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ARTICLE

German Pharmaceutical Imperialism in Brazil: Cinchona, Biopolitics, and Hybrid Knowledge in the Early 19th Century

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Abstract

Between 1817 and 1831, four German scientists – Karl von Martius, Georg Langsdorff, Ludwig Riedel, and Friedrich Sello – undertook expeditions in Brazil with the goal of collecting natural specimens, particularly focusing on Brazilian cinchona plants. Renowned for their medicinal properties, especially in the treatment of fever diseases, cinchona specimens were extensively utilized by local Brazilian communities. The widespread use of cinchona raises important questions regarding how German scientists acquired knowledge of the therapeutic properties of plants, previously unknown within German pharmacology. This paper argues that the German understanding of Brazil's cinchona trees was situated within an imperialist endeavor that not only appropriated indigenous knowledge but also involved conducting experiments on these plants and their effects on local populations. This hybridization of knowledge about cinchona was characterized by an asymmetrical dominance of German pharmacological experimentation, which sought to enhance organic life and establish utopian, "healthy" German societies, in both German territories and Brazil. Consequently, German chemical experiments with Brazilian cinchona specimens intersected with biopolitical practices, aimed at manipulating both plant and human life through therapeutic interventions.

Keywords: Cinchona bark; hybrid knowledge; scientific expeditions; biopolitics

In his 1826 monograph, *Versuch einer Monographie der China*, the Hamburg-based German pharmacist Heinrich von Bergen documented a global history and genealogy of cinchona, framed by a Eurocentric perspective that underscored Western scientific preeminence. According to Bergen's account, since the 17th century, this Peruvian antifebrile plant had disseminated and established itself across Europe through European transnational networks of trade, botanical exploration, exchange of botanical materials, and pharmacological experimentation. In German pharmacological culture, cinchona "in general terms [...] also encompasses the barks of [...] Exostemma, Cosmibuena, etc., which are mostly known in trade under the name china nova."[1] In his account, Heinrich acknowledged the diversity within organic life and botanical species. He describes how German apothecaries encountered various types of cinchona bark in the pharmaceutical market, sourced from Peru, Ecuador, Colombia, Brazil, French Guiana, Suriname, Jamaica, St. Lucia, Martinique, and Guadeloupe.

Furthermore, Bergen compiled an extensive botanical inventory of cinchona specimens, including *cinchona condaminea, cinchona lancifolia, cinchona cordifolia, cinchona magnifolia, cinchona purpurea, solanum pseudoquina, strychnos pseudoquina, cinchona rosea, exostemma*

[1] Heinrich von Bergen, *Versuch einer Monographie der China* (Hamburg: Hartwig & Müller, 1826), 75.

caribaeum, and *exostemma australe*.[2] This diversity of cinchona specimens led to a resolute conclusion: not all cinchona plants contained uniform levels of antifebrile alkaloids.[3] Consequently, determining the alkaloid content of cinchona bark became an essential task for the pharmacological market in Germany. There was a pressing need to identify cinchona specimens with the most potent curative alkaloids.

This monograph was written at a time when Austrian, Prussian, and Russian scientific expeditions converged in Brazil. In pursuit of new trade opportunities in the 1810s and 1820s, these states funded scientific missions led by German scholars to evaluate Brazil's agricultural and pharmacological potential, often referred to as "green gold."[4] As empiricists, German explorers meticulously observed, recorded, measured, collected, and transported mineralogical, zoological, botanical, and ethnographic materials. This included assessing the diversity and curative content of Brazilian cinchona specimens. In other words, these states adopted a "seeing-like-a-state" governance system, meticulously observing and managing natural resources beyond their own borders to extend their control.[5] On the one hand, these continental states lacked maritime colonies with systems of enslavement. On the other hand, their German scientists bridged the gap to indigenous and enslaved populations through ethnographic observations. In their scientific endeavors, German explorers were not merely passive observers but actively engaged with local populations to gather information about Brazil's natural resources. The search for new cinchona specimens aimed to enhance pharmacological inventories both in German territories and in German agricultural settlements established in Brazil. Discovering new cinchona plants fulfilled not only a scientific interest but also addressed a societal need to improve public health systems in the fight against febrile diseases.

I argue that this pharmacological need facilitated the development of hybrid medicinal knowledge concerning Brazilian cinchona specimens, merging local ethnobotanical insights with German chemical experimentation. This intercultural phenomenon challenges the narrative of Western modernity as a unidirectional and totalizing progression towards rationality and European scientific exceptionalism.[6] Secondly, I argue that this hybrid knowledge supported biopolitical experimental practices involving both plant and human subjects in Brazil, which validated the pharmacological efficacy of Brazilian cinchona. On the one hand, these experiments in Brazil laid the groundwork for biopolitical hygienic campaigns, endorsed by German doctors and early hygienists, directed towards establishing a bourgeois,

[2] Bergen, *Versuch einer Monographie der China,* 146–232.

[3] Sigmund Graf, *Die Fieberrinden in Botanischer, Chemischer Und Pharmaceutischer Beziehung* (Wien: Heubner, 1824).

[4] Bioprospecting is a concept originating from Londa Schiebinger's study of 18th-century botanical activities in the Atlantic world. This scientific endeavor involved observing, identifying, classifying, transporting, and acclimatizing botanical specimens to assess their medical, agricultural, and luxury potential for Europe's material and cultural advancement. European empires not only profited from these colonial products, often referred to as "green gold," but these plants also played a crucial role in sustaining the colonial system in the Atlantic world. See Londa Schiebinger, *Plants and Empire: Colonial Bioprospecting in the Atlantic World* (Cambridge: Harvard University Press, 2009); Flora Medeiros, "Viajantes e a construção de uma idéia de Brasil no ocaso da colonização," *Scripta Nova: revista electrónica de geografía y ciencias sociales* 10 (2006); Teresa Cribelli, *Industrial Forests and Mechanical Marvels: Modernization in Nineteenth-Century Brazil* (New York: Cambridge University Press, 2016); Harry Liebersohn, *The Travelers' World: Europe to the Pacific* (Cambridge, MA: Harvard University Press, 2006); Marina Loskutova, "Russian Empire in the System of Global Trade in Medicinal Plants in the late 18th- early 19th centuries and the Problem of Entanglements between 'Scientific' and Traditional Pharmaceutical Knowledge," *Voprosy istorii estestvoznaniia i tekhniki* 42, no. 4 (2021): 698–725; Jonathan Singerton, "An Austrian Atlantic: The Habsburg Monarchy and the Atlantic World in the Eighteenth Century," *Atlantic Studies* 20, no. 4 (2023): 673–97; Torsten dos Santos, "Atlantic Sugar and Central Europe: Sugar Importers in Hamburg and Their Trade with Bordeaux and Lisbon, 1733–1798," in *Globalized Peripheries: Central Europe and the Atlantic World,* ed. Jutta Wimmler et al. (Boydell and Brewer, 2020), 99–116.

[5] James Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven: Yale University Press, 1998).

[6] Edward Cooper, *Colonialism in Question: Theory, Knowledge, History* (Berkeley: University of California Press, 2005).

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civilized society in the German territories through anti-cholera campaigns in the 1830s. On the other, German experiments with Brazilian cinchona plants were ideologically tied to the broader racial whitening agenda promoted by the Brazilian state, while these efforts were simultaneously focused on preserving the health of German agricultural settlements. In this context, I define biopolitical practices as chemical and therapeutic interventions designed to enhance the vitality and organic composition of both plant and human populations, with the goal of constructing a "healthy" and "civilized" German society.

Historiographical contributions on German imperialism have offered both established and novel insights into the development of African colonies as arenas of state violence, sources of raw materials, centers of imperial liberal economic policies, and sites of scientific exploration in the late 19th century.[7] Many historians have skillfully redefined late 19th-century German imperialism as a historical phenomenon inherently intertwined with processes of territorialization, transnational migration, scientific internationalism, and globalization, thereby demonstrating that the metropole and periphery were not mutually exclusive realms.[8] Historians have frequently addressed the question of German imperialism by exploring the commonalities of genocidal violence between the Wilhelmine colonial ventures and Nazi colonialism in Eastern Europe.[9] Literature has increasingly emphasized how non-German empires served as conduits for German imperial influence, exemplified by scientific expeditions in British India, mining ventures in Mexico, and agricultural settlement colonies in Dutch Suriname, all led by German settlers, businessmen, and explorers.[10] Additionally, historiography on the nexus between German trade and business activities in the Global South throughout the 19th century has poignantly recast trade relations as a more effective means of leveraging state sovereignty for imperial purposes. Conversely, the portrayal of German interactions with Latin America in the 19th century as "imperial" has faced valuable critique. Scholars such as Glenn Penny argue that, in the 19th century, German entanglements with the world were mostly polycentric, mutable, and mutually constitutive, reflecting the cultural influence of various regions.[11]

Despite this richness of perspectives, the role of pharmaceutical knowledge and drugs as avenues of German global imperial influence in the early 19th century remains underexplored, particularly the role of cinchona as a tool of German imperial power. This paper contributes to the historiography of imperialism and science by exploring Germany's significant involvement in imperial practices prior to the 1880s, despite the absence of formally colonized territories. My paper will examine the scientific activities of four German scientists and explorers – Karl von Martius, Georg von Langsdorff, Friedrich Sello, and Ludwig Riedel – to demonstrate how German knowledge of Brazilian cinchona intersected with systems of enslavement and local knowledge. This analysis will also involve examining German

[7] Sebastian Conrad, *German Colonialism: A Short History* (Cambridge: Cambridge University Press, 2012); George Steinmetz, *The Devil's Handwriting Precoloniality and the German Colonial State in Qingdao, Samoa, and Southwest Africa* (Chicago: University of Chicago Press, 2007); Deborah Joy Neill, *Networks in Tropical Medicine: Internationalism, Colonialism, and the Rise of a Medical Specialty, 1890–1930* (Stanford, Calif: Stanford University Press, 2012).

[8] Sebastian Conrad, *Globalisierung und Nation im deutschen Kaiserreich* (München: Beck, 2006).

[9] Woodruff D. Smith, *The Ideological Origins of Nazi Imperialism* (New York: Oxford University Press, 1986). Matthew Fitzpatrick, "The Pre-History of the Holocaust? The Sonderweg and Historikerstreit Debates and the Abject Colonial Past," *Central European History* 41, no. 3 (2008): 477–503; Shelley Baranowski, *Nazi Empire: German Colonialism and Imperialism from Bismarck to Hitler* (Cambridge: Cambridge University Press, 2011).

[10] Brígida von Mentz et al., *Los pioneros del imperialismo alemán en México* (Mexico City: Ediciones de la Casa Chata, 1982); Jutta Wimmler and Klaus Weber, eds. *Globalized Peripheries: Central Europe and the Atlantic World, 1680–1860* (Woodbridge, Suffolk: The Boydell Press, 2020); Moritz von Brescius, *German Science in the Age of Empire: Enterprise, Opportunity, and the Schlagintweit Brothers* (Cambridge, United Kingdom: Cambridge University Press, 2018).

[11] Matthew Fitzpatrick, *Liberal Imperialism in Germany Expansionism and Nationalism, 1848–1884* (New York, N.Y: Berghahn Books, 2008); Erik Grimmer-Solem, *Learning Empire: Globalization and the German Quest for World Status, 1875–1919* (Cambridge: Cambridge University Press, 2019). For a polycentric overview of Germany's interaction with Latin America, see H. Glenn Penny, "Latin American Connections: Recent Work on German Interactions with Latin America," *Central European History,* 46, no. 2 (2013): 362–394.

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agricultural settlements, such as the colonies of Mandioca and Nova Friburgo, as sites of hybrid knowledge production involving indigenous people, enslaved Africans, and German scientists. Finally, I will explore how the pharmacological validation of Brazilian cinchona specimens was incorporated into German apothecaries and contributed to German biopolitical efforts oriented towards establishing a collective hygienic order.

