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Antibiotics "dumped": Negotiating Pharmaceutical Identities, Properties, and Interests in China–India Trade Disputes

China and India have become major producers of antibiotics, and the world has become highly dependent on them. Since 2000, the competition among Chinese and Indian manufacturers on key antibiotic ingredients has become increasingly intense in a series of trade disputes involving anti-dumping investigations. Analyzing these trade disputes, we find that they provide a space of communication and contestation where seemingly objective facts about pharmaceutical ingredients are transformed into debatable subjects, which are used and sometimes manipulated by stakeholders of conflicting interests. The disputes reveal entangled configurations and multilayered stakes in the China–India pharmaceutical nexus that often defy polarized national interests. Stakeholders must juggle multiple factors, including public health interests, nationalist sentiments, and corporate profit, in negotiating the national identities and the physical and chemical properties of "standard" pharmaceutical ingredients. The disputes also highlight the coexistence of collaboration and competition among Chinese and Indian stakeholders in global pharmaceutical supply chains. [antibiotics, active pharmaceutical ingredients (APIs), pharmaceutical nexus, dumping, trade disputes, China–India]

Introduction

In December 2021, Mr. Dua, the executive director of an Indian pharmaceutical company, Nectar Lifesciences, logged on to a Zoom webinar and gave an eloquent presentation titled "India Global Powerhouse of Pharma Formulations & *Aatmanirbhar* in Intermediates, Active Pharmaceutical Ingredients (APIs), and Key Starting Material (KSM)." Wearing a Nehru jacket, Mr. Dua proudly introduced his company as a global leader in a "highly specialized antibiotic space," as it is one of the few Indian companies that produce two essential antibiotic ingredients. He also promoted the Indian nationalist rhetoric *Aatmanirbhar Bharat* —"self-sufficient India"—by quoting Prime Minister Narendra Modi: "India's Pharma Industry is an asset not just for India, but for the entire world." Mr. Dua emphasized that India has played a leading role in reducing the cost of medicines by trillions of dollars worldwide, especially in low- and middle-income countries. According to Mr. Dua, Chinese competition has greatly challenged the goal of retaining a self-sufficient India in the production of pharmaceutical ingredients.

Mr. Dua's talk was part of a series of online events during a pharmaceutical trade fair in Shanghai, China, in 2021. The trade fair took a hybrid format including in-person exhibitions and an array of online opportunities for pharmaceutical professionals to connect. Among all the

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webinar speakers, Mr. Dua was the most adamant in promoting a "self-sufficient India" in the supply of pharmaceutical ingredients to the country's expansive pharmaceutical industry. In his talk, he mentioned two classes of antibiotics—penicillin and cephalosporin—that are widely used throughout the world for treating bacterial infections, and of which India and China are major global producers. Since 2000, the competition among Indian and Chinese manufacturers on key ingredients to produce antibiotics has become increasingly intense, and this has resulted in a series of trade disputes involving anti-dumping investigations. Various Indian pharmaceutical companies, including Mr. Dua's Nectar, regard Chinese competition as a result of "dumping," a term used in international trade to define injuring pricing policies and practices when manufacturers export a product to another country at a lower-than-normal price. Indian manufacturers have filed complaints asking the Indian government to initiate anti-dumping investigations against Chinese competitors to contest what they deem unfair trade practices, claiming that Chinese pharmaceutical ingredients are sold at unreasonably low prices—or being "dumped"—in the Indian market.

In this article, we view these China–India trade disputes as productive and novel sites for analyzing a pharmaceutical nexus that revolves around the globalization of pharmaceutical and antibiotic ingredients. "Pharmaceutical nexus" is a term used by medical anthropologists to refer to the broad set of political and social processes that happen through the globalization of pharmaceuticals (Petryna and Kleinman, 2006, 21), where the forces of international trade regulation, medicine, and global economy converge and the interests of actors from different scales resonate or clash. We argue that China–India trade disputes not only provide a platform for stakeholders on different scales from both countries to defend their pricing policies and practices but also serve as a space of communication and contestation that transforms seemingly objective facts about pharmaceutical ingredients into debatable subjects, which are used—and sometimes manipulated—by stakeholders of conflicting interests. Actors involved in trade disputes take advantage of the rules of anti-dumping investigations to negotiate the fluid nature of seemingly standard pharmaceutical ingredients in antibiotic production and make arguments in their favor. They juggle multiple factors, including public health interests, nationalist sentiments, and corporate profit in the process of defining, contesting, and negotiating the "national identities" and the physical and chemical properties of pharmaceutical ingredients. As such, the trade disputes reveal entangled configurations and multilayered stakes in the China–India pharmaceutical nexus that defy polarized national interests. The trade disputes also highlight the coexistence of collaboration and competition in the nexus between Chinese and Indian stakeholders in global pharmaceutical supply chains, and shed light on other important issues along the global commodity chain related to the distribution, circulation, and consumption of antibiotics.

We explore China–India trade disputes by combining different anthropological approaches, including in-person fieldwork conducted in India during a six-month period in 2022, digital fieldwork such as attending online pharmaceutical trade fairs, and an ethnographic approach to studying bureaucratic documents. During Bjerke's fieldwork in India, she interviewed professionals from the local pharmaceutical industry. Zhang engaged with documents from India's Ministry of Commerce and Industry and the World Trade Organization (WTO) Committee on Anti-Dumping Practices. Following the leads from both human and archival sources, both authors attended pharmaceutical trade fairs and analyzed reports from Indian and Chinese media. We are particularly interested in the trade disputes involving anti-dumping investigations of penicillins and cephalosporins, as Mr. Dua's talk directly indicated that much friction between China and India revolve around these two kinds of antibiotics, and the two together account for over half of the antibiotics consumed globally (Klein et al., 2018). The penicillin and cephalosporin ingredients on which we focus in this article are Penicillin-G, 6-APA, and Ceftriaxone Sodium Sterile, three crucial pharmaceutical ingredients for the global supply of essential antibiotics, as they are used in synthesized penicillin and cephalosporin production.

