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Covid-19 and Semi-Periphery

Argentina and the Global Vaccines Research and Development

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Abstract

The SARS-CoV-2 pandemic has disturbed the order of the world-system. While central countries—through their pharmaceutical multinationals—focused on the development of vaccines, semi-peripheral and peripheral countries fulfill another role, either by offering an environment for trials, or by inserting themselves in the hierarchical global order as a hub for research, development, or production of the candidate vaccines. This paper focuses on the analysis of the geopolitics of the world-system regarding production and participation in the clinical trials of vaccines for SARS-CoV-2 of Oxford University-AstraZeneca, BioNTech-Pfizer, and Sinopharm in Argentina. This is a case analysis of the Argentine semi-peripheral context, the local and global pharmaceutical industry, and the geopolitical order. We conclude that Argentina, which has scientific and industrial capabilities to manufacture vaccines, has joined in global value chains on the dependence side, deepening the scientific and technological gap vis-à-vis the central countries.

Keywords: Geopolitics, Semi-Periphery, Global Value Chains, Vaccines, Covid-19, Big Pharma

Several diverse voices of the political spectrum in Argentina celebrated during 2020 that the country was the place of research and development for important vaccines from global centers. AstraZeneca, Pfizer, and Sinopharm chose the country to be part of their complex vaccine development process, and that seemed excellent news. The country would even have preferential access to an important amount of doses once they had been manufactured and approved for application. In Hecht's (2009) terms, it was a techno-political achievement. Despite industrial facilities and important domestic scientific maturity, this turned out to be an example of how corporations in the core countries rely on the capabilities of the semi-periphery as a platform for their global businesses, accentuating the typical dependence of a peripheral country.

When the World Health Organization (WHO) declared the virus a pandemic, it advocated for a solution and vaccines for all countries, rich or poor. It was a performative effort: the world is such that some countries have access to the production and distribution of vaccines while others do not. In this global quagmire, core states financed research and development alongside large pharmaceutical companies (having the necessary logistics to carry out the production of vaccines, to conduct their research in different phases and in several populations distributed throughout the geography that would provide key information to determine that vaccines were safe and effective). What role did the different countries play in this global value generation chain? This article studies the role of Argentina within the development of these vaccines.

The coronavirus pandemic has different geopolitical dimensions in its global structure: centers, semi-peripheries, and peripheries. The global narrative during the pandemic has generally explained that in the world-system, the public and private sectors of the core countries invest millions in science, have global political initiative, forge and govern institutions of international cooperation, and monopolize most of the resources. The peripheral countries, by contrast, suffer from scarcity, poverty, and dependence on developed global players.

Vaccine production and clinical trials around the world require vast sums of money, local political connections, national and international legal management capacity in industrial and health systems. On the contrary, poor countries, small companies, and scientific institutes or universities will find themselves under constraints. Rich countries and powerful players of global value chains have all the advantages. The countries of the global periphery will accentuate their dependence. But what about the countries of the semi-periphery? They have infrastructure for development, and therefore capabilities to produce vaccines as well as tools to obtain advantages in the negotiation for some of those immunizing drugs. However, the peripheralization will deepen, and the dependency on the core countries will tighten. Big Pharma and the interests of rich countries that have a global rather than a national approach to vaccine development will orientate research and development, technology design, and business.

This paper seeks to analyze the geopolitics of the world-system in the production of Covid-19 vaccines, and the participation in the clinical trials of AstraZeneca, Pfizer, and Sinopharm in the Argentine Republic through understanding their global value chains. In this sense, we propose to study (a) how and why Argentina was chosen as a participant in the vaccine production chain;

(b) the role of the state through its different ministries in the management of relations with both multilateral organizations, as well as countries, universities, and biotech corporations that transfer technology; additionally, (c) we propose to analyze the geographical configuration of production to describe what the production and marketing process will be like. Finally, we conclude by proposing an explanation of the geopolitical logic behind the international division of labor in the world system, the control of technology transfer knowledge, and the role of a semi-peripheral country like Argentina to take a qualitative leap in terms of local production sovereignty.