Pharmacological Experimentations as Biopolitical Processes

In this imperial pharmacological culture, Brazilian cinchona trees captured the interest of German scientists seeking new antipyretic drugs. These scientists sought to deepen their understanding of the causes and treatment of febrile diseases, which were believed to be alleviated by cinchona plants. Within European nosological systems, organs and symptoms were conceptualized as diseases. Fever was not merely a symptom of a disease but rather the disease itself – e.g., *intermittierendes Fieber*, *Wechselfieber, Brustfieber*.[12] Moreover, German expeditions in Brazil during the early 19th century were comparable to other European ventures in their utilization of cinchona as an antifebrile. Cinchona-based preparations were purportedly used to protect German scientists from succumbing to febrile diseases. This discourse assigned significant pharmacological value to cinchona trees, recognizing them as essential medicinal agents. German pharmacological frameworks established a hierarchy of medicinal values, with antipyretic medicine occupying a prominent position.[13] For instance, Martius, a participant in the 1817 Austrian scientific expedition to Brazil, chose cinchona-based decoctions as a personal remedy to "endure two severe attacks of quartan fever during this journey, which I attempted to mitigate with potent emetics and cinchona."[14] This was also evident during the travels of Langsdorff, the German-born Russian consul who led a Russian scientific expedition in Brazil in the 1820s. He reported consuming cinchona-based decoctions while traveling in southern Minas Gerais: "I significantly improved after the rhubarb laxative, ammonia salt, and cinchona I took yesterday."[15] Langsdorff frequently combined chemical substances with cinchona bark to create pharmacological preparations that enhanced the plant's therapeutic efficacy.

As part of a broader German pharmacological culture, the scientific expeditions of Langsdorff and Martius spotlighted the growing prominence of cinchona decoctions as a pharmacological technology. The use of European cinchona preparations in Brazil underscored the plant's utilitarian role as an engineered tool, reinforcing imperial influence through scientific expeditions. These imperial practices were directed towards the discovery of new botanical specimens for the development of therapeutic drugs. Martius "believed that through comprehensive research on Brazilian medicinal plants, as well as other plant materials useful for artisanal work and industries, and by meticulously documenting their applications in their native regions, I could achieve the objectives of his mission

[12] These diseases presumably refer to various types of fever-related illnesses, characterized by the intermittent appearance of fever during different stages of the illness. See Volker Hess, "Medical Semiotics in the 18th Century: A Theory of Practice?" *Theoretical Medicine and Bioethics* 19, no. 3 (1998): 203–13.

[13] Matthew Crawford, *The Andean Wonder Drug: Cinchona Bark and Imperial Science in the Spanish Atlantic, 1630–1800* (Pittsburgh, PA: University of Pittsburgh Press, 2016); Jorge Cañizares, *Nature, Empire, and Nation: Explorations of the History of Science in the Iberian World* (Stanford, CA: Stanford University Press, 2022).

[14] Johann B. von Spix and Carl F. von Martius, *Reise in Brasilien auf Befehl S. M. Maximilian Joseph I, Konigs von Bayern, im Jahre 1817–20,* Vol. III (München: Lindauer, 1823–1833). For a biography of Martius, see Markus Wesche, *Zwei Bayern in Brasilien: Johann Baptist Spix und Carl Friedrich Philipp Martius auf Forschungsreise 1817 bis 1820: eine andere Geschichte* (München: Allitera Verlag, 2020); Alda Heizer, "Os jovens naturalistas Spix e Martius numa aventura científica ao Brasil," in *Natureza, ciência e arte na viagem pelo Brasil de Spix e Martius 1817–1820*, ed. Paulo Ormindo D. de Azevedo (Rio de Janeiro: Andrea Jakobsson Estúdio, 2018).

[15] Danuzio da Silva *Os diários de Langsdorff, Vol. 2* (Fundação Oswaldo Cruz, 1997), 258. For a Langsdorff's biography, see Roderick Barman, "The Forgotten Journey: Georg Heinrich Langsdorff and the Russian Imperial Scientific Expedition to Brazil, 1821–1829," *Terrae Incognitae* 3, no. 1 (1971): 67–96; Hans Becher, *Georg Heinrich Freiherr von Langsdorff in Brasilien: Forschungen eines deutschen Gelehrten im 19. Jahrhundert* (Berlin: D. Reimer, 1987).

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[scientific advancement and the advancement of civilization]."[16] Martius was not alone in viewing Brazil's medicinal herbs, particularly cinchona, as research objects around which the imperial interests of Austria, Russia, and Prussia converged.

Additionally, German pharmacology lacked a stable theoretical framework to determine the identity of cinchona specimens. Various types of cinchona bark remained the subject of intense academic debate concerning their utility and authenticity as antifebrile agents within the cinchona family. From a morphological perspective, different cinchona specimens resembled one another, leading to confusion about their provenance.[17] For example, Martius observed that Brazil's *quina do Piauhy* (*solanum pseudoquina*) and *quina do campo* (*strychnos pseudoquina*) exhibited morphological similarities to Peruvian and Ecuadorian cinchona specimens. He observed that "the color here is similar to that of dry cinnamon, and when the bark is fresh, it leans slightly more towards yellow."[18] However, he also remarked that *quina do Piauhy* "differs chemically from Peruvian cinchona, particularly due to the absence of the characteristic quinine alkaloid."[19] Despite their chemical differentiation from Peruvian and Ecuadorian cinchona specimens, *quina do Piauhy* and *quina do campo* continued to be classified and utilized as antifebrile cinchona plants within German pharmacology, given their morphological resemblance to Peruvian cinchona bark.

In Brazil, German pharmaceutical culture redefined the natural world and developed pharmacological technologies from plant life. German pharmacology was driven by a defined social purpose of progress. Adhering to this ideology of modernization, Martius asserted in 1829 that his botanical observations "hold promise for practical sciences, particularly Medicine, Technology, and Trade [...] dedicated to benefiting both humanity and Brazilian patriots [...] highlighting Brazil's wealth of useful plants deserving of commercialization and recognition by European physicians and technicians!"[20] Similarly, Martius' scientific perspective was heavily influenced by vitalist notions of nature and empirical approaches to understanding biological processes.[21] This vitalist perspective characterized both human and non-human entities as components of a holistic system of living forces, defined as material substances.[22]

German scientific expeditions became entangled with chemical experiments, implicitly connected to visionary goals of social, material, and biological progress. These experiments relied on a scientific language that analyzed cinchona specimens in terms of their biotic components. As plants with medicinal properties, the cinchona specimens, *solanum pseudoquina* and *strychnos pseudoquina*, for example, "can be valuable for the fields of Medicine,

[16] Spix and Martius, *Reise in Brasilien,* Vol. I, 6.

[17] See Daniela Bleichmar, *Visible Empire: Botanical Expeditions & Visual Culture in the Hispanic Enlightenment* (Chicago: University of Chicago Press, 2012), 43–79; Emma Spary, *Utopia's Garden French Natural History from Old Regime to Revolution* (Chicago: University of Chicago Press, 2000).

[18] BSBM, Martusiana I.A.2.9, 1846.

[19] Spix and Martius, *Reise in Brasilien,* Vol. II, 549. Quinine referred to the chemical alkaloid identified as the substance that contained the antifebrile power of cinchona barks. See Pierre Joseph Pelletier, *Analyse Chimique Des Quinquina* (Paris, 1821).

[20] BSBM, Martusiana II A 1. Advertencia, Munich em Baviera Fev., 20 1829.

[21] Robert Richards, *The Romantic Conception of Life: Science and Philosophy in the Age of Goethe* (Chicago: University of Chicago Press, 2002); John Zammito, *The Gestation of German Biology: Philosophy and Physiology from Stahl to Schelling* (Chicago: University of Chicago Press, 2017); Frederick Gregory, *Scientific Materialism in Nineteenth Century Germany* (Dordrecht, Holland: D. Reidel Pub. Co., 1977). Denise Phillips, *Acolytes of Nature: Defining Natural Science in Germany, 1770–1850* (Chicago: University of Chicago Press, 2012); Catherine Jackson, *Molecular World: Making Modern Chemistry* (Massachusetts: The MIT Press, 2023).

[22] Vitalism, a concept that emerged in the 18th century, was a scientific paradigm that characterized living organisms as possessing material life forces which directed their development and function in nature teleologically. See Peter Reill, *Vitalizing Nature in the Enlightenment* (Berkeley: University of California Press, 2005). For a transnational study of vitalism in the 18th century, see Keith Baker and Jenna M. Gibbs, eds. *Life Forms in the Thinking of the Long Eighteenth Century* (Toronto: University of Toronto Press, 2017).

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Industry, and Trade."[23] On February 16, 1818, Martius showed interest in a cinchona bark, *strychnos pseudoquina,* with a "very bitter, thick bark." The bitterness of this plant was a key physical characteristic, commonly associated with the cinchona family: "Fine cinchona bark is found near Mato Virgem [...] with considerable bitterness."[24] The description of *strychnos pseudoquina*'s composition as a bitter bark involved an objectification of its organs and vital forces.

This understanding of plant life facilitated the transformation of botanical organic substances into valuable pharmacological tools for manipulating the vital forces of the human body. For example, by examining the use of these plants among local populations, Martius argued that "strengthening medicines, such as cinchona bark, are also effective in treating the hardening of the spleen, liver, and mesenteric glands, conditions that are prevalent in the Sertão [a region in northeastern Brazil]."[25] After establishing that "the bark of this tree possesses a very pleasant bitterness," Martius further proposed that "a combination of the bark extract, which we instructed the natives to prepare, with mercurius dulcis, fully addresses these indications. The powder is administered in doses ranging from half to two drachms, while the extract is used in doses four to five times smaller."[26] The documentation of these pharmacological experiments is presented in his book *Reise in Brasilien*, as ethnographic observations on Brazil's customary social practices.

These ethnological annotations provide evidence of the chemical enhancement of *strychnos pseudoquina* in combating various Brazilian diseases. For instance, Martius noted that "the intense fevers which [...] following the flood wreaked havoc among the inhabitants of Rio de S. Francisco, are either purely nervous fevers or, more commonly, typhoid fevers."[27] Cinchona plants were classified as a botanical genus known for their potential to invigorate the nervous system.[28] The prevailing scientific paradigm in German pharmacology conceptualized therapeutics as a synthesis of plant and human vitalizing substances. Reflecting on the evolving vision of the medical profession, Martius argued that "physicians now concentrate more on accurately investigating the nature and history of the human body, how diseases affect it, and the chemical and morphological changes involved [...] By focusing on the alterations in diseases related to universal organismic processes (referred to as 'processes,' given that all organic matter evolves at specific intervals), they seek to treat health with a few simple and well-established remedies [plant-based drugs]."[29] In German pharmacology, it is evident that chemical experiments were conducted to systematize "pure" scientific knowledge concerning the organization of chemical properties in nature.[30] In the early 19th century, German chemists had already begun to develop chemical formulas as a theoretical tool to elucidate the chemical processes, relationships, and characteristics of various elements and compounds found in nature.[31] German chemical research in Brazil was part of a broader scientific trend targeted at determining the composition of oxygen, nitrogen, hydrogen, and carbon in nature to validate chemical knowledge.[32]

[23] BSBM, Martusiana I.C.1.5, 1818.

[24] BSBM, Martusiana I.C.1.5, 1818.

[25] Spix and Martius, *Reise in Brasilien*, Vol. II, 549.

[26] Spix and Martius, *Reise in Brasilien*, Vol. II, 549.

[27] Spix and Martius, *Reise in Brasilien*, Vol. II, 557.

[28] Hubert Steinke, *Irritating Experiments: Haller's Concept and the European Controversy on Irritability and Sensibility, 1750–90* (Amsterdam, Netherlands: Brill, 2005).

[29] Carl von Martius, *Contendo o catalogo e classificação de todas as plantas brasileiras conhecidas* (Rio de Janeiro: Eduardo Enrique Laemmert, 1854), XIII.

[30] For a discussion on how the design of chemical formulas served as "paper tools" to impose conceptual order on the chemical processes of natural elements in continental Europe, see Ursula Klein, *Experiments, Models, Paper Tools: Cultures of Organic Chemistry in the Nineteenth Century* (Stanford, CA: Stanford University Press, 2022).

[31] For a discussion regarding the academic discussions about how to produce chemical synthetics in Germany in the 1820s and 1830s, see Catherine Jackson, *Molecular World: Making Modern Chemistry* (Cambridge, Massachusetts: The MIT Press, 2023).

[32] For an explanation of how Martius exemplified one of many German doctors with a strong inclination towards chemical experimentation, see Wesche, *Zwei Bayern in Brasilien,* 82–108.