In the following sections, we first situate antibiotic ingredient production in the context of the global pharmaceutical industry with China and India rising in this arena. Then, we discuss why trade disputes can provide significant anthropological insights for deepening our understandings

of global pharmaceuticals. We continue by analyzing the bilateral trade disputes on penicillin and cephalosporin ingredients based on the debates around "domestic industry" and "like article," two key concepts that serve as prerequisite conditions of establishing a legitimate anti-dumping investigation. The disputes over penicillin ingredients show how Chinese and Indian interests are deeply entangled and how the identities of pharmaceutical ingredients defy an oversimplified dichotomy of the "Indian" vs. the "Chinese." The disputes over cephalosporin ingredients reveal how the "politics of sameness and difference" (Hayden, 2007) are manifested in negotiating the physical and chemical properties of seemingly standard pharmaceutical chemicals and how such politics are intertwined with defining national identities and interests. Finally, we conclude by highlighting the deep entanglements and clashing stakes in the global pharmaceutical nexus and call for bringing anthropological insights into issues related to antimicrobial resistance (AMR) and the global antibiotic supply chain.

China and India in Global Antibiotic Trajectories

Recent anthropological literature on pharmaceuticals asks what can be gained by "breaking open the pharmaceutical object" and "examining efficacy as a processual, relational, and situated event" beyond a pharmacological one (Hardon and Sanabria, 2017, 118). In the growing literature related to antibiotics, the short-term efficacy of antibiotics as a medical treatment to infection and diseases is often interrogated together with the long-term danger of antibiotic misuse. Anthropologists often remind us that structural issues such as fragile healthcare infrastructure, unequal distribution of medical resources, and food and income insecurities are all drivers of AMR (see, e.g., Hinchliffe et al., 2018; Willis and Chandler, 2019). Much research has been done on the structural issues behind prescription, distribution, and consumption of antibiotics; however, little has been written about their manufacturing, despite the fact that the process of producing one drug might entail financial, material, and intellectual inputs from multiple stakeholders across national borders. Even less has been written about the global trade and legal frameworks that govern the production and circulation of key antibiotic ingredients, despite the fact that the geographical concentration of their manufacturing in China and India is often considered one of the main reasons for recent antibiotic supply shortages in many countries worldwide (Shafiq et al., 2021).

Antibiotic products can be generally divided into two main categories in trade classifications: antibiotic ingredients and antibiotic medicines (Bjerke, 2022, 2), with the former referring to APIs, raw materials, KSMs, or bulk drugs, and the latter to formulated drugs. Antibiotic ingredients are an indispensable part of the complicated global supply chains of antibiotics that are heavily dependent on manufacturers in China and India. Such geographical concentration of antibiotic ingredient manufacturing is the result of the significant shift in the global production of antibiotics since the mid-1990s that reflects the general trends of the interconnected global economy (Horner, 2014, Quet et al., 2018). On the one hand, the Western pharmaceutical industry shifted its labor-intensive and environmentally costly operations to Asia in "the speculative wave of consolidations and asset dumping … with the creation of new sites of offshored manufacturing and raw material production" (Peterson, 2014, 127). On the other hand, China's Reform and Open era since 1978 opened doors for the rapid development of its domestic pharmaceutical industry, attracting investment from the West. Meanwhile in India, the introduction of several domestic patent and pharmaceutical reforms in the 1970s set the stage for Indian companies to become major domestic and international suppliers of APIs and generic medicines (Chaudhuri, 2005).

Social scientists studying pharmaceutical production and markets in the Global South often pay special attention to the entangled relationships between pharmaceuticals, bioscience, public health, political economy, and law, as well as their effects on drug access and use. For example, Stefan Ecks's work highlights how international trade disputes can affect drug access and uses the term "pharmaceutical citizenship" to interrogate "the relations between life-saving drugs and legal, political, and social rights" (2008, 166). Matthew Flynn shows how activism across

state–society boundaries can push against the forces of neoliberal globalization and improve countries' "pharmaceutical autonomy" through access to patented drugs (2015, 53). Carine Baxerres and Maurice Cassier (2022) demonstrate how colonial legacies and modern-day globalization shifts, including the flow of generic imports from Asia, have come to shape the making of pharmaceutical markets and modes of regulation in the Global South. However, the complicated relationship between the two major pharmaceutical ingredient-producing countries in the Global South—China and India—has not been thoroughly examined.

Between China and India, a general distinction is often made between the production of ingredients and formulated drugs, in which China is usually considered the major producer of the former, whereas India plays a more important role in the production of formulations—"a physical process of formulating the drug into a consumable form such as a tablet, liquid, capsule, cream, ointment, or injectable" (Horner, 2022, 72). China is currently the largest exporter of antibiotic ingredients in the world, accounting for 71 percent of the exported volume, while India and Europe are the largest importers (BCG and Wellcome Trust, 2022). Although India is also a big manufacturer of antibiotic ingredients, an estimated 70 percent to 80 percent of the Indian needs for ingredients come from China, and some ingredients to produce penicillin and cephalosporin are almost completely manufactured in China (PharmaSources, 2021a). The forces of global capitalism fundamentally drove the outsourcing of antibiotic ingredient production to China due to its capability to produce large quantities at low costs. For example, the production of Penicillin-G is allegedly dominated by Chinese manufacturers today—both a consequence of and a reason for the consistent dropping of the price from approximately USD 18 per BOU[1] in the early 1990s to USD 6.27 per BOU in the early 2000s (Xing, 2005). As one European pharmaceutical professional pointed out directly at a panel discussion during the Shanghai trade fair, if the price of a pharmaceutical ingredient is less than USD 10 per kilogram, no European manufacturer will make the effort to produce it (PharmaSources, 2021a). Although Chinese manufacturers of antibiotic ingredients today walk on thin profit margins, China's role in the global pharmaceutical trajectories has changed, in response to and in accordance with the neoliberal trends in the international pharmaceutical market.