World-Economy and Semi-Periphery

Argentina has a long history of well-developed human resources for vaccine development and local production (Corvalán 2017; Roggero 2006). The focus on the semi-periphery dwells on the systemic role of Argentina and the global division of labor in which vaccine research, development, and/or production for SARS-CoV-2 of AstraZeneca, Pfizer, and Sinopharm take place. Through a review of recent scientific publications, the press, laws, and regulations we analyze how Argentina, having scientific and productive capabilities to manufacture vaccines, has joined in global value chains, deepening the scientific and technological gap vis-à-vis the central countries.

Core economies are characterized by being areas in which diversified production of high profitability, advanced technology, and high wages is concentrated, while peripheral countries' production is less diversified and profitable; wages and technology use is lower (Wallerstein 1976: 462). While central countries have greater political and economic power—crystallized in higher levels of efficiency in the production of high-tech goods and higher prices in international markets—the periphery has a less sophisticated production system. Peripheral production is mainly export of raw materials and agricultural products, which present poorer international market's prices.

Argentina belongs to the semi-periphery—peripheral countries with certain industrial and scientific-technological capabilities that seek to compete in some segments of the world market defined by commercial applications based on technology—according to Wallerstein's classification of the world-system. In his words: "It is the normal condition of the global system having a three-layer structure," otherwise the system disintegrates, since it would be "much less stable politically, because this would mean a polarized world system" (Wallerstein 1974a: 404). The main feature is the distance between rich and poor. The categories of center, periphery, and semi-periphery are based on the position of the countries in the international division of labor. The semi-peripheral countries share characteristics of both the center and the periphery, generating capital goods with lower intensity than the core states, or producing raw materials and agricultural products, with lower wages (Wallerstein 1974a). According to Wallerstein (1974b), the relevant issue is not the kind of production—industrial manufactures or raw materials—but the wages. In other words, a core country can produce raw materials and agricultural goods as long as there is capital-intensive technology combined with a well-paid and skilled labor force. Core activities are

characterized by a higher levels of profit associated with productivity and technology. On the other hand, non-core production obtains lower profits associated with lower levels of capital intensity.

The countries of the center have superior levels of efficiency in the production of high-tech goods, and higher prices in international markets; while peripheral countries, having less sophisticated production systems, base their production mainly on low-technology goods. This way, "patterns of trade between countries constitute a relational structure in which some positions—the core positions—encourage relatively autonomous activity while others—the peripheral positions—encourage constrained or dependent activity" (Lloyd, Mahutga, and De Leeuw 2009: 52). Along the same lines, Evans (1979) associated the notion of semi-periphery with countries of the periphery with a certain industrial capacity driven by—integrated into—dependent development processes, characterized by the dominant presence of transnational capital in the most dynamic industrial sectors.

Semi-peripheral countries hope to increase their productivity, to develop and export greater added value to other countries on the periphery; seeking to improve their influence and status within the regional subsystem. From the core-countries' perspective, this aspiration of the semi-peripheral countries is perceived as part of the path to development in economically strategic areas, which has a potentially destabilizing effect on the geopolitical and geoeconomic order (Hurtado and Souza 2018) assigned by the international division of labor (Hall and Chase-Dunn 2006). However, historical evidence shows that transitions from the semi-periphery to the center have been "very rare" (Chase-Dunn 1998: 121), which can be explained in part by the high access barriers, both formal and informal, to leading industrial technologies. Thus, most of the time the semi-periphery is not a transitional category but a permanent place within the world capitalist system (Babones 2005). According to some authors "semi-periphery" is not a descriptive category, but an analytical instrument to study change within the modern world-system, improving the analysis of global inequalities; focusing on spatial inequalities than the simple view of core-periphery (Terlouw 2003).

The countries of the semi-periphery are affected when it comes to crafting technology policy locally and escalating in the industrialization process, to escape dependence on commodities. The structure of the world-system constrains those countries that seek to complete their industrialization process, since there are formal and informal barriers to accomplishing the development process, designing, and producing technologies for cutting-edge industries. This implies:

> Institutional instability that hinders the efficacy of public policies; scant private investment in R&D; dynamic industrial sectors dominated by transnational firms whose maximizing strategies are largely unconnected from local economic ecosystems; the growing and harmful influence of speculative finance since the late 1970s; and geopolitical disadvantage in negotiations on the "rules of the game" for technology transfer, catching-up, and learning processes. (Hurtado and Souza 2018: 124)

The debates about strategic technologies, such as nuclear, renewable energy, biotechnology, or vaccines, conceal a policy of the central economies to promote their own business while cooperating with peripherals they transfer costs and control over them (Hurtado and Souza 2018; Delvenne, Vasen, and Vara 2013). This shows an international division of labor in which central economies exercise economic advantages and control of production, having the know-how, patents, and capital to do it. Core firms take advantage of cheaper resources in the semi-periphery such as skilled labor and industrial facilities, research laboratories, and universities while standing as the forefront of technology.