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These German experimental activities in Brazil must be contextualized within the broader framework of social objectives and utopian visions that characterized German pharmacology and medicine. In the early 19th century, the professional endeavors of a group of German physicians and pharmacists, viewed as proponents of "reasoned insight, law, common good, progress, and modernity," were intrinsically regulated by and integrated into the bureaucratic systems of the German states.[33] This symbiotic relationship with the state apparatus was evident in the cameralist policies of the German absolutist systems in the 18th century. The management of public health was framed as a state strategy to enhance and improve the quality of the population.[34] In the early 19th century, the rational bureaucratization and administration of pharmacology and medicine involved a heightened enforcement of regulations concerning therapeutic practices, clinical treatment, and the production of medicinal drugs. This was notably achieved through pharmacopeias that prescribed the chemical composition and manufacturing methods of medications.[35]

As a state class of bureaucrats and *Bildungsbürgertum* (educated bourgeoisie), physicians and pharmacists enacted a state-modernizing ideology through their professional activities. In their therapeutic practices, physicians and pharmacists cultivated "bourgeois society to emancipate the individual's abilities in the interest of the whole."[36] These "educated" bureaucrats translated this vision into practical experiments with both scientific and social objectives, focused on modernization.[37] As a well-established scientist in Bavaria during the 1840s, Martius asserted that "in this era of medicine [the early 19th century], all those who prepare, more or less, by gathering and combining various natural substances, whose effects on the organism are known through their use, will contribute to this purpose. For this reason, I would like [...] to encourage physicians to focus on the rich pharmacy of this land [Brazil], which undoubtedly contains many natural treasures that could be beneficial to us, the rulers of the world, for our health and well-being."[38] This scientific discourse elucidated the German pharmacological and medical perspective on the regulation, control, and reorganization of human composition and behavior, intended to enhance the health of human populations. This notion of health was imbued with values of social modernization and medicalization. By focusing on human bodies, health acquired a medico-cultural significance. The living forces of the human body, particularly those of the nervous system, needed to be potentiated through the curative properties of cinchona specimens. This materialist manipulation of living forces exemplified how biopolitical intervention in biological processes would manifest at the medical level. "The management of one's own body was socially regulated and controlled, and adherence to these norms could be seen as a measure of social integration and civilization."[39] This civilizing mission required not only hygienic personal behavior but also intervention in human bodies through curative plant life to ensure a social order of "civilized" and "healthy" bourgeois individuals.

[33] See Thomas Nipperdey, *Deutsche Geschichte 1800–1866: Bürgerwelt und starker Staat* (München: C.H. Beck, 1983), 35.

[34] Georg Rosen. "Cameralism and the Concept of Medical Police," *Bulletin of the History of Medicine* 27, no. 1 (1953): 21–42; David F. Lindenfeld, *The Practical Imagination: The German Sciences of State in the Nineteenth Century* (Chicago: University of Chicago Press, 1997).

[35] Wolfgang Engels, *Zur Geschichte des Verstaatlichungsgedankens im deutschen Apothekenwesen* (Stuttgart: Deutscher Apotheker Verlag, 1984); Erika Hickel, "Die Pharmakopöe–ein Apothekerbuch?," *Pharmazie in unserer Zeit,* 2, No. 1, (1973): 1–8.

[36] Nipperdey, *Deutsche Geschichte 1800–1866*, 32.

[37] For an overview of the professionalization of the medical profession in Germany as part of the bourgeoisie, and its efforts to monopolize medical practice and knowledge in Prussia, see Claudia Huerkamp, *Der Aufstieg der Ärzte im 19. Jahrhundert: Vom Gelehrten Stand zum profesionellen Experten: Das Beispiel Preussens* (Göttingen: Vandenhoeck & Ruprecht, 1985).

[38] Martius, *Contendo o catalogo e classificação,* XV.

[39] Ute Frevert, *Krankheit als politisches Problem, 1770–1880: soziale Unterschichten in Preussen zwischen medizinischer Polizei und staatlicher Sozialversicherung* (Göttingen: Vandenhoeck & Ruprecht, 1984), 16.

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Indigenous Knowledge as a Basis of Biopolitical Therapeutics

After allegedly determining the "organic laws" and "nature" of *quina do campo* as an antipyretic through botanical classification methods, Martius turned to chemical experimentation to explore the pharmaceutical potential of this plant. The combination with *mercurius dulcis* or mercury chloride was ostensibly intended to overcome the "natural" limitations of *quina do campo*, with the goal of enhancing its healing effects.[40] In his research, the chemical preparation of *mercurius dulcis* and *quina do campo* intersected with Martius' exploratory goals, becoming a subject of pharmaceutical study and experimentation in its own right. This process thus generated knowledge "in the making."[41] The "natural" world emerged as a site for pharmacological practices, with indigenous therapeutic ideas underpinning the knowledge production in Martius' pharmacological experiments.

Although the voices of German scientists and indigenous people did not hold equal value as sources of pharmacological authority, the scientific activity of the former was reliant on non-European bodies of knowledge. In mapping the curative properties of *quina do campo*, Martius initially identified its therapeutic use within the pharmacological practices of the *sertanejos*, or rural populations, which included indigenous groups. The latter "used it particularly for chronic stomach weakness, dyspepsia, and intermittent fevers."[42] Martius developed a propensity to embrace traditional botanical knowledge because these ways of knowing were believed to be grounded in "nature" itself. For Martius, "nature" was an organic entity with a logic and "wisdom" of its own.[43] "As the dominant principle in all the natives' knowledge about natural things, their belief in the unity of nature can be identified. Everything earthly is interconnected, and all individual entities relate to one another."[44] In his medical ethnological studies, Martius reinterpreted the medicinal knowledge of the indigenous peoples of his time as "remnants of an earlier natural wisdom or traditions."[45] Martius argued that this "natural wisdom" remained active among the indigenous population, attributing it to their instinctual, "unbiased and far-reaching observation" inherent to all human beings. [46]

By virtue of this alleged instinct, the botanical expertise of Brazilian indigenous peoples "deserves the full attention of rational medicine."[47] He asserted that "these medicinal plants, in their fresh state [...] quite often possess the most decisive healing powers."[48] For him, "nature" was a repository of "hidden" therapeutic wisdom and knowledge. Likewise, the study of indigenous knowledge provided "a multitude of important facts for ethnography and natural history."[49] However, these traditional medicinal ideas were considered

[40] Bernadette Bensaude Vincent and Sacha Loeve, "Toward a Philosophy of Technosciences," in *French Philosophy of Technology,* ed. Sacha Loeve et al. (Cham: Springer International Publishing, 2018), 169–86.

[41] Bensaude and Loeve, "Toward a Philosophy of Technoscience," 169–86.

[42] Spix and Martius, *Reise in Brasilien*, Vol. II, 549. "Sertanejo" was a historical term referring to the population of the Northeastern region of Brazil, who lived in the countryside and rural areas of the Brazilian valleys and high plateaus. This population had a mixed ancestry, including Black, Indigenous, and Portuguese lineage. Their identity was closely tied to pastoral and agricultural activities, as well as to their rural living environments, which provided both sustenance and medical resources. See Maria Geralda, "Uma Leitura Etnogeográfica do Brasil Sertanejo," *GeoTextos* 18, no. 2 (2022): 231–254; Margarida do Amaral Silva, "Identidade, sertão e cultura no espaço-tempo," *Padê Brasília* 2, no. 2 (2008): 71–97.

[43] BSBM, Martusiana I.A.2.10 Das Pflanzenreich u. die Erde.

[44] J.E. Herberger and F.L. Winckler, *Jahrbuch für practische Pharmacie und verwandte Fächer* (Landau, J. Baur, 1844), 124.

[45] Karl von Martius, *Das Naturell, die Krankenheiten, das Ärzthum und Heilmittel der Uhrbewohner Brasiliens* (Munique: Druck der Wolfschen Buchdruckerei, 1844), 133; Raphael Uchôa, "From the state of nature to the state of ruins: 'American race' and 'savage knowledge' according to Carl von Martius," *Annals of Science* 79, no. 1 (2022): 40–59; Karen Macknow, *A nova Atlântida de Spix e Martius: natureza e civilização na viagem pelo Brasil (1817–1820)* (São Paulo: Editora Hucitec, 1997).

[46] Martius, *Das Naturell*, 131.

[47] Martius, *Das Naturell,* 141–142.

[48] Martius, *Das Naturell*, 141.

[49] Spix and Martius, *Reise in Brasilien*, Vol. III, 1173.

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underdeveloped and thus required rationalization. By this, Martius referred to the use of chemical decomposition to analyze the quantities of hydrogen, oxygen, carbon, and nitrogen atoms in plants. As part of his ethnobotanical observations, Martius noted that his "companion [an indigenous individual], in particular, [who] had suffered from intermittent fever attacks for some time and was only able to alleviate them with cinchona and other bitter remedies, especially the root of Tachia gujanensis."[50] Martius' approach to medicine provided insight into a broader German transnational pharmacological effort that classified Brazilian plants as "useful [...] whose most essential uses have remained completely unknown to them [indigenous people]."[51] The cultural narratives of this German imperial pharmacology did not view plants as passive objects of study. Instead, they categorized botanical specimens, including cinchona specimens, as living entities endowed with inherent teleology and dynamism: "They [medicinal plants] are subject to a necessity from which they can only be rescued by their own strength, possibly with the assistance of benevolent natural forces [other organic substances]."[52] According to Martius, the indigenous understanding of the teleological living force of plants remained anchored in rudimentary therapeutic practices. He addressed this deficiency using "superior" methods or chemical procedures to identify and track "benevolent natural forces."[53]

Situated within a vitalist framework, Martius collected botanical knowledge from indigenous medical practices involving cinchona genera. He maintained a favorable disposition toward indigenous medicine, noting that "their pharmacy is the forest."[54] Martius's apothecary and laboratory were not separate from this perspective; the Urwald, or primeval forest, served as both his workspace and a source of medical "wisdom." He collected medicinal materials from the Brazilian ecosystem, such as *quina do campo*, and tested the "indications of the Indian *materia medica*" with "sober caution [...] using them in his practice only after thorough examination."[55] German pharmacology became unequivocally a by-product of the historical interplay between German medicinal techniques and indigenous herbal practices. However, immersed in a pharmacological imagination geared towards enhancing plant life, Martius decontextualized Brazilian cinchona specimens from their indigenous uses. He subsequently reinscribed these cinchona specimens within German scientific thought, which encompassed a materialist conception of vital forces as both measurable and malleable.

The knowledge of indigenous peoples gained recognition within German pharmacological culture, though it was accorded less authority as a source of knowledge. Riedel, a member of Langsdorff's expedition, also ascribed significant scientific value to *quina do campo*. In his efforts to understand the chemical composition of Brazilian cinchonas, Riedel categorized this cinchona specimens as a plant that "contains no quinine. For hardening of the spleen, liver, and mesenteric glands. Bark extract with mercurius dulcis. Powder ½-2 drachms. The extract 4-5 times smaller."[56] It is difficult to ascertain how Riedel arrived at conclusions analogous to those of Martius concerning the medical and chemical aspects of *quina do campo*.[57] Through his encounters with ethnobotanical practices, Riedel demonstrated a similar appreciation and validation of ethnomedicinal knowledge. The description of the

[50] Spix and Martius, *Reise in Brasilien*, Vol. III, 1173.

[51] Martius, *Das Naturell*, 162.

[52] Martius, *Das Naturell*, 300; J.A. Buchner, *Repertorium für die Pharmacie* (Nürnberg; Schrag, 1844).

[53] Buchner, *Repertorium für die Pharmacie*, 1–46; Martius, *Das Naturell*, 300.

[54] Martius, *Das Naturell,* 139.

[55] Martius, Das Naturell, 134.

[56] Biblioteca Nacional do Brasil (BN), Relação de árvores e plantas do Brasil. 138 p., Localização: Manuscritos, 05,3,005. Quinine, extracted from Peruvian cinchona bark, was one of the chemical alkaloids identified by French chemists Pierre Pelletier and Joseph Caventou. This alkaloid became a crucial chemical marker, also employed by German chemists, to determine whether a plant belonged to the cinchona family. See Jonathan Simon, *Chemistry, Pharmacy and Revolution in France, 1777–1809* (London: Routledge, 2016).

[57] Auguste de St. Hilaire, *Plantes usuelles des Brasiliens* (Paris: Grimbert, 1824).

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adverse effects of *quina do campo* on the spleen, liver, and mesenteric glands was ultimately based on pharmacological data provided by indigenous sources among the *sertanejos*. The transformation of *quina do campo* into a pharmacological object reflected a hegemony of axioms and standards that legitimized scientific knowledge within German pharmacology. For Riedel, German chemical experimentation served as the ultimate means to validate practical knowledge. The chemical decoctions obtained from *quina do campo* exemplified a dialectical manufacturing process that integrated indigenous medical practices, empirical observation, and chemical manipulation, merging two distinct yet mutually constitutive forms of knowledge: European and non-European. This intricate exchange of ideas and techniques was facilitated by a cultural discourse that portrayed the Brazilian biosphere as a domain of interconnected living forces.