Although the flow of antibiotics from China to India seems unidirectional at first glance, the relationship between the two countries is much more nuanced: not only is China the biggest supplier for India, but China is also the fiercest competitor in antibiotic ingredient production. As a response to the increasing competition from China, numerous Indian pharmaceutical manufacturers have filed petitions through the Directorate General of Anti-Dumping and Allied Duties (DGAD; after 2020, known as Directorate General of Trade Remedies, DGTR)—a subdivision of India's Ministry of Commerce and Industry. Evoking relevant WTO regulations and precedent-case rulings, the Indian petitioners requested the Indian government to conduct anti-dumping investigations on an array of antibiotic ingredients originating from China, and to impose anti-dumping duties or implement administrative measures to protect India's domestic producers of the same products from unfair competition. As the documents from the WTO Committee on Anti-Dumping Practices demonstrate, from 2000 to 2021, approximately 20 types of pharmaceuticals from China have been disputed, among which nine are antibiotic ingredients (see Table 1). As such, antibiotic production is transnational from the very beginning and the process is rife with friction.

Understanding a Pharmaceutical Nexus Through Trade Disputes

Trade disputes on antibiotic ingredients provide an often-neglected niche where great insights into China–India relations and interests in a global pharmaceutical nexus can be generated and understood. Medical anthropologists use the term "pharmaceutical nexus" to capture the broad set of political and social processes and entanglements that happen through the globalization of pharmaceuticals, taking "a multi-layered look at the interests and stakes involved in the production of pharmaceuticals" (Petryna and Kleinman, 2006, 5). Following the "biographical approach"

Table 1. Indian complaints of dumping practices against Chinese antibiotic API manufacturers documented by the World Trade Organization (2000–2021)

Date	WTO document no.	Antibiotic ingredient in dispute
10/2021	G/ADP/N/362	Amoxicillin/Amoxicillin Trihydrate
10/2021	G/ADP/N/362	Ceftriaxone Sodium Sterile
10/2021	G/ADP/N/362	Ofloxacin and its intermediates
02/2021	G/ADP/N/353	Ciprofloxacin Hydrochloride
10/2020	G/ADP/N/348	Ceftriaxone Sodium Sterile
06/2020	G/ADP/N/344	Ciprofloxacin Hydrochloride
01/2020	G/ADP/N/338	Ciprofloxacin Hydrochloride
05/2014	G/ADP/N/258	Ceftriaxone Sodium Sterile
11/2012	G/ADP/N/236	Ceftriaxone Sodium Sterile
07/2012	G/ADP/N/232	Metronidazole
06/2011	G/ADP/N/217	Metronidazole
02/2011	G/ADP/N/212	6-Amino Penicillanic Acid (6-APA)
02/2011	G/ADP/N/212	Penicillin-G Potassium
10/2010	G/ADP/N/207	6-Amino Penicillanic Acid (6-APA)
10/2010	G/ADP/N/207	Penicillin-G Potassium
07/2009	G/ADP/N/195	Penicillin-G Potassium and 6-APA
10/2002	G/ADP/N/97	Trimethoprim-II
11/2001	G/ADP/N/84	Trimethoprim (TMP)
04/2001	G/ADP/N/76	Trimethoprim (TMP)
10/2000	G/ADP/N/70	Metronidazole
10/2000	G/ADP/N/70	Trimethoprim (TMP)
09/2000	G/ADP/N/69/Add.1	Trimethoxy Benzaldehyde (TMBA)

to pharmaceuticals, we consider each step involved in pharmaceutical production as "marked by particular context, actors, and transactions" and as "characterized by different sets of values and ideas" (Van der Geest et al., 1996, 153). As such, in this article we consider antibiotics as globalized commodities and provide a glimpse into the contexts of their manufacturing and circulation in the China–India pharmaceutical nexus, which forms a crucial part of the "biography" of global antibiotics. Furthermore, we consider international trade disputes and anti-dumping investigations as manifestations of the "assemblage" of international trade regulation, medicine, and global economic forces (Halliburton, 2017, 120), and show how they transform seemingly objective facts of pharmaceutical ingredients into debatable and contestable subjects, used—and sometimes manipulated—by stakeholders of conflicting interests. More specifically, actors from China and India apply the rules of trade dispute investigations to their favor by negotiating and contesting the "national identities" and the "chemical and physical properties" of the pharmaceutical ingredients they produce. By doing so, they defy polarized national interests demarcated by national borders.

To unravel the entanglements and condensed relationships manifested in China–India trade disputes, we resort to the publicly available documents of India's anti-dumping investigations against Chinese manufacturers. This part of the research is greatly inspired by anthropologists who have studied bureaucratic documents as ethnographic objects by focusing on how the materiality of documents contributes to the "construction of subjects, objects, and socialities" (Hull, 2012a, 253). Anthropologists see documents as constitutive tools in promoting administrative control within and beyond organizations by coordinating different perspectives and activities, in constructing bureaucratic objects and subjectivity, and in enacting bureaucratic practices and actions (Hull, 2012a, 257–59; see also Harper, 1998). The anti-dumping investigation reports consulted for this research are striking manifestations of a contemporary "pharmaceutical nexus,"

as they are at once representations of views from different interested parties, justifications for courses of actions, and political and diplomatic devices (Harper, 1998, 4). They are particularly constitutive in forming "associations," "coalitions," or "oppositions" among "people, things, and processes" (Hull, 2012b, 21–22); more specifically in our cases, among the Chinese and Indian state, pharmaceutical manufacturers, transnational capital, international trade regulations, and the pharmaceutical ingredients themselves. By "following" these documents, we "follow the drugs" as they move across national borders and become the center of attention in international trade disputes.

