by Africans and thus limiting what they regarded as overstocking and overgrazing – and hence soil erosion." In 1934, the governor of the Tanganyika Territory used a similar argument when asking the Colonial Office "for permission to abandon rinderpest eradication." London refused, but it did not repair recent cutbacks to government veterinary staff in the region.[84] The change in vaccination policy at the end of the 1930s was not only a reaction to the outbreak; it was also a reflection of a transformation in British imperial policy that increasingly chose action over inaction.[85]

In 1940, London passed the Colonial Development and Welfare Act, which committed the British government to improving not just infrastructure and agriculture in the colonies, as previous acts had done, but to actually improve the living standards of its colonial subjects. The transformation came from the ground up. "Officials and experts in London," Joseph Hodge has argued, "were confronted in the late 1930s by an empire that appeared to be in the grips of a series of dramatic social, economic, and ecological crisis" that were challenging "the very legitimacy of the colonial project."[86] Colonial poverty and exploitation had

[83] Hornby, H.E. *Report on the Special Anti-Rinderpest Campaign in Tanganyika Territory, 1938* (November 28, 1938); CO 691/173/13; NAUK; Branagan, D. and J. A. Hammond, "Rinderpest in Tanganyika: A Review," *Bulletin of Epizootic Diseases of Africa* 13:3 (September 1965): 225–245; Spinage, *Cattle Plague*, 594.

[84] Gilfoyle, Daniel. "South Africans Abroad: The Origins of the International Control of Rinderpest in East Africa, 1917–1951," presented at the BIHG Conference (5–7 September 2013), unpublished paper. David Anderson also writes about this colonial attitude in Anderson, David. "Kenya's Cattle Trade and the Economics of Empire, 1918–48," in *Healing the Herds*, ed. Brown and Gilfoyle, 250–268. See also, Waller, Richard "'Clean' and 'Dirty': Cattle Disease and Control Policy in Colonial Kenya, 1900–40." *The Journal of African History* 45:1 (2004): 45–80.

[85] There was a 62 percent rate of increase in animal ("nearly all" cattle) protective inoculations in Britain's African colonies between 1931 and 1937. Inoculations in India almost tripled. During those years, colonial officials recorded giving a total of 17,191,967 rinderpest inoculations to cattle and buffalo in India (over 10 million there alone), Nigeria, Kenya, Uganda, Sudan, Gold Coast, and Tanganyika (Rogers, Leonard. "Prophylactic Inoculations against Animal Diseases in the British Empire." *The British Medical Journal* 1:4080 (March 18, 1939): 565).

[86] Hodge, Joseph Morgan. *The Triumph of the Expert: Agrarian Doctrines of Development and the Legacies of British Colonialism*. Athens: Ohio University Press, 2007, 179.

become too politically embarrassing for the government to ignore, precisely because the interwar international community had decided to start drawing attention to them and had started to act to change them. That community, centered in the League of Nations, had by the late 1930s created an international society "characterized by the close intersection of international welfare issues, the establishment of systematic information exchange and the pursuit of economic interest" that challenged imperialism like nothing before.[87]

That society had not started out that way. The League became "more holistic," embracing "social health and welfare," only in the aftermath of the Great Depression and the breakdown of its efforts to secure stronger inter-governmental cooperation. Determined to stay relevant, the League shifted focus. The transition was most evident in the creation in 1935 of the "Mixed Committee on the Problem of Nutrition," which brought together people from the League of Nations Health Organization (LNHO), the International Labor Organization (ILO), the International Institute for Agriculture (IIA), and the Economic and Financial Organization (EFO) to analyze the global food situation.[88] The resulting report on the committee's work published statistics on food production and consumption and recommendations of minimum caloric requirements. By doing so, the report highlighted global inequality in access to food and "in the process created a new language for discussing poverty and consumption on a global scale." By insisting that a laboring adult anywhere in the world needed 2,500 calories a day, the report established a benchmark that could be used to pressure government authorities.[89] That work complemented the LNHO's *International*

France would take similar action in 1946. See Cooper, Frederick. "Reconstructing Empire in British and French Africa." *Past and Present*, Supplement 6 (2011): 196–210 and Cooper, Frederick. "Development, Modernization, and the Social Sciences in the Era of Decolonization: The Examples of British and French Africa." *Revue d'Histoire des Sciences Humaines* 10 (2004): 9–38.