Argentina developed a series of strategies, including the local development of vaccines, increasing the number of hospital beds, local production of testing kits, and so on, to combat the pandemic (Rabinovich and Geffner 2021). Juliana Casattaro's group from the Institute of Biotechnological Research of the Universidad Nacional de San Martín is a noteworthy example. Her serum works on a recombinant vaccine that is at the preclinical phase (UNSAM 2020). Also, Claudio Prieto's group from the Biotechnological Center at the Universidad Nacional del Litoral that works on developing a vaccine based on Virus Like Particles (UNL 2020). These national Research and Development (R&D) processes are partially blocked by local and global value chains, which end up importing technology (vaccines), or governing business, research, and knowledge; holding global patents and making it difficult to finance local researchers due to lack of resources that instead focus on the businesses of multinational pharmaceutical companies or their local partners, who see greater economic returns in tech transfer than in local development.

From the 2008 world economic crisis, global governance has been difficult as levels of multilateralism are diminishing. Structural change is in the process of a new industrial revolution accompanied by the exhaustion of globalization as an economic cycle. In a context of economic financialization marked by volatility, the problem of real production is further exacerbated by dependence on financial speculation. The closure of the post-Fordism production cycle due to technological changes promotes dynamics of productive relocation, automation, and the integration of global value chains through digital platforms (Sanahuja 2017).

In the twenty-first century, scientific and technological knowledge is a geopolitical factor and has become a commodity. Towards the end of the nineteenth century, "the business world began to recognize the importance of technological knowledge as a strategic asset" (Coriat and Weinstein 2011: 273). The key aspect is knowledge and its ownership. Along with the property regime, the legislation that regulated the appropriation of company proprietorship was modified. The neoliberal model led to regulations such as the Bayh-Dole Act in the United States, which allowed patenting with funds contributed by the federal government, making it mandatory that all development financed by the state should be applied at the governmental level. This regulation allowed universities, laboratories, and firms to commercially develop technology financed by the state: "a spectacular boom of spin-offs" (Coriat and Weinstein 2011: 282). In fact, there is a strong concentration of power in the core countries regarding Big Pharma and its corporate behavior (Rikap 2019).

Biotechnology and Geopolitics

The geopolitical dimension illuminates elements of international politics emphasized by the 2020 pandemic; the fissures have increased, leading to nationalism and militarism (Díaz and Mountz 2020), a vaccine nationalism (Santos Rutschman 2020), and a global reset and systemic rivalry (Dunford and Qi 2020). The question of the geopolitical order refers to the geographical and hierarchical elements that condition economic and political relations. "A mixture of cohesion and conflict between actors, an organized governance system that defines the actors, the rules, the principles of interaction, and shared conceptions among the actors about trade, force and diplomacy (Agnew and Cordbridge 1995: 15-16). This hierarchy has the structure of the three strata, in which a semi-peripheral Argentina is subsumed de facto to the policies of the powers and advanced economies of the core (Flint and Taylor 2018). The world-economy is a dynamic system based on flows of value from the bottom to the top (Gereffi and Korzeniewicz 1990; Clelland 2014), being a question of power and extraction of value (Dallas, Ponte, and Sturgeon 2019).

Argentina is a semi-peripheral country that has scientific and productive capacities to produce vaccines. However it has a subordinated role in global value chains and has been inserted in the global hierarchical order as a research, development, or producer hub for AstraZeneca, Pfizer, and Sinopharm against Covid-19. The hierarchical element of the geopolitical order, which unfolds within a framework of written and unwritten rules, is defined by the global distribution of capital-labor relations, or international division of labor; that means, who produces what things (and under what conditions), who benefits (and with what margins), and how the terms of trade and value flows are decided.