Anti-dumping investigations conducted by the Indian authorities follow a standard format. The investigation reports first introduce the background of the cases indicating the product in dispute, the petitioners' names, and the status of precedent rulings. Then the reports list investigation procedures, including notifying relevant parties and stakeholders, notably the Chinese embassy in India and an array of Chinese manufacturers and exporters. At the same time, the investigation authorities also send questionnaires to relevant Indian manufacturers and importers to solicit their opinions. This section clearly identifies the names of all relevant parties and stakeholders, as well as how many of them have responded to the investigation requests. Then the reports continue with sections defining the scope of "domestic industry," determining "normal value," "export price," and "dumping margin," assessing the scale of "injury," and establishing a "causal link" between "dumping" and "injury." Each section summarizes the views from different parties in bullet points with a conclusion from the investigation authorities. Although key data such as the actual selling price, profit, and loss of pharmaceutical companies are usually kept confidential and purposely omitted as ***, the reports clearly present the alliances and animosities among different stakeholders. Most of the contentions exist around the following aspects: first, who is considered India's "domestic industry" and based on what criteria; second, whether the competitive price advantage of Chinese-manufactured antibiotic ingredients is the result of state intervention or market economy mechanisms; third, whether Chinese- and Indian-manufactured antibiotic ingredients should be considered "like articles" and can be used by consumers interchangeably; and, finally, whether imposing anti-dumping measures on Chinese-manufactured ingredients will harm the section of the Indian industry that produces downstream products, which may further increase drug price and negatively impact "the public interest."

Among these aspects, the debates in defining "domestic industry" and "like article" stand out, as the contestations over the two concepts lay bare the entanglements between Chinese and Indian stakeholders. According to the WTO definition, "domestic industry" refers to "the domestic producers as a whole" or "those of them whose collective output of the products constitutes a major proportion of the total domestic production," while recognizing exceptions when a producer can be deemed "related" to an exporter or importer of the allegedly dumped product "if there is a relationship of control between them." Due to the exceptions, whether some Indian manufacturers should be considered as part of India's "domestic industry" due to their ties with China is questionable. The second heatedly debated concept, "like article," is defined as "a product which is alike in all respects to the product under consideration, or, in the absence of such a product, another product which, although not alike in all respects, has characteristics closely resembling those of the product under consideration." The definition opens up a space for interpreting the "sameness" and "difference" of related pharmaceutical ingredients. Furthermore, the two aspects are also interrelated because the decision regarding "like article" is the basis of determining which companies constitute the domestic industry, and that determination in turn governs the scope of the investigation and determination of injury and causal link (WTO, n.d.). In this way, not only the concepts of "domestic industry" and "like article" are both contested, they are also interrelated in the negotiation processes of the trade disputes.

Therefore, by analyzing the debates around these two key concepts and the relationship between them, we elaborate how different stakeholders take advantage of the space of communication and contestation provided by the investigation framework and the ambiguity from the WTO definitions to channel their opinions and interpretations on the identities and properties of

pharmaceutical ingredients. While each stakeholder presents "facts" to the investigation authorities, the combination of these "facts" produces contestable subjects open to negotiation and ready to be redefined. Essentially, the negotiation of the "national identities" and the "chemical and physical properties" of pharmaceutical ingredients underpins the disputes over pricing policies and practices. In the following section, we analyze anti-dumping investigations on Penicillin-G, 6-APA, and Ceftriaxone Sodium Sterile. The first set of cases centers around disputes on penicillin ingredients, their "national identities," and the "national interests" they represent. The second set of cases highlights the "politics of sameness and difference" surrounding the "physical and chemical properties" of cephalosporin ingredients and how such politics are intertwined with defining national interests.

"Self-reliant" India vs. "self-disciplined" China: Disputes on Penicillin-G and 6-APA

Penicillin conjures nationalist sentiments in both India and China historically and in the more recent trade disputes. Penicillin was part of the Indian nation-building project in the 1950s that stemmed from India's nationalist goal to become economically independent (Tyabji, 2004, 349). India's dependency on pharmaceuticals from abroad continued into the 1960s. It wasn't until the introduction of several domestic patent and pharmaceutical reforms in the 1970s that the tide started turning, and Indian companies gradually became major domestic and international suppliers of pharmaceuticals (Chaudhuri, 2005). As early as 1985, directors of India's leading pharmaceutical companies already emphasized the importance of achieving self-reliance through pharmaceutical ingredient production (Zaman and Khanna, 2021). Recognizing the challenges posed by Chinese competition since the 1990s, Indian scholars and professionals have underlined the need to reduce dependency and warned about "the perils of excessive import dependence on a single country for the bulk of the requirements of APIs" (Joseph, 2020, 1). The Indian government recently introduced schemes to promote the domestic manufacturing of antibiotic ingredients, with the goal of making "Indian pharma truly *Aatmanirbhar*" (Sharma, 2021). Taking advantage of a pharmaceutical market "amendable to competing moral claims" (Flynn, 2015, 52), Indian stakeholders use the virtue of self-reliance as a moral device to push for changes toward favorable policies.

In China, the development of an independent pharmaceutical industry after World War II was also considered part of the nation-state building process, as antibiotics were considered "key national resources" (Bud, 2007, 75). After Communist China gained national independence in 1949, the country was still in urgent need of penicillin due to China's Civil War and its participation in the Korean War. The first batch of China's indigenous, industrial-scale penicillin production was realized in Shanghai in 1953. Afterward, China sought to enhance its penicillin production capacity and started to build a large pharmaceutical production facility in northern China, with technical support from the Soviet Union. Since its establishment in 1958, the factory has played a significant role in manufacturing antibiotics and supplying China's domestic needs. Although Chinese manufacturers initially needed support from both the West and the Soviet bloc, a strong sense of national pride was attached to the ability to independently produce penicillin (Cai, 2021). After various reforms over the past six decades, the company (now known as North China Pharma) is still one of the most important penicillin manufacturers in China. Since 2000, it has been the primary target of anti-dumping investigations filed by Indian penicillin producers.