The chemical validation of Brazilian cinchona specimens within the context of German pharmacology was reflective of a knowledge regime that rendered "the reality of life both conceivable and calculable."[58] This process was rooted in materialist conceptions of organic life, in which vital forces were perceived to possess both a corporeal and malleable nature. The inherent complexity of plant life, as "the species that have given life to the world of forms," was conceptualized as a collection of microscopic chemical substances, which were ostensibly subject to human manipulation, control, and reformulation.[59] Within the framework of German pharmacology, these experiments, along with their underlying assumptions about life, contributed to the development of a knowledge system focused on systematically categorizing and regulating the life of cinchona plants. As previously noted, "systems of knowledge provide cognitive and normative frameworks that create biopolitical spaces and define both subjects and objects of intervention."[60] This German pharmacological knowledge system, which shaped public health policies designed to control the populace, was supported by a hybrid epistemology. It not only acknowledged and incorporated indigenous ethnomedical knowledge but also prioritized German chemical classifications and experimental methodologies. Although these pharmacological regimes proved useful in supporting practices to manage human life, they did not function as epistemological tools intended to suppress local Brazilian forms of ethnomedicine. Instead, a notable degree of mutual learning and exchange existed, emphasizing that the cross-fertilization of medicinal knowledge between German and Brazilian sources was a common occurrence.

Nevertheless, once extracted from indigenous frameworks of knowledge, Brazilian cinchonas underwent an ontological transformation through German experimentation. According to Martius, cinchona decoctions represented an artificial chemical composite of both non-living entities–usually minerals–and living matter. Cinchona thus functioned not only as an object of study but also as a biopolitical technology: "Biopolitics' last domain is [...] control over relations between the human race, or human beings insofar as they are species, insofar as they are living beings, and their environment, the milieu in which they live."[61] This living mass encompassed more than the management of human health, racial and sexual reproduction, or hygienic behavior.[62] The control of diseases and the enhancement of plants' curative properties constituted a biopolitical effort by German scientists in Brazil to achieve "an overall equilibrium that protects the security of the whole [human populations] from internal dangers."[63]

[58] Thomas Lemke, *Biopolitics: An Advanced Introduction* (New York: New York University Press, 2011), 119.

[59] Emanuele Coccia, *The Life of Plants: A Metaphysics of Mixture* (Cambridge, UK; Polity Press, 2019), 12.

[60] Lemke, *Biopolitics*, 119.

[61] Foucault, *"Society Must Be Defended,"*245.

[62] Michel Foucault. *The History of Sexuality*. Edited by Frédéric Gros. Translated by Robert Hurley. First American edition (New York: Pantheon Books, 1978); For a discussion on the relationship between race and biopolitics within the context of imperialism, see Ann Laura Stoler, *Race and the Education of Desire: Foucault's History of Sexuality and the Colonial Order of Things* (Durham: Duke University Press, 1995).

[63] Foucault, *"Society Must Be Defended,"* 249. For further discussion on biopolitical management of the environment, see Luciano Espinosa Rubio, "Variaciones biopolíticas sobre naturaleza y vida," *ARBOR Ciencia, Pensamiento y Culture* 762 (2013).

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For German pharmacology, diseases interacted with human and plant species within a framework of biological contingency and spontaneity. Illnesses could intermittently emerge from climatic phenomena and biological materials in decay, thereby posing an unabated and pernicious threat to human populations.[64] "The extractive substances from some decaying plant parts that have been absorbed, and perhaps also the lack of refreshing air movement [...] might be the reasons for the reduced salubrity of the nearby stagnant waters."[65] Diseases were perceived as a biological threat that required regulation and control. According to Martius, this interplay of biological beings resulted from human civilization's interaction with nature: "Insatiable [...] civilization drags all of nature around it into its powerful current."[66] In German pharmacology, cinchona, regarded as an entity of "nature," was transformed into a pharmacological technology leveraged to control the "natural" habitat of diseases.

Local Knowledge, Pharmacology and Biopolitics

In 1822, Sello's expedition in Paraguay was made possible through the active involvement of an enslaved individual of Nâgo ethnicity, a group originating from the West African region of Benin, who was under Sello's ownership.[67] "My guide, a big, strong Negro born in Paraguay, was very talkative and uninhibited in his questions."[68] During his journey from Paraguay into the Brazilian hinterlands, Sello recorded a variety of the region's mineral resources, including granite, and made note of the presence of cinchona bark in his botanical observations. He observed that "the *solanum pseudoquina* is commonly known and highly regarded here, much like a rubiaceae also referred to as quina [cinchona bark], which was shown to me."[69] As part of his ethnobotanical observations on "the preparation of the herbs," Sello highlighted the crucial role of "those who know more" in crafting plant-based herbal decoctions in the rainforest.[70] According to Sello, the preparation of therapeutic remedies from *solanum pseudoquina* involved a series of spiritual invocations. He noted that "several neighbors came to see the caves on this occasion [...] and they occasionally prayed in the large cave and made vows to their invisible saints."[71]

For Sello, the identity of these "wise people" was closely linked to the life and traditions of rural areas in Brazil, specifically the *capoeiras* – uninhabited landscapes of wild scrub and brush.[72] He referred to these "people who know more" as rural inhabitants near the São

[64] Osagie Obasogie, *Beyond Bioethics: Toward a New Biopolitics* (Berkeley: University of California Press, 2019); Espinosa Rubio, "Variaciones biopolíticas."

[65] Spix and Martius, *Reise in Brasilien*, Vol. III, 1020. For more information on how German medical thought perceived the "natural" environment as a contingent source of maladies and diseases, see Theodor Baltz, *Meinungen über die Entstehung, das Wesen und die Möglichkeit einer Verhütung der sogennanten Cholera* (Berlin: Mittler in Comm. 1832).

[66] Carl von Martius, *Die Pflanzen und Thiere des tropischen America, ein Naturgemälde* (München: Friedrich Fleischer, 1831).

[67] Geheimes Staatsarchiv Preussischer Kulturbesitz (GStA PK), I. HA 76 Kultusministerium, Sekt. 2, Tit. 23 LITT. A, Nr. 5 Bd. 1. Diplomatic report from Albert von Flemming in Brasilien, November 12, 1817; GStA PK, I. HA 76 Kultusministerium, Sekt. 2, Tit. 23 LITT. A, Nr. 5 Bd. 3. Letter from Friedrich Sello to the State Minister Altenstein on October 18, 1824, from Rio de Janeiro. In the early 19th century, the largest number of enslaved people arriving in Bahia, Brazil, were from the West African region, predominantly the Nagô people who primarily spoke Yoruba. This group was dispersed across Brazil and even reached as far as Uruguay. See Cheryl Sterling, *African Roots, Brazilian Rites Cultural and National Identity in Brazil* (New York: Palgrave Macmillan US, 2012); Mônica de Souza, "La cultura de los negros esclavizados del Brasil: arquitectura y rito en la ciudad de Salvador, Bahia," *Arquitecturas del sur*, no. 42 (2012): 60–73; Jean Hébrard, "L'esclavage au Brésil: le débat historiographique et ses racines," in *Brésil: quatre siècles d'esclavage. Nouvelles questions, nouvelles recherches*, ed. Jean Hébrard (Paris: Karthala & CIRESC, 2012): 7–61.

[68] Museum für Naturkunde zu Berlin (MfNB), ZM, S I, Sellow, Exk., 1, 1r. See 23. bis 24. Dezember 1822, Uruguay, Rio de la Plata.

[69] MfNB, ZM, S I, Sellow, Exk., 1, 1r.

[70] MfNB, ZM, S I, Sellow, Exk., 1, 1r.

[71] Voeks, *The Ethnobotany of Eden,* 157–205.

[72] MfNB, ZM, S I, Sellow, Exk., 1, 1r.

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Paulo region, noting that they had "ample fodder for dairy cows and horses or mules."[73] Sello alluded to a geographical isolation that defined the lives and mobility of these "people who know more." In the context of 19th-century Brazilian slavery, runaway Black individuals often sought refuge in these *capoeiras* to escape enslavement on plantations, establishing places of freedom known as *quilombos*.[74] The *capoeiras* offered secluded spaces where Black individuals could engage in agricultural and pastoral activities, utilize local vegetation for therapeutic purposes, and venerate their *Orixás* – religious deities from the Yoruba religion.[75] It is difficult to ascertain with certainty whether the therapeutic practices observed by Sello corresponded to the ethnobotanical rituals of Brazilian *quilombos*, despite their apparent resemblance. However, it is evident that Sello gathered information on medicinal plants through ethnological observations. He exhibited a clear openness to acknowledging ethno-traditional medicinal knowledge from Brazilian local groups. His encounters with *solanum pseudoquina* were similarly guided and informed by the expertise of local informants, including his guide from Benin.

Reliance on oral forms of medicinal knowledge became commonplace in Sello's botanical explorations. For example, during his 1828 journey from Curitiba to Paranaguá, Sello encountered and collected bark from *solanum pseudoquina*.[76] According to Sello, this plant "was discovered by the father of the current Capitão Mor [Governor Captain], who, despite lacking botanical expertise over his sixty years, deduced from the plant's bitter taste that it was cinchona."[77] The identification of *solanum pseudoquina* did not follow a controlled laboratory process; rather, it relied on a diverse array of local knowledge sources and methods to validate the plant's pharmaceutical value.

On the one hand, the perspective of Capitão Mor's father, a governor of rural communities in the Curitiba region, reflected a transnational discourse concerning the bitter taste of cinchona. This characteristic had been integrated into Brazilian popular medicinal practices as a criterion for identifying and validating various genera of cinchona.[78] In fact, this narrative was collectively embraced by various groups engaged in the transmission of therapeutic knowledge across the world, including Spanish pharmacologists, Portuguese apothecaries, enslaved healers in the American South, French colonists in Algeria, Ottoman traders, British imperial physicians, Peruvian cinchona collectors, and other medical experts and users.[79] On the other hand, Sello's botanical annotations offer archival insights into a German pharmacological and botanical culture that was intricately interwoven with an intercultural and unconventional foundation of epistemological authorities, pharmaceutical principles, and standards of "objectivity."[80] Orality played a legitimizing role, functioning as a normalized

[73] MfNB, ZM, S I, Sellow, Exk., 1, 1r.

[74] George Reid, *Afro-Latin America, 1800–2000* (Oxford: Oxford University Press, 2004).

[75] Mônica de Souza, "La cultura de los negros esclavizados del Brasil: arquitectura y rito en la ciudad de Salvador, Bahia," *Arquitecturas del sur*, no. 42 (2012): 60–73; Cheryl Sterling, *African Roots, Brazilian Rites Cultural and National Identity in Brazil* (New York: Palgrave Macmillan US, 2012); Toyin Falola and Matt D. Childs, *The Yoruba Diaspora in the Atlantic World* (Bloomington: Indiana University Press, 2004).

[76] Hanns Zischler, "Eine grosse gefährliche Untersuchung," in *Die Erkundung Brasiliens: Friedrich Sellows unvollendete Reise*, ed. Hanns Zischler, Sabine Hackethal, and Carsten Eckert (Berlin: Verlag Galiani Berlin, 2013); Miriam Junghans, "Ordenar o Mundo e Sondar a Natureza: O Projeto Humboldtiano de Friedrich Sellow (1789–1831)" (PhD Diss., Fundação Oswaldo Cruz, 2017).

[77] MfNB, TB 42, Bestand MM, S I, Sellow, Tagebuch 42. Reise von Curitiba nach Paranaguá, 1828.

[78] MfNB TB 42, Bestand MM, S I, Sellow, Tagebuch 42.

[79] Stefanie Gänger, *A Singular Remedy: Cinchona across the Atlantic World, 1751–1820* (Cambridge: Cambridge University Press, 2021), 91–119.

[80] Sello was aware of the archetypal antipyretic properties of cinchona bark from Latin America, which he may have learned about under the botanical tutelage of Alexander von Humboldt in Paris. Additionally, Sello was familiar with the botanical writings and collections of St. Hilaire, a French botanist who, in his work *Plantes usuelles des Brésiliens*, classified *solanum pseudoquina* as a potential substitute for Peruvian cinchona bark. See GStA PK, I. HA 76 Kultusministerium, Sekt. 2, Tit. 23 LITT. A, Nr. 5 Bd. 1; Alexander von Humboldt, "Über die Chinawälder in Südamerika," 57–68; GStA PK, I. HA 76. Letter from Sellow to Altenstein, May 1, 1829.