[87] Knab, Cornelia and Amalia Ribi Forclaz, "Transnational Co-Operation in Food, Agriculture, Environment and Health in Historical Perspective: Introduction." *Contemporary European History* 20:3 (August 2011): 249. See also, Pedersen, "Empires, States and the League of Nations," in *Internationalisms: A Twentieth-Century History*. ed. Glenda Sluga, and Patricia Clavin. Cambridge: Cambridge University Press, 2017, 113–138 and Gorman, *The Emergence of International Society in the 1920s*. Cambridge: Cambridge University Press, 2012.

[88] Clavin, Patricia. *Securing the World Economy: The Reinvention of the League of Nations, 1920–1946*. Oxford: Oxford University Press, 2013, 8–9, 161.

[89] Amrith, Sunil and Glenda Sluga. "New Histories of the United Nations." *Journal of World History* 19:3 (2008), 251-274; Boroway, *Coming to Terms with World Health*,

Health Yearbook, which provided "a survey of the progress made by the various countries in the domain of public health."[90] The League also supported ILO and EFO efforts to collect and publish comparative data on standards of living – a concept "that became a lens through which to see the world as an object to be improved by liberal capitalism, western science, and international organization."[91] League efforts were aided by the efforts of individual economists to compile and publish national income estimates.[92] A 1939 League report explained that the work was "making men and women all over the world more keenly aware of the wide gap between the actual and potential conditions of their lives," which, in turn, was making them "impatient to hear that some real and concerted effort is being made to raise the standard of their lives nearer to what it might become."[93]

Knowledge of global inequality changed what people demanded from their governments, be they national or imperial. It also changed ideas about the purpose of international cooperation. By the end of the 1930s, the League was insisting that the "really vital problems" facing the world did "not lend themselves to settlement by formal conferences and treaties" and, therefore, "the primary object of international co-operation should be rather mutual help than reciprocal contract – above all, the exchange of knowledge and the fruits of experience."[94] There was, of course, more than a little bit of self-interest in the shift. The League had clearly failed in its original purpose of preventing another global war and it was looking for a way to remain relevant. But the decision to emphasize the exchange of knowledge and technical skill was more than just a defensive maneuver; it was the outcome of a decade-long shift in priorities at Geneva toward "positive security" that sought peace through

379–394; Cullather, Nick. *The Hungry World: America's Cold War Battle against Poverty in Asia*. Cambridge, MA: Harvard University Press, 2010, 38, 32–33.

90 A.G.N., "The International Health Year-Book of the League of Nations, 1928," *Canadian Medical Association Journal* 22:1 (January 1930): 93; Boroway, *Coming to Terms with World Health,* 177–183.

91 Clavin, *Securing the World Economy*, 172–179.

92 This will be discussed in greater detail in Chapter 3. See, Schmelzer, Matthias. *The Hegemony of Growth: The OECD and the Making of the Economic Growth Paradigm*. Cambridge: Cambridge University Press, 2016; Mitchell, Timothy. *Rule of Experts*. Berkeley: University of California Press, 2002; Arndt, H. W. *Economic Development*. Chicago: University of Chicago Press, 1987.