The bilateral trade disputes have challenged the pharmaceutical nationalist sentiment in both countries. Disputes on penicillin ingredients started soon after China's accession to the WTO, and the anti-dumping investigations took place mainly from 2004 to 2005 and from 2008 to 2009 (see Table 2). Starting from 2003, a series of "coordination" (*xietiao*) meetings among China's several major penicillin ingredient manufacturers, including North China Pharma, were held to discuss the possibility of the industry's internal "self-disciplinary" (*zilv*) agreement. The goal was to avoid dumping accusations from India by collectively setting a higher threshold export price for penicillin ingredients and by limiting the total amount of production within China (*xianchan*

Table 2. Timeline of Penicillin-G, 6-APA, and Ceftriaxone Sodium Sterile disputes

Penicillin-G and 6-APA dispute timeline						
2004	**2005**	**2006**	**2008**	**2009**	**2010**	**2011**
India attempted to limit Penicillin-G import by administrative measures on import licensing procedures.	A series of industry "self-discipline" negotiation meetings were held among Chinese manufacturers from 2003 to 2005.	Indian company Southern Petrochemical Industries Corporation filed for anti-dumping investigation on Penicillin-G at DGAD. The case was later withdrawn.	Indian company Alembic filed for anti-dumping investigation on Penicillin-G and 6-APA at DGAD. The case was later withdrawn.	Indian companies Alembic and Southern Petrochemical Industries Corporation filed for anti-dumping investigation on Penicillin-G and 6-APA at DGAD. The case proceeded.	Preliminary findings of the case filed in 2009 concluded by recommending imposition of provisional anti-dumping duty on Penicillin-G and 6-APA originating from China.	Final findings of the case filed in 2009 confirmed the preliminary findings in 2010.

Ceftriaxone Sodium Sterile dispute timeline					
2007	**2008**	**2012**	**2014**	**2020**	**2021**
Indian company Aurobindo Pharma Ltd filed for anti-dumping investigation on Ceftriaxone Sodium Sterile at DGAD. The case proceeded.	Preliminary findings of the case filed in 2007 concluded by recommending imposition of provisional anti-dumping duty on Ceftriaxone Sodium Sterile originating from China. Final findings confirmed the preliminary findings.	Indian companies Nectar Lifesciences and Kopran filed for Sunset Review (extension of anti-dumping measures) on Ceftriaxone Sodium Sterile at DGAD. The case proceeded.	Final findings of the case filed in 2012 concluded by recommending extension of anti-dumping measures.	Indian companies Nectar Lifesciences and Sterile India filed for anti-dumping investigation on Ceftriaxone Sodium Sterile at DGTR. The case proceeded.	Final findings of the case filed in 2020 concluded by recommending imposition of anti-dumping duty on Ceftriaxone Sodium Sterile originating from China.

*DGAD: Directorate General of Anti-Dumping & Allied Duties, Department of Commerce, Ministry of Commerce and Industry, Government of India, DGTR: Directorate General of Trade Remedies, Department of Commerce, Ministry of Commerce and Industry, Government of India

baojia) (Liu, 2005). The meetings were held as a response to both the pressure from India, which threatened to impose trade remedy measures against Chinese products, and the recognition of the problems faced by Chinese producers in China's domestic market. According to multiple Chinese media reports, the Indian government suspended imports of Penicillin-G from China in July 2004, which brought production in China to a standstill, since more than 70 percent of the Chinese-manufactured Penicillin-G was destined for the Indian market. Some media reports described the shock to China's penicillin industry as "a heavy blow to the head" (*dang tou yi bang*) and "a catastrophe that destroys the whole lineage" (*mie men zhi zai*). Although some Chinese manufacturers promised to practice "self-discipline" and agreed to set the export price no lower than USD 6.3 per BOU (Xing, 2005), others were unwilling to sacrifice their own profit for the collective good of the Chinese penicillin industry and therefore failed to follow the agreed conditions. As a result, the "self-disciplinary" agreement failed to "discipline" the Chinese penicillin producers because some chose to prioritize their own corporation's interest over the collective interest (Liu, 2005).

India's suspension of Penicillin-G imports from China in 2004 was a prelude to the series of anti-dumping investigations in the first decade of the 2000s. In 2008, Alembic—an Indian pharmaceutical company that traces its Penicillin-G production to the 1960s—filed an application through the Indian government to initiate anti-dumping investigations concerning Penicillin-G from China. Together with two other Indian producers, Alembic claimed that they had suspended their Penicillin-G production due to the injury caused by Chinese competition (DGAD, 2008b). After a brief termination of the investigation request, the original petitioner garnered stronger support from their industry peers from the public–private joint venture of Southern Petrochemical Industries Corporation in Tamil Nadu, India, and filed a new request for investigation only two months later, expanding the scope of investigation to both Penicillin-G and 6-APA from China. The combined production of the two petitioners allegedly accounted for 100 percent of the production within India at the time of investigation (DGAD, 2009). As part of the investigation, 26 Indian stakeholders were invited to express their opinions, of whom 15 responded. It is worth noting that Mr. Dua's company, Nectar, was one of the respondents, as it was involved in the manufacturing of downstream products.

As the Penicillin-G and 6-APA investigations delved deeper, the reports shed light on two kinds of entanglements between China and India and cast doubt on the supposedly unified "national identities" of pharmaceuticals and the "national interests" that pharmaceutical companies represent. The first is a horizontal entanglement across national borders. Such entanglement is the most salient in the contentions around defining the scope of the Indian "domestic industry." One Indian company, DSM India, was ruled out by the Indian government as an ineligible domestic producer of 6-APA, because the company was considered directly related to two of the Chinese producers under investigation. As stated in one of the cases, DSM India "has itself imported significant 6-APA from China" and it is also "related to the exporter of 6-APA in China" (DGAD, 2010, 8). The investigation also noted that the company's entire production "is meant for captive consumption only" (DGAD, 2010, 8), meaning that the 6-APA is imported for further value addition and production within the same company instead of for sale in India's domestic market. Furthermore, the Indian authorities found that the two related Chinese companies belong to a Sino-Foreign Joint Venture whose contributing capital came from a Chinese state-owned corporation and a 100 percent subsidiary of Royal DSM BV—a company listed in the Netherlands (DGAD, 2010, 13; 2011, 14). Another Chinese producer under investigation, Aurobindo Bio/Pharma, proved to be a 100 percent subsidiary of an Indian company carrying the same name, and the Penicillin-G produced by the Chinese branch is also consumed captively (DGAD, 2011, 21). Ironically, the mother company, Aurobindo Pharma, is often identified as the most "Indian" of Indian pharmaceutical companies for being more independent of foreign investment (Halliburton, 2017, 117). As such, the capital in the intertwined global pharmaceutical trajectories of two penicillin ingredients involves stakeholders in multiple countries across continents. Some Indian companies were

excluded from "Indian domestic industry," as they were not "Indian" enough from the perspective of trade regulators because of their relationship with Chinese manufacturers in the supply chain.