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and objective method for generating knowledge about *solanum pseudoquina*. This approach preceded the formal inscription of Brazilian cinchona plants into the domains of chemical decomposition, evaporation, crystallization, and pharmaceutical reconfiguration. The oral discourse of local voices exerted a notable influence on German pharmacological culture. An oral form of knowledge acquisition occurred prior to the decontextualization of this botanical specimen from its ethnobotanical origins and its local harvesting in Brazil.[81] For German scientists, orality complemented the processes of observing, documenting, and extracting the medicinal properties of *solanum pseudoquina*. Within German pharmacological culture, expertise regarding this plant initially emerged from a cultural context that incorporated herbs into ritualistic practices. These unconventional methods of generating medicinal knowledge intersected with the biopolitical orientation of German pharmacology – a system of therapeutic practices aimed at enhancing the healing capacities of plants for the betterment and modernization of German society through public health policies.[82]

Sello was not the only empiricist aware of the purported antifebrile properties of *solanum pseudoquina*. Martius also acknowledged its utility as "one of the best bitter remedies." In his work *Systema Materiae Medicae Vegetabilis Brasiliensis*, Martius indicated the potential for chemical experiments to enhance the plant's healing properties. He contended that this chemical improvement could be achieved through "soluble resin in water, nitrogenous matter combined with potash and lime, unctuous matter, and oxalic and phosphoric lime, as well as iron."[83] Local knowledge regarding *solanum pseudoquina* served as a foundation for German pharmacological practices. However, Martius envisioned a pharmacological paradigm in which drugs, primarily derived from the plant kingdom, were "elaborated and extracted through chemical processes."[84] This approach facilitated the further development of chemical decoctions, extractions, and infusions, contributing to a German ideal of pharmacological advancement.[85] "I am absolutely certain," Martius affirmed, "that in the progress of the same medicine, the doctrine of specific medications [...] also becomes increasingly firm and more verified."[86] This chemical intervention led to an epistemological displacement, or *epistemischer Bruch*, of *solanum pseudoquina* from its local habitat into a realm of enhanced material living forces – a corporeality defined by the observable, verifiable, and measurable.

This reinscription into German chemical conventions facilitated the establishment of a German medical system that integrated enhanced forms of cinchona's organic compounds with other chemical alkaloids. Beyond the treatment of diseases, one of its objectives was to uphold a bourgeois social order through the optimization and regulation of the sanitary practices of German citizens. By the 1830s, the human body was already regarded as a site of state regulation in the German territories, with public hygiene concepts deeply embedded in the cultural framework of the bourgeois medical community.[87] In this paradigm, individual hygiene, nutrition, and prophylactic measures were regarded as essential virtues of a modern, healthy German society.[88] These sanitary habits needed to be developed, cultivated, and disseminated throughout the German territories.

German physicians benefited significantly from the chemical experiments conducted by German pharmacists, who successfully extracted the alkaloids from various cinchona

[81] MfNB TB 42, Bestand MM, S I, Sellow, Tagebuch 42.

[82] Alberto Castrillón and Martha Pulido, "Biopolítica y cuerpo: medicina, literatura y ética en la modernidad," *Educación y Pedagogía* 15, no. 37 (2003): 187–197.

[83] Martius, *Contendo o catalogo,* 153–162.

[84] Martius, *Contendo o catalogo*, 13.

[85] Bernadette Bensaude-Vincent et al., "Matters of Interest: The Objects of Research in Science and Technoscience," *Journal for General Philosophy of Science* 42, no. 2 (2011): 365–83.

[86] Martius, *Contendo o catalogo*, 15.

[87] Frevert, *Krankheit als politisches Problem, 1770–1880,* 123–152.

[88] Johannes Wilhelm Stintzing, *Beiträge Zur Nosologie, Pathologie und Physiologie an Asiatischer Cholera Leidender* (Altona: Aue, 1833).

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variants, namely quinine and cinchonine.[89] Specifically, the extraction of quinine enabled doctors to develop purportedly enhanced therapeutic methods for addressing epidemics. For instance, during the cholera epidemic of the 1830s, the Germans employed quinine in conjunction with other medicinal plants, such as ipecacuanha, opium, and vanilla, to stimulate what they referred to as the "vital forces" of the human body, which were believed to reside within the nervous system.[90] German physician Woldemar Nissen from Nienstädten noted that "through these means [the use of quinine as a cure and prophylactic], the normal nourishment of the nerves was promoted."[91] This approach became a widely accepted conception of the most effective anti-cholera therapeutics. Quinine garnered a reputation as "the most suitable medication for the fundamental nature of cholera," based on the clinical observations of the German physician Ludwig Wilhelm Sachs.[92] The perceived medical value of quinine stemmed from the belief that cinchona acted as an antipyretic, thereby strengthening the human body. Sachs stressed the importance of prioritizing quinine as an anti-cholera remedy to "properly invigorate, support, strengthen, and correctly guide the fluctuating and, in any case, weakened organic energies."[93] This therapeutic application represented not only a medical innovation but also a significant experiment within the German medical community, as quinine was, for the first time, associated with and used as a potential anti-cholera drug in German pharmacology. Interestingly, the seeds of a biopolitical language and conception were already present among German physicians. For these doctors, human life was dissected and compartmentalized into material living forces and organs.[94] These material forces could be potentiated and regenerated through the technical intervention of pharmacological drugs, which were chemically enhanced to stimulate the human nervous system.[95]

German healing methods were grounded in a therapeutic rationale that supported public health campaigns designed to foster and sustain "healthy" bodies through "rational" lifestyles and treatments.[96] This biologizing conception of German civilization in the early 19th century was not predicated on polygenetic racial theories – scientific notions positing that human races have distinct origins and asymmetrical racial compositions – or evolutionary concepts. Furthermore, this cultural discourse predated the holistic biological perspectives within the German scientific community of the late 19th century, which linked the bodies of Germans as a collective to environmental organisms, as noted by historian Lynn Nyhart.[97] In the early 19th century, the biologizing aspects of German civilization, prevalent among German doctors, were based on cultural tropes of "healthy" lifestyles and bodies with functional living forces or substances. The German medical discourse conceptually segregated human bodies and plants into entities with living forces subject to medical manipulation, aimed not at improving a German race, but at optimizing the organs of a German population according to bourgeois values. This mode of medical thinking translated into actual public health policies

[89] Sigmund Graf, *Die Fieberrinden in botanischer, chemischer und pharmaceutischer Beziehung* (Wien: J.G. Heubner: 1824).

[90] August Andreae, *Die Erkenntniß Und Behandlung Der Asiatischen Cholera* (Magdeburg: Creutz, 1831); For a discussion about the human nervous system as the central organ that regulated living forces in human bodies, see Johanna Bleker, *Die Naturhistorische Schule 1825–1845: Ein Beitrag Zur Geschichte Der Klinischen Medizin in Deutschland* (Stuttgart: Fischer, 1981),17–26.

[91] Ibid, p. 30.

[92] Ludwig Wilhelm Sachs, *Die Cholera: Nach Eigenen Beobachtungen in Der Epidemie Zu Königsberg Im Jahre 1831 Nosologisch Und Therapeutisch Dargestellt*. Königsberg: Borntäger, 1832, p. 301.

[93] Sachs, *Die Cholera,* 314.

[94] Jorge Linares, *Ética y mundo tecnológico* (Madrid: Tecnos, 1997); James Hughes, "Techno-Progressive Biopolitics and Human Enhancement," *in Progress in Bioethics,* ed. Jonathan Moreno and Sam Berger. 2009. MIT Press. pp. 163–188.

[95] Irene Poczka, *Die Regierung Der Gesundheit: Fragmente Einer Genealogie Liberaler Gouvernementalität*. (Bielefeld: transcript-Verlag, 2017).

[96] W. Salomon Kaufmann, *Ueber Die Indische Brechruhr in Praktisch-therapeutischer Beziehung* (Hamm: Schulz, 1831).

[97] Lynn Nyhart, *Modern Nature: The Rise of the Biological Perspective in Germany* (Chicago: University of Chicago Press, 2009).

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that upheld a biopolitical practice of human engineering, focused on producing a "healthy" bourgeois social fabric.[98] German physician L. Grüneberg recommended herbal medicines "to alleviate spasms and enhance diminished vitality [caused by cholera], focusing less on the root causes of these phenomena and more on using oxygenated and acid-astringent remedies, such as quinine and aromatic acid tinctures, to complete the treatment."[99] The cholera epidemic of the 1830s evinced how the use of quinine was integrated into a holistic treatment approach intended for a social engineering initiative: addressing poverty as a source of disease and a threat to a German bourgeois utopian ideal.[100] German physician Kaufmann observed that cholera "usually prevails only where it encounters individuals who are defenseless against it, more susceptible due to their incorrect way of living."[101] For German doctors, the use of quinine as a "rational" remedy and prophylactic complemented public sanitation campaigns. These efforts were focused on improving cleanliness in the homes of the poor, promoting the consumption of "rational" food, and encouraging a lifestyle of "moral" restraint. For example, it was essential to ensure the circulation of fresh air in households, avoid spoiled food, maintain only marital sexual relations, and prevent the accumulation of stagnant water near homes – practices symbolizing a more "refined" way of living.[102] Such individual measures were believed to maximize the effectiveness of quinine in treating diseases. By addressing poverty, it was thought that diseases would have fewer vectors of transmission, thereby protecting entire populations.

These cultural values aligned with the bourgeois moral order of the early 19th century, which characterized the social class of German bureaucrats and reformers, including physicians and apothecaries. According to historian Thomas Nipperdey, this class cultivated a utopian vision as architects of a modern German society and state in the post-Napoleonic era: "Man is more than a means, a cog in a machine; he is also an end in himself, autonomous, capable of self-determination, and self-active [...] The reform towards autonomy and responsibility, towards a new human, towards 'rebirth,' and towards the 'ennoblement of humanity'."[103] The anti-cholera function of quinine was part of the development of a new medical imagination that framed health as a social hygiene issue requiring biopolitical management and regulation of human bodies for the collective good.[104] The post-Napoleonic anti-cholera campaigns, which validated quinine as an effective prophylactic, transformed this "ennoblement of humanity" into tangible public health initiatives directed towards regulating human behavior.

The biopolitical function of quinine extended beyond German public health programs and sanitation initiatives. These social engineering practices were made possible by German apothecaries who sourced biological material from various regions to extract, validate, and authenticate the curative properties of different cinchona types, such as Brazilian *solanum pseudoquina*, *china suriname*, Peruvian *china fusca*, and Jamaican *china caribbaea*.[105] The chemical comparison of these cinchona specimens allowed German apothecaries – primary institutions for chemical experimentation and pharmacological production in the German

[98] Harless, Johann Christian Friedrich Harless und Friedr, *Die Indische Cholera nach Allen Ihren Beziehungen: geschichtlich, pathologisch-diagnostisch, therapeutisch und als Gegenstand Der Staats- und Sanitäts-Polizei dargestellt* (Braunschweig: Vieweg, 1831).

[99] L. Grünberg, *Theorie Der Orientalischen Cholera oder Versuchte Beantwortung der von Der Russischen Regierung aufgegebenen Frage über Diese Krankheit* (Berlin [u.a.]: Reimer, 1836), p. 278–279.

[100] To study the medicalization of poverty, see Frevert, *Krankheit als politisches Problem, 1770–1880,* 25–60.

[101] W. Salomon Kaufmann, *Ueber die Indische Brechruhr in Praktisch-therapeutischer Beziehung* (Hamm: Schulz, 1831), 2.

[102] Harless, Johann Christian Friedrich Harless und Friedr, *Die Indische Cholera nach allen ihren Beziehungen: geschichtlich, pathologisch-diagnostisch, therapeutisch und als Gegenstand der Staats- und Sanitäts-Polizei dargestellt* (Braunschweig: Vieweg, 1831).

[103] Nipperdey, *Deutsche Geschichte 1800–1866.*

[104] Jorge Castillo-Sepúlveda, "Sobre la producción de certidumbre en salud pública: biopolítica y objetos especulativos," *Saúde e Sociedade* 31, no. 1 (2022).

[105] Sigismund Friedrich Hermbstädt, *Grundriss der theoretischen und experimentellen Pharmacie zum gebrauch bey vorlesungen, Zweiter Theil* (Berlin: Heinrich August Rottmann, 1808).

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territories – to identify the Peruvian and Ecuadorian specimens with the highest levels of quinine.[106] The chemical decomposition of cinchona plants into their alkaloid forms required a method of comparative analysis, a standard practice in early 19th-century chemistry. In this method, the same organic specimens were decomposed with chemical acids to obtain the purest forms of antipyretic substances. Subsequently, the alkaloids obtained from each cinchona specimen – from Brazil, Peru, Ecuador, and the Caribbean – were to be compared with the purpose of determining which cinchona genus exhibited greater antifebrile potency. Consequently, German apothecaries developed extensive networks with German scientific expeditions in Latin America. For instance, the Hamburg-based pharmacist, Heinrich von Bergen, obtained various types of cinchona from Brazil through his connections with German scientists. In his pharmacological treatises, Bergen detailed his efforts to acquire fresh bark and flowering specimens of different cinchona varieties: "With each expedition departing directly from here to South America, I have thoroughly informed the respective cargo owners of my desires, provided them with detailed instructions, and offered means for obtaining the specimens through exchange if necessary."[107] Although it is difficult to pinpoint all the scientists with whom he collaborated, it is clear that he worked with multiple individuals, including Karl von Martius. These transnational scientific networks linked German apothecaries, sites of organic life technification into useful pharmacological tools, with other spaces of biopolitical practice, including the experimentation of German explorers with Brazil's local population.