Central countries tend to see semi-peripheral countries' aspiration to improve their technological capabilities as a crucial part of their path towards expanding strategic areas for endogenous development while having a potentially destabilizing effect on the geo-economy. At the same time, however, the industrialization and modernization of public infrastructure in central countries are coveted by peripheral countries as a means of gaining scale and reach in global technology markets.

Value chains sometimes cross the borders of states, so they are subject to national authorities and regulations. A state can impose tariffs, decide what goods do enter; but also, in Wallerstein's words "may pressure other governments to make conditions that are in the interests of the state placing the pressure, or in the interests of particular producers in the country of the state placing the pressure" (Wallerstein 2009: 83). This implies that each state actively takes part in its role in global value chains, contributing to reproduce the roles assigned to each society in the world-system.

In recent years, a process has taken place that led to the commodification of patents becoming an input for the financial economy and an instrument of speculation. The new commodities were regulated by legislation in the northern countries and then the southern countries were pushed to do the same, forcing them to pay rents for the use of goods with great added knowledge (Orsi and Coriat 2006; Merkina 2009; Danneels 2012; Landesmann 2015; Scazzieri, Baranzini, and Rotondi 2015; Rikap 2019). In technologies such as chemistry or pharmaceuticals, "patents are used on a

relatively large scale as a direct source of income, as well as a means to block competing products. The possession of certain patented inventions has the ultimate purpose that a company benefits from its innovations" (Coriat, Orsi, and Weinstein 2003: 235). In several biotech industries, by placing R&D sites in certain locations other than their headquarters, companies can take advantage of resource rents and location-based relational subnets. This enables companies to extract technological rents through intellectual property rights and has implications not only for the competitiveness of the industry, but also for the power relations between companies, the state, and communities (Ipsen 2016: 41). However, the technological transformation in developing countries requires active policies on the part of the state that, under free market and rules made for advanced countries, would not work (Chang, Chima, and Mises 2002). The globalization of technological production processes contributed to the fragmentation and relocation of production.

Global Value Chains constitute the sequence of activities that firms and workers carry out from the design of a product to its final use; the result of which is the emergence of different patterns of geographic structuring and governance, in which the inputs of production and services are developed where the necessary resources and skills exist and are available at a competitive price and quality (Porta, Santarcangelo and Schteingart 2017). The productive matrix in biotechnology has a share in these Global Value Chains, with R&D and production from several companies in the sector (Gutman and Lavarello 2014; UBATEC and CAB 2016). Networks of global cities participate in this global chain through the biotechnology and pharmaceutical industry (Krätke 2013).

The dominant paradigm in the pharmaceutical sector is the exploration of different types of chemical compounds and their subsequent organic synthesis. From the beginning, the industry was shaped by a handful of German and Swiss multinational corporations; the United States and the British joined them after the Second World War (Malerba and Orsenigo 2000; 2002). During and after the war this bloc of corporations benefited greatly from investment in biomedicine and in extensive health plans on the part of the Western powers. Until the mid-1970s, the global scenario of the pharmaceutical industry remained relatively stable, with few new members in the small group of multinationals that operated in the sector (Mazzucato and Dosi 2006).

From then on, the industry suffered a series of setbacks that modified its structure, drastically changed the way they generated knowledge, and conditioned its operation to this day. Since the mid-1970s, advances in physiology, biochemistry and, above all, molecular biology, had fully struck the pharmaceutical industry. The birth of modern biotechnology came after (Gutman and Lavarello 2014). Before 1980, large multinationals of the main core of the industry searched for active ingredients to treat a pathology through a random trial-and-error process. New discoveries led to the understanding of biological genomic mechanisms of each particular pathology, and offered drugs or vaccines to solve it and satisfied those market niches (Gambardella 1995).

The new actors are the small biotechnology companies that emerged around American universities after the sanction of the Bayh-Dole Act. (Angell 2004; Corvalán 2017). At the beginning of this process it was believed that, at a global level, large pharmaceutical companies would be replaced by small biotechnological spin offs; these smaller laboratories boosted their

growth in the use of molecular biology, genetic engineering, and bioinformatics strategies (Gutman and Lavarello 2014). What actually happened was a division of labor within the pharmaceutical business;. Biotechnology companies and public laboratories deal with the upstream part: research, knowledge generation, and development; and large pharmaceutical companies deal with the burdensome clinical tests of the products and the aggressive commercialization required to place them on the market. These multinationals acquire the intellectual property of the molecules developed or directly absorb them from small biotechnology companies, buying them out (Mazzucato and Dosi 2006).