The second kind of entanglement can be considered vertical and is related to downstream products in the global supply chain. Such entanglement is reflected in the divergent opinions from within India's pharmaceutical industry documented in the investigations. For instance, India's Federation of Pharmaceutical Entrepreneurs argued that any imposition of anti-dumping measures would directly impact the price of life-saving end products such as the antibiotic cloxacillin, and thereby negatively affect the "public interest." India's pharmaceutical formulation industry feared the negative effects of imposing anti-dumping duties, as the measures could significantly affect the production of downstream products. For example, Indian manufacturers of GCLE, an intermediary using Penicillin-G as a key input, concurred, and feared for the cascading effect on the prices of GCLE and other related pharmaceutical products. They also anticipated that anti-dumping measures would trigger fiercer competition from Chinese producers, resulting in "unfair advantage to Chinese GCLE manufacturers and a distortion of the domestic industry of GCLE in India" (DGAD, 2011, 35). One company representing India's bulk drug manufacturing industry and formulators voiced their concern that anti-dumping duty would increase bulk drug prices by at least 30 percent, which would result in "the import of bulk drugs by formulators and 'kill' India's bulk drug manufacturing industry" (DGAD, 2011, 27). It is evident that the national interests represented by penicillin are entangled with, and sometimes in contradiction with, the national interests that other related pharmaceutical products represent.

Despite the divergent opinions about the anti-dumping measures, the Indian authorities eventually concluded that Indian Penicillin-G and 6-APA producers suffered severe injury from Chinese competition due to intensified dumping. In 2011, Indian media reported that one of the three petitioners in 2009—Southern Petrochemical Industries Corporation—"unceremoniously closed down" its penicillin production line because the company was "overwhelmed by unhealthy competition from China" (SACEM, 2011). As the penicillin cases demonstrate, the conceptual opposition between Indian and "foreign" pharmaceutical companies is often problematic (Ecks, 2008; Halliburton, 2017). Not only are Chinese and Indian companies "highly enmeshed" (Halliburton, 2017, 118), so are "Chinese" and "Indian" interests. The trade disputes on penicillin ingredients demonstrate that, because of these entanglements, the corporate interests of actors involved in global antibiotic trajectories cannot be clearly demarcated by national boundaries, although such national demarcations often inform drug quality perceptions among consumers in a "geography of subjective value" (Baxerres et al., 2022, 264). Collaboration is often disguised by competition and the "national identities" of pharmaceuticals are often blurred and contested in contexts of international trade disputes.

"Sterile" vs. "Non-Sterile": Disputes on Ceftriaxone Sodium Sterile

If the contentions over penicillin ingredients revolve around the "national identities" of the pharmaceuticals and the "national interests" they represent, cases about a cephalosporin ingredient called Ceftriaxone Sodium Sterile demonstrate that the seemingly objective chemical and physical properties of pharmaceuticals can also be contested in trade disputes. Ceftriaxone Sodium Sterile has been investigated in three periods: 2005–2006, 2011–2012, and 2020–2021 (see Table 2). Ceftriaxone is a third-generation parenteral cephalosporin antibiotic, and Ceftriaxone Sodium Sterile is a key ingredient to produce it. Mr. Dua's Nectar has been actively involved in the investigations related to ceftriaxone. It was listed as an "interested party" in the penicillin investigations; however, in the cephalosporin disputes, Nectar has been a lead petitioner on behalf of India's domestic industry. In the latest investigation during the COVID-19 pandemic, Indian petitioners argued that they are "sensitive towards the importance of the product and cannot leave the country in the hands of China in this time of the pandemic" (DGTR, 2021, 31). On behalf of the Indian domestic industry, Nectar argued that imposing anti-dumping measures on the imports of Ceftriaxone Sodium Sterile from China is "in the interest of the public at large" because it can ensure "a

strong, competitive domestic production of life-saving cephalosporin antibiotics" in India (DGTR, 2021, 31).

Some contentions in Ceftriaxone Sodium Sterile cases are similar to those in the penicillin disputes. The boundaries between nation-states are often blurry, as the production of Ceftriaxone Sodium Sterile also involves multiple inputs and stakeholders. In determining whether the petitioners are qualified to represent India's "domestic industry," any relationship that the petitioners have with China was again under scrutiny by investigation authorities. However, the Ceftriaxone Sodium Sterile cases are particularly intriguing as the trade disputes provide a space for stakeholders to negotiate and contest the physical and chemical properties of the pharmaceutical ingredients, turning seemingly objective facts into debatable subjects. In these cases, defining "sameness" and "difference" between two related products became the center of debate among interested parties. More specifically, stakeholders heatedly debated whether Ceftriaxone Sodium Sterile (referred to as "Sterile" hereafter) and Ceftriaxone Sodium Non-Sterile (referred to as "Non-Sterile" hereafter) should be considered different products, as procedures of sterilization add significant value to the product, even though the two products contain similar chemical substances. Defining "sameness" and "difference" between Sterile and Non-Sterile is closely relevant to defining key concepts such as "like article" and "domestic industry," which sets the legal premises in establishing anti-dumping investigations.

Studying the generic drug industry in Mexico, Cori Hayden (2007) draws our attention to the politics of "sameness" and "difference" in pharmaceuticals and argues that multiplicities emerge in lieu of the seemingly tidy binary between "the original brand names" and "the generic copies," as a third category—"the similar"—exists in Mexico, pointing to off-patent drugs that are not proven to be "therapeutically equivalent" (482). As Hayden further argues, contests over appropriate measures of "sameness," "interchangeability," and "equivalence" are "saturated with transnational regulatory and trade politics and struggles for shares of pharmaceutical markets" (Hayden, 2012, 276). Such politics of "sameness" and "difference" not only exist in the domestic pharmaceutical market in Mexico, but they also affect China–India trade disputes on antibiotic ingredients. In all the investigation reports consulted for this article, the contests over "sameness" and "difference" center around establishing the status of "like article," one of the key preconditions for launching a legitimate anti-dumping investigation. The Indian authorities, often in accordance with the arguments of Indian petitioners, rule that Chinese-manufactured ingredients are technically and commercially interchangeable with Indian-manufactured products. Therefore, Chinese-manufactured and Indian-manufactured ingredients are "like articles," and anti-dumping investigations can be justified.