Biopolitical Experiments in Brazil

The interaction between German scientists and Brazilian cinchona specimens comprised not only the extraction of local knowledge but also experimentation with local populations, including enslaved individuals. In his investigations into the causes of diseases in Brazil, Langsdorff noted that "almost nobody escapes from malignant intermittent fever."[108] While formulating a pharmaceutical remedy, Langsdorff observed that "the few occurrences of this disease (cold fever) still belong to the last rainy season."[109] Attuned to nosological theories about water as vectors of disease, Langsdorff frequently advocated for cinchona-based remedies to combat fever, "such as in the case of a child aged one and fourteen months who, six months ago, contracted it from its wet nurse. I prescribed a cinchona infusion for the wet nurse; for the child, cinchona with milk."[110] This typically included the use of salt ammoniac. Wet nurses, who were often enslaved women responsible for breastfeeding the children of their masters, were among those subjected to medical interventions.[111] Langsdorff's reports did not provide specific details about the origin or social status of this specific wet nurse; however, his language reflects the local racial categories of Brazilian society. In Brazil, "wet nurses" were identified as enslaved individuals.[112] In addition, Langsdorff's provision of medical assistance to this wet nurse may be considered an altruistic act, as he "could not help it providing medical assistance to some ill people."[113] While this point is not disputed, it is evident that he employed enslaved bodies for medical

[106] Sigmund Graf, *Die Fieberrinden in botanischer, chemischer und pharmaceutischer Beziehung* (Wien: J.G. Heubner: 1824).
[107] Bergen, *Monographie der China,* XI.
[108] Silva, *Os diarios de Langsdorff Vol. 3*, 145.
[109] Silva, *Os diarios de Langsdorff Vol. 3*, 150.
[110] Silva, *Os diarios de Langsdorff Vol. 3*, 150.
[111] Robson Silva, A presença das amas-de-leite na amamentação das crianças brancas na cidade de São Paulo no século XIX," *Antítesis* 9, no. 17 (2016): 297–322; Karoline Carulla, "Perigrosas amas de leite: aleitamiento materno, ciência e escravidão," *História, Ciências, Saúde-Manguinhos,* 19 (2022): 197–214.
[112] Silva, "A presença das amas-de-leite," 197–214.
[113] Silva, *Os diarios de Langsdorff Vol. 3*, 139; Ângela Pôrto, "O sistema de saúde do escravo no Brasil do século XIX: doenças, instituições terapêuticas," *História, Ciências, Saúde-Manguinhos* 13, no. 4 (2006): 1019–1027; Iamara da Silva Viana, "Corpo esclavizado e discurso médico: para além da anatomia (1830–1850)," *Revista de História Comparada* 12, no. 1 (2012): 172–202.

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experimentation. This underscores a normalized connection between enslavement and scientific practice in the German pharmaceutical context. It is also important to demonstrate that enslaved people were not the only members of Brazilian society subjected to therapeutic experimentation with cinchona drugs. During his visit to Vila Diamantino, Langsdorff administered, for instance, cinchona decoctions to a "woman of middle age who suffered an attack of fever with shivers and completely lost her consciousness and voice."[114]

Langsdorff investigated the potential causal relationship between unsanitary water deposits and fever-related diseases. He concluded from the reiteration of experiments that, in cases of fever, "its onset and cause may reflect nature's attempt to restore balance between illness and health."[115] In other words, he recognized the possibility of fever as a symptom rather than a direct cause of disease. Langsdorff's expedition thus served multiple purposes: extracting biological materials, developing new therapeutic methods, and providing explanations for diseases encountered in both Brazilian and German contexts. The generation of medical knowledge through empirical observation extended beyond geographic and laboratory boundaries. Understanding the origins of diseases and developing effective treatments became central to German medical experimentation in Brazil. This process involved not only the use of local plants but also the testing of European theories about water as a disease vector on Brazilian human subjects.[116] The notion of stagnant, polluted water as a source of disease deeply influenced early 19th-century German pathology and continued to shape explanations of cholera in the 1830s.

Langsdorff's experimentation with local populations in Brazil foreshadowed the public health biopolitical practices that would emerge during the cholera epidemic of the 1830s in the German territories. In his investigations, particularly in Vila Diamantino, "a region deemed highly insalubrious," Langsdorff tested various Brazilian cinchona types.[117] His medical observations often reiterated European theories about disease, emphasizing the role of hygienic conditions and individual behavior. He noted: "add to all this [the abundance of swampy and putrid water] the predisposition to diseases in weakened, debilitated, emaciated, jaundiced bodies, victims of the dissolute lives they lead and the excesses they commit: they play cards day and night, eat and drink without moderation."[118] For this reason, cinchona drugs were widely administered to individuals in Vila Diamantino suffering from fever, including Joaquim Gomes Bezerra, a neighbor of the previously mentioned enslaved wet nurse. Specific details about Bezerra's condition and background remain scarce.

Langsdorff's anti-fever campaign using Brazilian cinchona specimens reflected a reductionist view of human life, treating it as composed of material bodies and living substances. Langsdorff's therapeutic strategies in Vila Diamantino exemplified early attempts to address the social conditions that exacerbated the health of debilitated individuals. Thus, the village's lifestyle and socioeconomic factors became central to medical scrutiny and intervention. Langsdorff's emphasis on the biological and social conditions of the population led to the creation of analytical categories such as "emaciated organisms,"[119] which reduced human life and its psyche to material substances, organs and physical forces.[120] These medical frameworks formed the theoretical backdrop against which Brazilian cinchona plants were tested and validated as invigorating tonics. In this technified approach to organic

[114] Silva, *Os diarios de Langsdorff Vol. 3*, 169.
[115] Silva, *Os diarios de Langsdorff Vol. 3*, 151.
[116] Silva, *Os diarios de Langsdorff Vol. 3*, 145–160.
[117] Silva, *Os diarios de Langsdorff Vol. 3*, 145.
[118] Silva, *Os diarios de Langsdorff Vol. 3*, 147.
[119] Silva, *Os diarios de Langsdorff Vol. 3*, 185.
[120] For a philosophical discussion on how human and non-human lives are technified, see Bensaude-Vincent et al., "Matters of Interest," 365–83. For a contemporary discussion about human health as a holistic condition between the body parts and the psyche, see Christian Schubet, *Was uns krank macht–Was uns heilt: aufbruch in eine neue Medizin* (Germany: Fischer & Verlag: 2024).

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life, Brazilian cinchona drugs were incorporated into a scientific discourse that aligned with broader practices of biopolitical management and regulation of human bodies.

Beyond generating pure chemical knowledge, Langsdorff's pharmacological experiments also elucidated the scope and limitations of cinchona specimens as a therapeutic technology for diseases perceived to have social causality. Brazilian cinchona plants were not merely tools detached from their social context; they were conceptualized and tested as tonics or stimulants for human vitality within German pharmacological practices.[121] In his studies, Langsdorff demonstrated that *solanum pseudoquina*, collected from "the thickets [that] contain guavas [...] bauhinia, solanum, eupatorium," was effective against fever due to its systematic use throughout his expedition.[122] Langsdorff evaluated German "modern" therapeutic techniques and theories of morbidity and disease etiology by employing *solanum pseudoquina* in human bodies. These German medical theories often framed diseases as endemic to specific regions, such as the so-called "malignant fever."[123] This perspective objectified Brazil as a land predisposed to various fevers due to conditions of poverty and "torrid" weather.[124] Such medical thought was reflective of a broader trend in European medical discourses. Langsdorff's experiments with cinchona specimens must be understood within this cultural imaginary. He posited that environmental factors, such as poor ventilation and stagnant air, contributed to the spread of disease: "Due to the lack of ventilation and fresh air, air currents form, producing mephitic vapors, which render not only the vicinity of the springs but also the entire surrounding region unhealthy."[125] Additionally, Langsdorff wrote that "my research and observations," which employed cinchona against fever diseases, proved that "the consumption of stagnant pond water is the main cause of intermittent fever."[126] Reservoirs of polluted water were believed to breed, especially, fever-related diseases.

For German medical thought, all fever diseases belonged to a common family of pathologies. It is no wonder that the cholera of the 1830s, identified as an Asian disease, was associated with the same genealogy of fever diseases from Brazil. "On this second line of magnetic indifference [East Brazil], or at least near it, is the source of yellow fever, the American counterpart of the Asian plague [cholera]."[127] It is not implausible to believe, given his transnational networks and communication with other German scientists, that Langsdorff was one among many German physicians who, with his medical observations in Brazil, contributed to the pathologization of Brazil as a wellspring of fever diseases. To understand Langsdorff's medical experiments, they must be viewed as transnational and decentralized biopolitical practices. His experiments with Brazilian cinchona varieties in the 1820s represented one facet of the biopolitical manipulation of human bodies.

Managing the behavior and bodies of the poor in the German territories in the 1830s stemmed from prior experimentation with various cinchona plants. This activity ranged from chemical procedures in German apothecaries to improvised antifebrile treatments in Brazilian enclaves of poverty, such as Vila Diamantino. The latter offered opportunities to determine the medical value of Brazilian cinchona types: their power to enliven weakened human bodies in conditions of pauperism. In other words, Langsdorff recombined and

[121] Langsdorff tended to chemically experiment with and test the curative properties of Brazilian plants to use them as pharmacological drugs in his medical treatments and investigations in Brazil. A case in point was the discovery of a plant named cainca or raiz preta. See Iberoamerikanisches Institut (PK IAI), Nachlass Langsdorff VIII, Mikrofilm von Langsdorff in der wissenschaftlichen Korrespondenz der akademischen Konferenz.

[122] Silva, *Os diarios de Langsdorff Vol. 1*, 66.

[123] Nancy Leys Stepan, *Picturing Tropical Nature* (Ithaca, NY: Cornell University Press, 2001).

[124] Mark Harrison, *Medicine in an Age of Commerce and Empire: Britain and Its Tropical Colonies, 1660–1830* (Oxford: Oxford University Press, 2010).

[125] Silva, *Os diarios de Langsdorff Vol. 3*, 146.

[126] Silva, *Os diarios de Langsdorff Vol. 3*, 168.

[127] C.F. Kleinert, *Cholera orientalis: Extrablatt zum allgemeinen Repertorium der gesammten deutschen medizinisch-chirurgischen Journalistik* (Leipzig: Christian Ernst Kollmann, 1831), 363.

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merged plant and human species to chart how the so-called fever diseases could be theorized about, controlled, and repelled. Vila Diamantino became a living laboratory where diseases and human organisms were intermingled. This pauperized town provided human substrata to probe the breeding, development, and behavior of fever maladies. "I will try," Langsdorff asserted, "to investigate the causes of this [malignant] fever and diseases during my stay here."[128] This biological experimental material – human bodies in fever-ridden social and climatic conditions – also enabled the testing of the antifebrile effects of the Brazilian cinchona family. Thus, experimentations in Brazil enriched the pharmacological inventories of German apothecaries, private institutions regulated by state bureaucracies, such as the *Ministerium der geistlichen, Unterrichts, und Medizinal-Angelegenheiten in Prussia*.[129] These apothecaries primarily marketed tinctures and decoctions based on Peruvian and Ecuadorian cinchona types. But the use of Brazilian and Caribbean specimens was not uncommon. They frequently appeared under the label *china nova*.[130] This linkage demonstrates how an early form of pharmacological capitalism in the German territories was informed by and tacitly abetted German scientific expeditions in Brazil.

Settlement Plantations as Sites of Pharmacological Activity

In the German territories, pharmacological expertise was cultivated, reinvented, and tested within a dynamic nexus that intertwined chemical practices, mobile laboratory spaces, and mercantile interests. German apothecaries served as crucial sites for both the industrial production of therapeutic substances and the experimentation with new compounds. This ecosystem of scientific ideas relied heavily on organic matter, often necessitating the exploitation of resources from the Atlantic world. This region provided fertile ground for exploratory endeavors, offering a rich array of botanical specimens and natural resources that were of interest to the pharmaceutical industry. Nevertheless, the exploration and exploitation of natural resources occurred within a broader context marked by enslavement and the exchange of knowledge between different cultures. This extraction of botanical material was not simply a matter of scientific inquiry or industrial production but rather a multifaceted enterprise that intersected with economic, social, and ethical considerations.