Following Angell (2004), R&D in biotechnology firms is quite similar to those carried out by large pharmaceutical companies. It differs in that instead of producing small molecules through chemical means, biotech labs are mainly dedicated to creating or modifying very large molecules, such as proteins or hormones, using biologically living systems—often with DNA recombination technology, which refers to techniques based on molecular biology and applied genomics that make it possible to cut and paste fragments of genetic information with the aim of modifying genomes of living organisms to carry out some useful work for pharmaceutical and economic purposes.

The contemporary, modern vaccine industry is considered one of the most important branches of biotechnology, in an institutional framework made up of public laboratories, universities, different profiles of biotechnology companies (Malerba and Orsenigo 2002; Pisano 2006), and a smaller number of large companies (Gutman and Lavarello 2014). The emergence of modern biotechnology had a decisive impact on the production and market of vaccines. Molecular biology and genetic engineering techniques that opened a field of action on the modification of the genome have eliminated most of the technical barriers that previously limited its development. Much of the rapid growth in the development of new vaccines is due to the implementation of advances in biotechnology that took place in the 1980s and 1990s. This set of technological tools presented new opportunities to treat infectious diseases, as well as cancer, allergies, and chronic diseases (Levine 2004).

The notorious concentration in the number of suppliers of these inputs in industrialized countries—the result of technological change and its monopoly ownership with the new regime of intellectual property—obdurated processes of industrialization and increased the technological center-periphery gap (Hurtado and Zubeldía 2017) which undermined production capacity, making the supply of vaccines unequal (Angell 2004). The resulting international market for vaccines has been structured into two segments: traditional vaccines, low cost and technological aggregate, used and produced predominantly by countries of the periphery or semi-periphery; and modern vaccines, high cost and technological aggregate, used and manufactured for the most part by central countries (Corvalán 2010; Gadelha et al. 2020; WHO, UNICEF and World Bank 2010).

In the central countries, the traditional vaccines—attenuated or inactivated pathogens—were gradually replaced by more sophisticated modern vaccines: second generation—subunit, recombinant, conjugated vaccines—and even third generation—virus like particles, RNA or DNA vaccines, vector vaccines (Corvalán 2010; Fernández et al. 2020). As a corollary, the number of

producers and suppliers of traditional vaccines in developing countries had an exponential increase, representing 86 percent of suppliers worldwide. Low-cost and mainly traditional vaccines with low technological complexity are produced by these suppliers in developing countries for local or in other low- and middle- income countries use, a market that constitutes 84 percent of the world's population (WHO et al. 2010). The other side concentrates strongly a few economic players, vaccine producers in developed countries; in which a handful of large pharmaceutical companies, with great access to financing and oligopolistic positions, dominate the market. In 2017, only four large multinationals—GSK (24 percent), Merck (23 percent), Pfizer (22 percent), and Sanofi (21 percent)—were responsible for approximately 90 percent of the total amount earned from vaccine sales in the world (Gadelha et al. 2020). In 2018, the pharmaceutical market was $864 billion in size. Within it, vaccine sales accounted for $30,500 million, 3.5 percent of the sector's revenue (Gadelha et al. 2020).

Table 1: Traditional and Modern Vaccines: Examples and Technical Characteristics

Global Features / Type of vaccine	Generation	Price	Technology asset	Type of technology	Example	Companies/institutes
Traditional Vaccines (Microbiology techniques pre-modern bioctechnology)	First	Low	Low	Attenuated, dead or inactivated pathogen	BCG, DPT, smallpox.	Serum Institute of India Pvt. Ltd. BioVac (SouthAfrica) Instituto Finlay (Cuba)
Modern Vaccines (Biotechnology: Molecular biology, genetic engenieering techniques)	Second	High	Middle	Polysaccharide-protein conjugated vaccines Recombinat vaccine (subunit) Subcelular fragments	Hepatitis B, HPV, HiB, Pneumococcal, Pentavalent vaccine.	FioCruz (Brasil) Indian Immunologicals Ltd. Sinergium (Argentina) Pfizer, Merck, Janssen
	Third	High	High	Virus like particles, RNA or DNA vaccines, vector vaccines.	BNT162b2 (Pfizer), AZD1222 (AstraZeneca) both for Covid-19	GSK, Merck, Pfizer, Sanofi

Table 1: Traditional and Modern Vaccines: Examples and technical characteristics.