However, in the Ceftriaxone Sodium Sterile cases, different stakeholders disagreed on what should be considered "same" and "different" products in defining "like articles." The Indian manufacturers claimed that Sterile and Non-Sterile should be considered different products because "the value addition from Non-Sterile to Sterile is much higher," and they belong to different categories, as Non-Sterile is classified as an unprocessed raw material, whereas Sterile is considered an active pharmaceutical ingredient. They should be considered different products also because they use different types of packaging, as "Non-Sterile is supplied in plastic, fibre, or HDPE drum, whereas Sterile is supplied in sterile aluminum drum" (DGTR, 2021, 33). However, Chinese manufacturers argued that "such a division of the product has been adopted by Indian manufacturers only to cover up the petitioners' own imports of Non-Sterile from China," as the petitioners "are only engaged in the business of sterilizing the Non-Sterile imported from China" (32). Therefore, it is "impossible that such huge dumping as claimed by the petitioners is taking place only in the Sterile product but not in the Non-Sterile product" (17). Chinese manufacturers further argued in the report that the reason why the Indian petitioners filed for anti-dumping investigation is because "the petitioners suffered losses due to their imports of Non-Sterile from China and later they could not realize any margin as expected from the sterilization process" (21).

The Chinese manufacturers also attempted to debunk the arguments of Indian petitioners point by point. In terms of the classification of the product, they argue that "it is absurd to say that

Non-Sterile is only an intermediate but not a drug" (DGTR, 2021, 32), and that "it is 'irrational' to categorize Non-Sterile as a raw material" (9). In terms of the difference in packaging, Chinese manufacturers maintain that Sterile and Non-Sterile are essentially the same products because of the basic chemical substance, as they argue:

> The purifying process does not modify the basic properties of Ceftriaxone Sodium so both should be considered the same product, and the petitioners have not explained how the two differ in terms of CAS number, HS code, Pharmacopoeia, molecular formula, molecular weight, chemical structure, basic raw material, etc. (DGTR, 2021, 9)

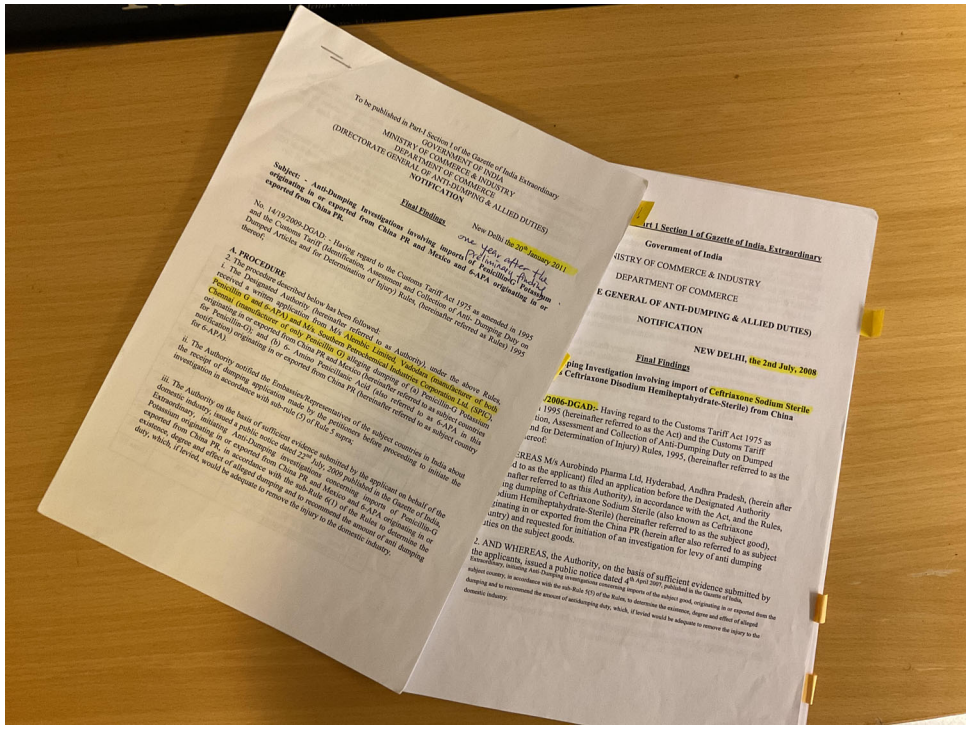
Escalating the intensity of the debate, the Indian manufacturers responded by saying that the Chinese manufacturers' arguments show that they are not even "aware of the raw materials involved in producing the product and it is absurd for them to think 'purification' not as a significant manufacturing process" (DGTR, 2021, 8). Therefore, the Indian authorities must impose a ban on exports by such Chinese companies "who are unable to even distinguish and differentiate between Sterile and Non-Sterile, as goods supplied by such producers can be a huge health hazard for the country," which could potentially "lead to large-scale deaths in hospitals" (5–9).