The case of Nova Friburgo, founded by a Brazilian elite of enslavers and Swiss colonists in 1818, serves as a poignant example of how Central European colonial ventures in Brazil were intertwined with the institution of enslavement within a capitalist liberal economic system.[131] Founded through a collaboration between Portuguese slavers and Swiss colonists, Nova Friburgo epitomized a blend of civilizational ideology and economic exploitation.[132]

[128] Silva, *Os diarios de Langsdorff Vol. 3*, 145.

[129] For a discussion on the relationship between the German states and private initiatives in the field of pharmacology, see Wolfgang Engels, *Zur Geschichte des Verstaatlichungsgedankens im deutschen Apothekenwesen* (Stuttgart: Deutscher Apotheker Verlag, 1984); GStA PK, I. HA Rep. 76 Kultusministerium VIII A Nr. 1895. Die Verfassung der Apotheken und Anlegungen neuer Apotheken in Pommern 1830–1834; GStA PK, I. HA Rep. 76 Kultusministerium VIII A Nr. 1990. Die Verfassung der Apotheken dergl. Die Apotheken Gerechtigkeiten u. Anlegung neuer Apotheken in Bromberg, 1827–1830.

[130] I. HA 76 Kultusministerium, Sekt. 2, Tit. 23 LITT. A, Nr. 5 Bd. 1.

[131] Thomas David et al., *Schwarze Geschäfte: Die Beteiligung von Schweizern an Sklaverei und Sklavenhandel im 18. und 19. Jahrhundert.* (Switzerland: Limmat, 2005). The concept of 'second slavery' serves as an analytical category that explains how the 19th century saw the development of a liberal capitalist system which, rather than oppositional, became increasingly reliant on the reconfiguration and expansion of the slave trade. This occurred even as Britain pursued the emancipation of enslaved people in its colonies. Within this capitalist framework, a new production regime, focused on commodities such as cotton, coffee, and sugar, transformed the American South, Cuba, and Brazil into epicenters of slavery-based production. These regions depended extensively on large-scale enslaved labor to fulfill global demands for raw materials. See Dale Tomich, "The Second Slavery and World Capitalism: A Perspective for Historical Inquiry," *International Review of Social History* 63, no. 3 (2018): 477–501; Dale Tomich, *Through the Prism of Slavery: Labor, Capital, and World Economy* (Lanham: Rowman & Littlefield, 2004).

[132] Giralda Seyferth, "The Slave Plantation and Foreign Colonization in Imperial Brazil," *Review - Fernand Braudel Center for the Study of Economies, Historical Systems, and Civilizations* 34, no. 4 (2011): 339–87.

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While the Swiss-German immigrants may have been driven by ideas of cultural modernization and work ethics, their success in coffee agriculture relied intensely on the labor of enslaved individuals.[133] The bureaucratic administration of Nova Friburgo during the 1820s was dominated by Brazilian-Portuguese elites who, as Brazilian historian Emília Viotti da Costa explains, were primarily invested in the perpetuation of enslaved labor for economic gain.[134] This convergence of interests between local elites and immigrant settlers facilitated the proliferation of enslaved labor in the colony, mirroring the production practices of other European colonial powers.[135]

The establishment of a medical system with a hospital and an apothecary within the Nova Friburgo settlement colony exemplifies how healthcare infrastructure was integrated into the colonial project. The financing of medical drugs by the Brazilian government underscores the significance of healthcare provision within the colony. In correspondence with the Portuguese imperial government, José F. de Castilho, Portuguese manager of the colony, stated: "these medicines are already for the ordinary pharmacy of the colony, which Mr. José Caetano Sequizer will be supplying, receiving the money as promptly as ever."[136] The involvement of Swiss-German pharmacists, particularly Böhle and Boélé, in managing the apothecary underscores the Swiss-German influence on medical practices within the Nova Friburgo settlement. The inclusion of *cortex chinae* and *extractum chinae*, commonly known as cinchona bark and cinchona extract, in the colony's pharmacological inventory highlights their adoption as standard medications.[137] Although the specific pharmacological origins of these drugs within the Swiss-German context are not explicitly detailed, the professional backgrounds of the apothecaries and doctors suggests a strong European intellectual influence. In other words, European production of cinchona medications was a significant component of the everyday medical practices in Nova Friburgo.[138]

The widespread use of cinchona preparations among Swiss-German colonists in Brazil illustrates a deeply entrenched pharmacological culture oriented towards the artificial enhancement of organic life, indirectly linked to the capitalist system of enslavement. Nova Friburgo, with its focus on coffee trade, epitomized one of the economic frontiers that revitalized trans-Atlantic slave-based production in the 19th century, similar to the cotton system in the American South and sugar plantations in Cuba.[139] The integration of cinchona preparations into daily medical practices within the colony foregrounds the entanglements of European scientific knowledge with colonial ventures, showcasing how European pharmacological advancements became woven into the fabric of colonial economic systems. This linkage further connected Central Europe with the Atlantic world through the dissemination of medical practices that upheld the integrity of the colony, thereby contributing to the expansion of the liberal capitalist system.

[133] Rodrigo Marins, "A Escravidão velada: a formação de Nova Friburgo na primeria metade do século XIX" (PhD Diss., Universal Federal Fluminense, 2014).

[134] Emilia Viotti, *The Brazilian Empire: Myths & Histories* (Chapel Hill, N.C: University of North Carolina Press), 2000; Leslie Bethell, *The Abolition of the Brazilian Slave Trade: Britain, Brazil and the Slave Trade Question, 1807–1869* (Cambridge, Eng: University Press, 1970).

[135] Viotti, *The Brazilian Empire,* 94–150; Leslie Bethell, *Brazil: Essays on History and Politics* (London: Institute of Latin American Studies, School of Advanced Study, University of London, 2018).

[136] BN, Ofícios, ordens e outros documentos relativos a colônia suiça de Nova Friburgo. Nova Friburgo: [s.n.], 1818–1820. Carta de Jozé F. de Castillo a José Caetano Marques, abril 1820, 157.

[137] BN, Ofícios, ordens [Relações em Cássia dos Medicamentos que a Boticaria da Colônia, April 1820].

[138] GStA PK, I. HA Rep. 76 Kultusministerium, VIII A, No. 1712. Die Anordnungen und Festsetzung wegen Einrichtung der Apotheken, 1822–1823; GStA PK, I. HA Rep. 76 Kultusministerium, VIII A, No. 1712. Die Entwerfung und den Abdruck der Pharmacopoea Borussica, 1828–1840; GStA PK, I. HA Rep. 76 Kultusministerium, Generalia, Vol. I und II, No. 31. Die Apotheken, 1801; Justus Arnemann, *Praktische Arzneimittellehre* (Göttingen: Vandenhoek und Ruprechtschen Verlage, 1795); Geheimen Rath Cothenius, *Chemische Untersuchung der rothen Chinarinde* (Berlin und Stralsund: Gottlieb August Lange, 1783); Johann Rahn, *Briefwechsel mit seinen ehemaligen Schülern* (Zürich: Ziegler und Söhne, 1787).

[139] Tomich, *Through the Prism of Slavery.*

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The possibility of Langsdorff acquiring cinchona decoctions at Boélé's apothecary in Nova Friburgo is plausible, although there is no direct evidence to confirm this connection. In the early 1820s, Langsdorff, "after organizing the notes and materials brought from [...] Nova Friburgo [...] embarked on a larger journey to the Province of Minas Gerais."[140] Langsdorff's exploration in Nova Friburgo and the surrounding areas, as well as his subsequent trip to the Province of Minas Gerais, involved a series of stopovers where botanical specimens were collected and prepared for dispatch to Russia. In these locations, plants were sorted into small boxes after a period of acclimatization.[141] It is plausible that Langsdorff could have acquired pharmacological supplies, including cinchona preparations, for use during his voyage to Nova Friburgo. The fact that Langsdorff utilized chemical preparations of cinchona suggests a broader trend of itinerant pharmacological activity during this period. Although there is no concrete evidence directly linking Langsdorff to Boélé's apothecary, the commercial enterprise of supplying pharmacological goods in colonial settlements such as Nova Friburgo may have supported Langsdorff's explorations and the wider patterns of colonial trade.

Integral to German expeditions were the diverse botanical species that thrived around German settlement colonies. Langsdorff's establishment of the Mandioca plantation in 1816 illustrates the tangible manifestation of German colonial aspirations in Brazil during the early 19th century. This plantation, involved in the cultivation of yucca, coffee, and corn, served as a focal point for agricultural production and European exploration efforts. Situated on the outskirts of the mountainous region of Serra d'Estrella in Rio de Janeiro, Mandioca provided shelter and support to European visitors and explorers amidst the challenging Brazilian landscape. The establishment of plantations in Mandioca represented a private colonizing project that intertwined with German territorial expansion and cultural aspirations.[142] These endeavors were not merely fictional or discursive, as argued by Zantop, but constituted tangible efforts to assert German presence and influence in the Brazilian hinterlands.[143] During his visit to Langsdorff's estate, Georg Anton Schäffer, a German recruiter of migrants from Bremen and Hamburg, acknowledged that "the estate of the state councillor Langsdorff [...] has clearly demonstrated what German agriculture can achieve in Brazil. With twenty slaves, a well-ordered agricultural enterprise has been established here, which not only produces all of its own needs but also abundant field and garden crops."[144] In the pre-unification era, these plantations in agricultural settlements symbolized the materialization of German colonial aspirations for modernization, which had permeated the German cultural milieu since the 17th century.[145] In addition, Friedrich von Weech, a German explorer, remarked that "*Herr* von Langsdorff intended to manage his *fazenda* [farm or plantation] according to rational principles."[146] Despite his cosmopolitan background and scientific pursuits, Langsdorff was deeply committed to transforming Mandioca into a larger German colony with German immigrants, demonstrating his desire to establish a distinctly German cultural presence in Brazil.[147] Yet, Langsdorff's commitment

[140] Silva, *Os diarios de Langsdorff Vol. 1*, 361.

[141] BN, Ludwig Riedel, Relação de árvores e plantas do Brasil.

[142] Yuko Miki, *Frontiers of Citizenship: A Black and Indigenous History of Postcolonial Brazil* (Cambridge, United Kingdom: Cambridge University Press, 2018).

[143] See Zantop, *Conquest, Family, and Nation in Precolonial Germany, 1770–1870* (Durham, N.C: Duke University Press, 1997), 10–48.

[144] Ritter von Schäffer, *Brasilien als unabhängiges Reich, in historischer, mercantilischer und politischer Beziehung* (Altona: J.F. Hammerich, 1824), 30.

[145] Conrad, *Globalisierung und Nation*, 294–295.

[146] Friedrich von Weech, *Reise über England und Portugal nach Brasilien und den Vereinigten Staaten des La-Plata-Stromes während den Jahren 1823 bis 1827, Zweiter Theil* (Munich: Fr. Auer, 1831), 144.

[147] David Blackbourn, *Germany in the World: A Global History, 1500–2000* (New York, NY: Liveright Publishing Corporation), 2023; Weech, *Reise über England,* 140–155.

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to modernization compelled him to acquire enslaved individuals, who lacked legal subjecthood, for the purposes of tilling and harvesting the land.[148]

Not only did Mandioca provide opportunities for the cultivation of plants with an agricultural objective, but it also became a site for collecting cinchona specimens. Langsdorff hoped that "this paradisiacal land will become increasingly known and visited by more Europeans with a scientific and entrepreneurial spirit," who will give a new impetus to the improvement of native and foreign plants and fruits."[149] Two antifebrile cinchonas, known as *quina do mato* and *quina do Piauhy*, whose cinchona identity was in dispute, were collected by both Martius and Riedel in the vicinity of Mandioca, although not simultaneously.[150] In a leaflet about the practical usage of Brazilian flora for medicine in 1829, Martius emphasized that "the vegetable substances are undoubtedly the most interesting, and these are required not only in their raw state but also in a few carefully collected specimens with some art, in order to be recognized and scientifically analyzed."[151] In the case of Mandioca, Martius found an enclave to conduct the examination of cinchona plants for subsequent chemical transformation.