Table 1: Elaborated by the authors based on Folegatti et al. 2020 and Mulligan et al. 2020

Semi-peripheral countries face a global context with two macroeconomic variables. The first one, an oligopolistic structure of suppliers from developed countries—fewer than ten players worldwide—with strong intellectual protection systems and royalties that set significant barriers to cutting-edge development and processes to shorten the technological gap (Corvalán 2017). The second one is a growing financialization of the economic agents of the drug market and a preponderance of the generation of value through financial assets instead of production and systematic investment in R&D (Chena, Buccela, and Bosnic 2018).

Global Governance Bodies

From the point of view of the global scale of world-system, some scholars point out that there is a global governance of the value chains of a public and private nature, controlled by several parties, involving "control over logistics, the division of labor in the chain, technology and innovation, property rights, branding and other determinants of competitive positioning in final markets and the distribution of returns" (Davis, Kaplinsky, and Morris 2018: 44). Despite the multilateral

nature of international trade regimes and legislation, advanced economies have an advantage in setting the rules of the game, owed to their privileged position as core over the periphery mentioned above. Many international financial institutions such as "the World Bank [have] viewed conditionality as a blueprint package of policy conditions attached to tranche release of single loans" (Branson and Hanna 2000: 1).

Since the 1990s, through policies framed by the Washington Consensus and a neoliberal agenda, the National Health System of Argentina transferred several competencies towards sub-national governments. Simultaneously, global technocratic organisms acquired competencies and power, constituting themselves as agents for the governance of liberalization (Khor 2008). A case in point is the 1994 Agreement on Trade in Pharmaceutical Products (concluded during the Uruguay Round of trade negotiations): it "eliminates tariffs and other duties and charges on a large number of pharmaceutical products and the substances used to produce them" (WTO Web). "The World Bank…has become a policy advisor and international financier of drugs [and] vaccines… in low and middle-income countries" (Govindaraj, Reich, and Cohen 2000: 1). This involvement in pharmaceuticals is embedded in the partnership on pharmaceutical policy and provision with WHO and other multilateral institutions.

Global health governance bodies, foundations, and alliances that operate in the vaccine market had a considerable impact on the productive capacities of Argentina. The World Health Organization (WHO) and the Pan American Health Organization (PAHO), parallel with the technological change described above, began to outline a series of recommendations and initiatives for member countries in the mid-1970s. We highlight the EPI (Expanded Program on Immunization) of 1974 (Levine 2004), the creation of the PAHO Revolving Fund for the acquisition of vaccines—from which Argentina currently obtains more than 85 percent of these inputs (Zubeldía 2020)—to ensure the supply of vaccines to poor countries in Latin America.

UNICEF joined this group of institutions in the 1980s, making massive purchases of vaccines from suppliers in developed countries to channel them to poorer countries together with PAHO, in joint purchase funds; generating economies of scale for transnational companies in the sector. (Corvalán 2017). In the 1980s these were traditional childhood vaccines, the core group of six diseases: diphtheria, pertussis, tetanus, polio, measles, and tuberculosis (WHO et al. 2010).

The global market for vaccines did not represent a major source of profit for the large pharmaceutical transnationals until the 1980s, when the advances of modern biotechnology began to be applied (Levine 2004). Simultaneously, there was progress in the health policies of the semi-peripheral states of the suggestions and initiatives of the WHO; obtaining vaccines through the PAHO Revolving Fund—and in countries on the periphery, massive donations from UNICEF—and EPI. The generation capacity of modern vaccines increased significantly in suppliers of central economies: transnational companies that saw peripheral economies as a way to gain markets and scale. The global governance bodies linked to health began to channel the placement of these supplies in markets of the periphery or semi-periphery.