The contention on whether the investigation should distinguish between Non-Sterile and Sterile exists because the "sameness" and "difference" of the two products affect the definition of "domestic industry." If the Indian authorities include Non-Sterile and consider it the "same" as Sterile products, the two will have to be investigated together and it will affect the status of the petitioners as legitimate Indian "domestic industry," as a much larger proportion of the imports from China is used in captive consumption because of the entanglement between Indian and Chinese manufacturers. Consequently, whether the major value-adding step of sterilization changes the properties and the categorization of the pharmaceutical ingredient became a focus of contention in establishing the rationales of the anti-dumping cases. The final ruling of the Indian authorities concluded that Non-Sterile is a chemical and cannot be used for human consumption; it only becomes humanly consumable after sterilization and additional testing. Therefore, they ruled that Sterile and Non-Sterile should be considered different products, but Chinese-manufactured Sterile and Indian-made Sterile are "like article," therefore legitimizing the anti-dumping investigation. Having kept the "larger public interest" in consideration, the Indian authorities also stated that anti-dumping duty would help "re-establish open and fair competition in the Indian market, which is in the general interest of the country" (DGTR, 2021, 34). Since anti-dumping duty would not completely forbid import from China, it would not affect drug supply and accessibility for the public. The Indian authorities concluded: "The imposition of the anti-dumping duty will be in the public interest" (36).

Without doubt, Mr. Dua's Nectar played a leading role in the anti-dumping investigations of cephalosporin ingredients, and he has been very vocal in polarizing Chinese and Indian interests in the global pharmaceutical industry through multiple media outlets. In one podcast, Mr. Dua (PharmaLytica, 2020) recalls that when he started his career in the pharmaceutical industry in the late 1970s, India was "vulnerably dependent on the West." However, although he is extremely proud of the achievements of India's pharmaceutical industry today, he warns the listeners that currently 90 percent of the domestic formulation in India is vulnerably dependent on Chinese imports: "Ladies and gentlemen, that is a very scary scenario." The COVID-19 pandemic has finally exposed the fact that, Mr. Dua repeats, "it is high time to focus on the self-sufficiency of APIs" for India. However, perhaps not everybody in India's pharmaceutical industry shares the same steadfast opinion as Mr. Dua. In a panel discussion on APIs at the Shanghai trade fair, an Indian pharmaceutical professional emphasized that "collaboration between China and India is more important than ever" and "collaboration and healthy competition can co-exist" (PharmaSources, 2021b). In an interview conducted by Bjerke in Hyderabad, a professional from the pharmaceutical industry shared his view about the entanglements of Chinese and Indian interests:

> It is fair to say that India has far more dependence on Chinese Active Pharmaceutical Ingredients than China has on India, and people often talk about this one-way dependence of India on China. But on the other hand, there is also a Chinese dependence on India. Let's say, hypothetically, that the Indian API industry shuts down one day, will China be able to supply worldwide? If we look at medicine supplies to Africa, India supplies the final finished form, pills, much more than China does. I think we should not treat China as a pariah. We should treat China as a partner, as a collaborator and both India and China do things that they are probably best at and leverage each other's strengths.

In short, due to the historical development of Indian and Chinese antibiotic industries, both countries developed national pride over their respective pharmaceutical industries. Antagonizing national interests in international trade disputes on antibiotic ingredients is both constitutive to nationalist sentiment related to the country's pharmaceutical industry and the result of it. As a result, the competition between China and India on antibiotic ingredients seems inevitable. However, India's goal of pharmaceutical self-reliance remains idealistic in the context of multiple entanglements between China and India today. As the trade dispute cases have shown, both the "identity" and the "properties" of antibiotic ingredients can be ambiguous and fluid, and readily debatable when such entanglements come to the fore. Although nationalist sentiments on both sides amplify competition between India and China, collaboration between the two countries is as common as competition. A unified "national interest" in both countries often disguises the internal conflicts among domestic parties and the divergent opinions of different stakeholders in China–India pharmaceutical supply chains.



Conclusion

Global pharmaceutical supply chains are extremely intricate and fractured. As a result, a drug ready for patient use may contain multiple ingredients and value-adding procedures from

different stakeholders across national borders. In the global antibiotic supply chain today, China and India have become major players and their entangled relationships render antibiotics as complicated pharmacological objects. China–India trade disputes deepen our understandings of the fluid nature of global pharmaceuticals as they document how pharmaceutical ingredients are situated in the assemblage of international trade regulation, medicine, and global economic forces, and how stakeholders negotiate and contest pharmaceutical identities, properties, and the national interests they represent. Furthermore, the disputes also highlight the coexistence of collaboration and competition in the China–India pharmaceutical nexus, where various actors across borders and scales balance between corporate, public health, and national interests. Although it is easy to connect trade disputes with national interests and nationalist sentiments, nuanced conflicts widely exist within the Chinese and Indian domestic industries beyond the nation-state level. Trade disputes can hardly have a clear winner no matter what the final ruling is, as very often, what is "Chinese" is intertwined with what is "Indian."

Our analysis of the trade disputes contributes to medical anthropology in the following aspects: first, it situates antibiotics beyond the contexts of the consumption and distribution of finished formulations. By focusing on pharmaceuticals in the contexts of the China–India pharmaceutical nexus of ingredient production and circulation, we deepen our understandings of the often-invisible entanglements in which pharmaceutical ingredients are situated. Second, we enrich the literature on pharmaceutical production in the Global South, in which much has been written on issues related to access to patented drugs and intellectual property rights, while less has been written about essential drugs like antibiotics, many of which have never been patented or whose patents have long expired. Furthermore, we provide insights into China's role in the global pharmaceutical industry today—a much-needed discussion considering the level of dependency on China in the global antibiotic supply chain. We believe that antibiotic ingredients are objects of concern in pharmacology, international trade, and global public health simultaneously. Trade disputes can have unexpected consequences on supply chain security, downward pricing, and drug quality. In this regard, we call for studies of antibiotic trajectories to be contextualized at the intersection of global health governance and the global trade framework. In a heightened sense of urgency to fight against antimicrobial resistance on a global scale, scholars must attend to how trade disputes between major producers of antibiotic ingredients, such as India and China, might affect the affordability, availability, accessibility, and quality of formulated drugs both inside and outside of clinical settings worldwide. As the profit margins of traditional antibiotics have dived, governmental organizations must consider new incentives to support a secure and stable supply of essential antibiotics and the development of new antibiotics. Pharmaceutical companies must consider their social responsibilities of ensuring sustainable antibiotic supply beyond a fierce competition for cheapness.

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1. The Billion Oxford Unit is an international unit commonly used as a measure for antibiotics such as penicillin.

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