Similarly, between 1820 and 1830, Riedel chronicled encounters with various cinchona specimens near Mandioca. Specifically, Riedel documented the presence of *quina do mato* and *quina do Piauhy* as "bitter, mucilaginous" barks, taxonomically identifying them as *exostema cuspidatum*.[152] While Riedel's lists do not contain detailed commentaries on the specific methods of his chemical preparations using Brazilian cinchonas, his annotations suggest that he experimented with various types of cinchona and local plants to produce decoctions, infusions, and powders for medicinal purposes. "The common diseases are [...] diarrhea, hemorrhoids, corruption [malignant fever]. In cases of bad or putrid fever, which you recognize by a dry and rough tongue, you can administer an emetic made from Ipecacuanha [...] As a drink, a concoction of the root of Aristolochia (mil homens), (cordo santo) here *Argemone mexicana*. The root of *Cassia foetida* (Fedagosa), the root of *Dorstenia* (Carrapia Casopia); Cinchona, the root of *Elephantopus* (sossoya), and ⅛ of the oriental stone, these are boiled together."[153] Through his experimentation, Riedel sought to understand the therapeutic properties of these botanical specimens and their effectiveness in treating diseases. This practical approach to botanical exploration elucidates the connection of scientific inquiry and medical activity in Riedel's work, illustrating a hands-on methodology for understanding the pharmacological potential of plants native to the Brazilian landscape. Riedel's aggregation of botanical specimens into antifebrile medicine utilizing cinchona bark was reflective of a European chemical method of combining various organic compounds to enhance the curative properties of plant materials.[154] Yet, this practical engagement with Brazilian cinchona bark became possible largely due to German plantations, which served as enclaves of scientific activity within a milieu of normalized enslavement.

Riedel's pharmacological activities spotlighted the flexible and adaptable nature of cinchona as a botanical category in German pharmacology, in which different types of cinchona bark could be used interchangeably. For instance, *quina do Rio de Janeiro* was deemed "effective in decoction."[155] Riedel's use of cinchona in pharmacological decoctions underscored this versatility, as he likely employed any available type of cinchona bark – *quina do mato*, *quina mineira*, *quina de Piauhy*, or *quina de S. Paulo* – that was available and

[148] Viotti, The Brazilian Empire, 94–150; Miki, *Frontiers of Citizenship.*

[149] PK IAI, Nachlass Langsdorff I. Brief an einen Freund in Teutschland, Heinrich Langsdorff.

[150] BSBM, Martusiana II A 1. Advertencia, aos Curiosos do paiz, 1829; Waldemar Peckolt, "Contribuição ao estudo de falsas quinas."

[151] BSBM, Martusiana II A 1. Advertencia, aos Curiosos do paiz, 1829.

[152] BN, Ludwig Riedel, Relação de árvores e plantas do Brasil.

[153] PK IAI, Nachlass Langsdorff XI.Apotamentos sobre botanica, 1827–1832.

[154] Bergen, *Versuch einer Monographie der China,* 1826.

[155] BN, Ludwig Riedel, Relação de árvores e plantas do Brasil.

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deemed suitable for the treatment of febrile diseases.[156] Cinchona thus emerged as a malleable and adaptable pharmacological plant within the context of "fever" diseases and antipyretic properties. German pharmacological and botanical activities emerged from an imperial yet hybrid pharmacological culture, characterized by geographical mobility and experimentation with varying cinchona preparations. Riedel was among several German scientists who utilized indigenous knowledge to enhance the therapeutic efficacy of cinchona plants. The medicinal use of *dorstenia* and *aristolochia*, known as *mil homens*, was a pharmacological practice among Brazilian indigenous people for antifebrile purposes, as documented by Martius and Langsdorff.[157] Riedel likely became familiar with the indigenous use of these plants as supplementary medicinal herbs in antifebrile decoctions through correspondence with Martius and Langsdorff or his own ethnographic research. Riedel's inclination to utilize indigenous medicinal knowledge related to cinchona corresponded to the larger German medical thought, which recognized the scientific value of Brazilian local traditional knowledge.[158]

In these German agricultural settlements, the pharmacological production of cinchona-based drugs was also linked to utopian projects of German civilization in Brazil, which involved biopolitical practices. The partitioning and commercialization of agricultural land for German immigrants were formalized by an imperial immigration decree in Brazil in 1808, described as "a means of spreading European civilization in the tropics."[159] The enforcement of this sanction remained effective even after Brazil's transition from a Portuguese colony to the formation of the Brazilian Empire in 1822.[160] This decree encouraged the influx of European immigrants with the goal of "whitening" the Brazilian racial composition. This civilizing project necessitated the establishment of medical infrastructure, including apothecaries, as a critical component of medical modernization, aligning with both German medical thought and Brazil's public health policies.[161] Influenced by European pharmacopeias and the Rio de Janeiro Medical Society, the municipal administration of Nova Friburgo implemented a regime of pharmacological drugs as part of a "modern" medical approach.[162] The use of these drugs, along with the establishment of agricultural plantations and a housing system, was intended to support German colonies and, ultimately, to improve the Brazilian "race" through the arrival of white European immigrants. These immigrants would occupy uninhabited lands and extend "white" civilization with their perceived "industrious" and "diligent" qualities, regarded as attributes of a superior culture.[163] This racial discourse, endorsed by the Brazilian royal state during the founding of Nova Friburgo and Mandioca, was representative of a biopolitical intervention designed for the racial

[156] Waldemar Peckolt, "Contribuição ao estudo de falsas quinas," 1916.

[157] Martius, *Das Naturell*, 150–170; Silva, *Os diarios de Langsdorff Vol. 1,*

[158] Martius, *Das Naturell,* 167.

[159] Rodrigo Marins Marretto, "A escravidão velada: a formação de Nova Friburgo na primeira metade do século XIX" (PhD Diss., Universidad Federal Fluminense, 2014), 3.

[160] Yuko Miki, *Frontiers of Citizenship: A Black and Indigenous History of Postcolonial Brazil* (Cambridge, United Kingdom: Cambridge University Press, 2018).

[161] Betânia Gonçalves Figueiredo, *A arte de curar: cirurgiões, médicos, boticários e curandeiros no século XIX em Minas Gerais* (Rio de Janeiro: vício de Leitura, 2002); Frevert, *Krankheit als politisches Problem, 1770–1880,* 25–60.

[162] BN, Ofícios, ordens e outros documentos relativos a colônia suiça de Nova Friburgo. Nova Friburgo: [s.n.], 1818–1820. Carta da João Joze da Motta from Monsenhor Miranda on January 8, 1821, 645. For more discussion about the influence of European medical thought and its paradigm about diseases as product of climatic conditions through the Society for Medicine of Rio de Janeiro, see Douglas de Araújo Ramos Braga, "A Institucionalização da medicina no Brasil Imperial: uma discussão historiográfica." *Temporalidades-Revista de História,* 10, no. 1, (2018): 64–82.

[163] Eduardo Relly, "Imigração alemã ao Brasil (século XIX) e Prússia: fronteiras permeáveis e diálogos entre história global e micro-história," *História Unisinos* 20, no. 3, (2016): 273–286; Sales Augusto dos Santos, "Historical Roots of the 'whitening' of Brazil," *Latin American Perspectives,* 29, no. 1, (2002): 61–82; Eugene S. Cassidy, "Germanness, Civilization, and Slavery: Southern Brazil as German Colonial Space (1819-1888)" (PhD Diss., University of Michigan at Ann Harbor, 2015). For further discussion on the racial discourses in the Brazilian state, see Giralda Seyferth, "Colonização, imigração e a questão racial no Brasil," *Revista USP,* no. 53 (2002): 117–149.

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reengineering of the Brazilian population through miscegenation or by replacing the black race with the free labor of the white "race."[164] The attempt to transform the racial composition of entire populations to produce a supposedly superior human species was not uncommon in certain imperial contexts, such as the French Empire. As early as the late 18th century, bureaucrats with scientific backgrounds, serving in the colonial administration of Saint-Domingue, enacted laws aimed at promoting interracial marriages with the objective of "improving" the black race with the white European "blood." The goal was to create genotypes deemed more suitable for military purposes and the protection of the island.[165] Biopolitical discourses involving biological intervention in human populations for the purposes of state-building were already widespread across various polities.

This Brazilian racial ideology, commensurate with a German imperial vision, promoted the expansion and preservation of German cultural values of "work diligence" and "thriftiness" in Brazil.[166] Its vision was more geared towards the transformation of Brazil's land through German "ingenuity" and labor.[167] In this context, "medicine would become a technique of knowledge/power, serving both as a 'scientific seizure on biological and organic processes' and a 'political technique of intervention'."[168] German scientific expeditions became sites for the enhancement and technification of organic life. This scientific activity was infused with a German and Brazilian medical utopian imagination that fueled a biopolitical transformation of both German and Brazilian populations. Cinchona-based remedies were designed to strengthen, cure, and protect German bodies as part of the effort to build "civilized" societies. In this context, cinchona decoctions acquired cultural significance as a medical instrument of civilization. As a pharmacological technology, cinchona served to advance interconnected projects of biopolitical modernization and control over human bodies in both Brazil and Germany.[169]

Conclusion

The intersection of cinchona with German pharmaceutical imperialism in the early 19th century extends beyond a simple narrative of imperial control over raw materials in peripheral regions for the advancement of German apothecaries in the metropole. Such categorical distinctions are inadequate to describe a form of imperialism that was dynamic and manifested in fragmented ways. The production of German pharmaceutical knowledge did not merely oppose traditional therapeutic practices; instead, these practices were viewed as valuable repositories of medical expertise. German scientific knowledge involved the appropriation, decontextualization, and reformulation of local ethnobotany, driven by scientific improvisation, serendipity, and multicultural encounters. For German explorers in Brazil, scientific expeditions not only facilitated the collection of botanical materials for the pharmaceutical industry but also enabled the reinvention of cinchona as an artificially enhanced

[164] Maria Guimarães, *Civilizando as Artes de Curar: Chernoviz e os manuais de medicina popular do Império* (Rio de Janeiro: Fundação Oswaldo Cruz, 2016); Martin Nicoulin, *A gênese de Nova Friburgo: emigração e colonização suíça no Brasil: 1817–1827* (Rio de Janeiro: Fundação Biblioteca Nacional, 1995).

[165] William M. Nelson, *Enlightenment Biopolitics: A History of Race, Eugenics, and the Making of Citizens* (Chicago: The University of Chicago Press, 2024).

[166] Cassidy, "Germanness, Civilization, and Slavery." For further discussion on biopolitics and the reengineering of populations in Brazil and Africa through the influx of Polish immigrants from the German Empire in the mid-19th century, see Lenny Ureña Valerio, *Colonial Fantasies, Imperial Realities: Race Science and the Making of Polishness on the Fringes of the German Empire, 1840–1920* (Athens: Ohio University Press, 2019).

[167] Cassidy, "Germanness, Civilization, and Slavery." 95–176.

[168] Ann Laura Stoler, *Race and the Education of Desire: Foucault's History of Sexuality and the Colonial Order of Things* (Durham and London: Duke University Press, 1995), 58.

[169] Benjamin Lipp and Sabine Maasen, "Techno-bio-politics: On Interfacing Life with and Through Technology," Nanoethics 16 (2022): 133–150; Donna Haraway, *Simians, Cyborgs, and Women: The Reinvention of Nature* (New York: Routledge, 1991).

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object. The on-site transformation of botanical life into chemical hybrids by German scientists demonstrated the practical and normative value attributed to plant life.

Although Brazil was not a colony of any German-speaking state, German scientific activities related to cinchona established experimental frameworks and opportunities that intersected with structures of enslavement, the appropriation of knowledge, and the infrastructure of imperial agricultural modernization. Pharmaceutical experimentation involving enslaved individuals and local Brazilians demonstrated a German tendency to generate imperial scientific knowledge grounded in real-life contexts and practical utility. Pragmatism thus became a valid form of knowledge shaping German botanical and pharmacological practices in Brazil. Brazilian systems of enslavement and rainforests functioned as sites of empirical activity and testing, analogous to German hospitals and apothecaries. In this context, the validation of Brazilian cinchona's healing properties bridged German-speaking territories with the trans-Atlantic world. Enslavement was pervasive not only across various economic spheres and labor hierarchies but also within German pharmacological practices and bodies of medical knowledge.

German chemical experiments and therapeutic techniques entailed a complex and often contradictory process of knowledge hybridization, which was fundamental to efforts purposed for human optimization. In the context of German pharmacology in Brazil, local knowledge about cinchona specimens became associated with various projects of social modernization. Through the production of pharmacological knowledge in Brazil and the transnational circulation of Brazilian cinchonas, two utopian visions of social reengineering coalesced around a transnational biopolitical intervention affecting both plant and human biological processes. The pursuit of establishing a "healthy" German civilization, embedded in a biologized cultural discourse, paralleled the racial whitening project of the Brazilian state. For German explorers, Brazil served as a living laboratory, providing human and plant samples to test interactions between diseases, plant medicine, and human bodies. These scientific findings supported the commercial interests of German apothecaries and state policies of human control. Brazilian cinchona specimens thus intertwined with systems of enslavement, pharmacological capitalist networks, German settlements, scientific expeditions, and German public health policies, creating a unified arena for the intervention and manipulation of both plant and human composition.

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