During the 1990s, the enactment of GATT/TRIPS increased the oligopolistic conditions of the sector, strengthening the penetration capacity of five or six multinationals in global markets

with the ability to overcome entry barriers by implementing specific technical regulations in its formulation, capacity to generate economies of scale, pay for multi-center clinical trials in manifold countries, logistical power to carry out registries, and approvals in several regulatory agencies simultaneously—first and foremost in Federal Drug Administration (FDA) and European Medicines Agency (EMA)—enabled more iron-clad strategies of intellectual protection through patents (Martínez, Piva, and Tripo 2019).

Corvalán (2017) describes the loss of vaccine production capacities in Argentina as the WHO and PAHO health policies penetrate the country. Since the mid-1970s, when these two organizations began to recommend policies for the application of vaccines to their member countries, these supplies began to be imported. Until the end of the twentieth century, Argentina retained part of its local production capacity; but the arrival of multinational pharmaceutical companies was reflected in the addition of vaccines to the national vaccination calendar (NVC). As of 2002, another phase began, in which transnational firms in the NVC pushed for the dismantling of organizational and local production capacities and a copious entry of newer vaccines. Between 2003 and 2012, eight modern vaccines were added to the NVC, besides the eight that previously existed. The participation of multinationals increased from 64 percent to 79 percent in the same stage (Corvalán 2017). Currently, four of the 18 in the CNV are from local production (Zubeldía 2020).

Meanwhile, in 2000, the Global Alliance for Vaccines and Immunization (GAVI) was created in an initiative that brings together the WHO, UNICEF, the Bill and Melinda Gates Foundation, and the private monopoly industry—Johnson & Johnson, GlaxoSmithKline (GSK), Merck, Novartis, Sanofi-Pasteur, Janssen, Sanofi-Aventis, and Pfizer (Greco 2004). This alliance is one more arm of the WHO to sign sales agreements with different states, and each transnational laboratory has its own specialty: for example, Merck markets rotavirus vaccines like Rotateq and the HPV vaccine Gardasil; Sanofi markets the yellow fever and polio vaccines; Pfizer the pneumococcal vaccine; Janssen the Quinvaxem pentavalent vaccine DTP-HepB-Hib (GAVI 2020).

GAVI also works with donors, including central country governments and private sector foundations. NGOs, advocacy groups, professional and community associations, religious organizations, and the academic world are central to the validation role that large laboratories need to penetrate a state's health policy design (GAVI 2020). The discursive scaffold of alliances like EPI or the PAHO Revolving Fund are similar: equity in vaccines access to poor countries vis-à-vis industrialized countries; population growth and dangers of transmission of infectious diseases as a consequence of travel and migration; and the damage supposedly generated by sovereign policies or initiatives in health matters, isolated from global institutions' advice (Greco 2004).

Coalition for Epidemic Preparedness Innovations (CEPI) and Covid-19 Vaccine Global Access (COVAX) complete the scenario. CEPI is an association of public, private, philanthropic, and civil organizations, funded through its own donations. It was launched in 2017, with the aim of developing vaccines against emerging infectious diseases. It focuses on WHO's "blueprint priority diseases," including: Middle East Respiratory Syndrome-related coronavirus (MERS-

CoV), Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), Nipah virus, Lassa fever virus, and Rift Valley fever virus; as well as Chikungunya virus, and what they called a hypothetical and unknown pathogen "Disease X." It was co-founded and co-funded with $460 million from the Gates Foundation, The Wellcome Trust—a London based charity for biomedical research—and a consortium of nations, including Norway, Japan, and Germany, later joined by the European Union (2019) and Great Britain (2020). In 2020, CEPI was identified as a "key player in the race to develop a vaccine" for Covid-19 disease (Gouglas et al. 2019; Coy 2020).

In partnership with the WHO and GAVI as well, CEPI launched COVAX to ensure equitable access to Covid-19 vaccines for all countries. In addition to WHO, GAVI and CEPI, and COVAX, access facilitation to vaccines against Covid-19, in collaboration with vaccine manufacturers from central and peripheral countries, is the only global initiative that works with governments and manufacturers to ensure that Covid-19 vaccines are available worldwide for both core and peripheral countries (GAVI 2021).