93 Quoted in Amrith and Clavin, "Feeding the World," 35.

94 League of Nations, *The Development of International Co-Operation in Economic and Social Affairs*, quoted in Clavin, *Securing the World Economy*, 231.

higher living standards, and higher living standards through technical and scientific cooperation for the expansion of human welfare.[95]

The League had been engaged to a limited degree in exactly that kind of exchange from the beginning via the work of some of its agencies and affiliates, but now it argued that such efforts could become the *purpose* of international cooperation. It was driven to do so by the need to stay relevant; it was able to do so by the beneficial results that had come out of those exchanges.[96] Notably, those exchanges had not been limited to League efforts. As Helen Tilly and others have shown, "national, imperial, and international scientific infrastructures were constituted simultaneously" during the interwar period.[97] The OIE, which was not a League institution, aided in the construction of all of them. So, too, did rinderpest, as the effort to control the virus engaged the attention of

[95] Clavin, *Securing the World Economy*, 231–240. See also, Packard, Randall M. *A History of Global Health: Interventions in the Lives of Other Peoples*. Baltimore: The Johns Hopkins University Press, 2016, 51–90.

[96] On League technical assistance, see Madsen, Thorvald. "The Scientific Work of the Health Organization of the League of Nations." *Bulletin of the New York Academy of Medicine* 13:8 (August 1937): 439–465; Akami, Tomoko. "A Quest to Be Global: The League of Nations Health Organization and Inter-Colonial Regional Governing Agendas of the Far Eastern Association of Tropical Medicine 1910–25." *The International History Review* 38:1 (2016): 1–23; Amrith and Clavin, "Feeding the World"; Amrith, Sunil. *Decolonizing International Health: India and Southeast Asia, 1930–1965*. London: Palgrave MacMillan, 2006; Pemberton, JoAnne. "New Worlds for Old: The League of Nations in the Age of Electricity," *Review of International Studies* 28 (2002) 311–336; Hell, Stefan. "The Role of European Technology, Expertise and Early Development Aid in the Modernization of Thailand before the Second World War." *Journal of the Asia Pacific Economy* 6:2 (2001): 158–178; Gorman, Daniel. *The Emergence of International Society in the 1920s*. Cambridge: Cambridge University Press, 2012, 52–108; Zanasi, Margherita. "Exporting Development: The League of Nations and Republican China." *Comparative Studies in Society and History* 49:1 (2007): 149; Osterhammel, Jürgen. "'Technical Co-Operation' between the League of Nations and China." *Modern Asian Studies* 13:4 (1979): 661–680; Farley, John. *To Cast Out Disease: A History of the International Health Division of the Rockefeller Foundation (1913–1951)*. Oxford: Oxford University Press, 2002; Weindling, Paul. "Philanthropy and World Health: The Rockefeller Foundation and the League of Nations Health Organization." *Minerva* 35 (1997): 269–281.

[97] Tilly, Helen. *Africa as a Living Laboratory*. Chicago: The University of Chicago Press, 2011), 7. See also Neill, Deborah. *Networks in Tropical Medicine: Internationalism, Colonialism, and the Rise of a Medical Specialty, 1890-1930*. Stanford: Stanford University Press, 2012; Bennett, Brett M. and Joseph M. Hodge, eds. *Science and Empire: Knowledge and Networks of Science across the British Empire, 1800–1970*. New York: Palgrave MacMillan, 2011) and Akami, Tomoko. "Beyond Empires' Science: Inter-Imperial Pacific Science Networks in the 1920s," in *Networking the International System: Global Histories of International Organizations*, ed. Madeleine Herren. Switzerland: Springer International Publishing, 2014, 107–132.

nations, empires, international bureaucracies, and the scientists that they employed. The successes that had come from technical cooperation in the interwar period encouraged calls for a continued reliance on such cooperation in the future. The international machinery that operated throughout the 1920s and 1930s had not stopped the world from descending into war, but it had convinced more people than ever before that international collaboration was necessary to fix the problems that many argued lay at the heart of the war: economic insecurity and hunger.

The widespread adoption of this recognition would ultimately transform imperialism, nationalism, internationalism, and international society in general. It would also transform the human struggle against rinderpest, turning it from a primarily imperial economic concern into a global economic and welfare concern. The new vocabulary of "standards of living" would play a central role in that shift, but so, too, would the war itself, which made food not only an international humanitarian concern but an essential tool for victory.