Argentina: Covid-19 Vaccines

The agreements of the Argentine State that we will analyze are: AstraZeneca an Anglo-Swedish firm with mAbxience, producer of bio-similars, to manufacture the active ingredient of the vaccine developed by the University of Oxford. Pfizer and BioNTech, an alliance of an American and a German firm with the Infant Foundation, carried out phase III trials of their vaccine at the Central Military Hospital "Cirujano Mayor Dr. Cosme Argerich". Lastly, Chinese Sinopharm with the Huésped Foundation to carry out Phase III at "Vacunar" center, sponsored by ELEA laboratories. Whether producing commodities or advanced manufactures, if the full knowledge of the process of production is located overseas and is property of foreign firms, and the local or international legislation constrains how or what to produce, the country is in a subordinate position in the world-system. The three Phase III cases analyzed are vaccine developments whose knowledge has been produced overseas, and these corporations from the United States, Europe, and China use local resources and facilities to solve the global problem of the pandemic.

AstraZeneca and mAbxience. In order to produce the vaccine against Covid-19 in Latin America, AstraZeneca signed an agreement with mAbxience in August 2020. mAbxience is a biotechnology company specialized in research, development, and manufacture of biosimilar antibodies—monoclonal antibodies—to treat oncological and autoimmune diseases; it is a part of the pharmaceutical group Insud Pharma. The mentioned agreement took place between private parties; the Anglo-Swedish laboratory selected mAbxience as one of the few companies in Latin America that could manufacture the active ingredient of the viral vector vaccine (Folegatti et al. 2020). In the words of Hugo Sigman, founder of Grupo Insud, "this was a negotiation between private parties, no government played any role. AstraZeneca approached us and understood that ours was the best factory. They did all the inquiries and verified the technological requirements and the adequacy of the facilities" (Perfil 2020). It is remarkable to note the absence of government involvement to intercede and/or specify strategic state objectives linked to health solutions for the

pandemic when the agreement was signed. The Slim Foundation, also part of the agreement, finances the vaccine, which is produced at risk. Phase III was underway in Brazil, the United Kingdom, South Africa, and the United States (AstraZeneca 2020; Página 12 2020a; Página 12 2020b). The vaccine is expected to cost $3 to $4 per dose, allowing drug companies to cover their expenses but not generate a profit (Smink 2020).

The link that locks the production chain is that while mAbxience will manufacture the active ingredient of the vaccine—the assembled viral particle—the Mexican laboratory Liomont will package it; "a practical decision due to the number of doses to be filled," according to the Chief Scientific Officer of mAbxience Argentina, Esteban Corley. Specifically, the process of packaging and finishing the injectable will be carried out in Mexico. Before the pandemic, the Liomont Company produced health supplies and drugs for the Mexican and U.S. markets. There is a sort of international division of labor in pharmaceutical code. Now, based on these facts, some questions may be formulated: Why did the Argentine state not intervene in the negotiations between the Argentine company and the multinational? Could it have been negotiated that part of the active principle remained and be packaged locally in one of the smaller volume plants that exist in our country? It is a strategic asset in the midst of a pandemic of unknown proportions, and it does not seem very pragmatic that the technology transfer for the production of the modified adenovirus should be made, finished packaging 8,000 kilometers away, and then bought and brought back. The idea of the pharmaceutical company is "to produce the vaccine in each region, but with local producers" (Esteban 2020a). Is the insertion in the global chain of value of the vaccine in a dependent key, satisfying the logistics needs of the multinational to place its production in one of the largest markets in the world?

Pfizer and BioNTech: An mRNA Vaccine. The vaccine designed by the American multinational Pfizer and the German biotechnology company BioNTech is based on the technology of mRNA—messenger ribonucleic acid. These are third-generation vaccines, which had never been tested in humans until the pandemic caused by SARS-CoV-2 (Fernández et al. 2020; Navas 2020a). The mRNA vaccines promise a new era in vaccinology and this is due, among other causes, to productive reasons: they are easier to manufacture and scale industrially than any other type of vaccine (Servick 2020). Phase III trials for this vaccine in Argentina began in August and ended in late November 2020, at the Central Military Hospital Cirujano Mayor Dr. Cosme Argerich (CABA). The trials were coordinated by the team of Dr. Fernando Polack, a pediatrician and infectious disease specialist who runs the Infant Foundation specialized in the study of diseases of the respiratory system (Disposal ANMAT 2020a). Study applicants received two doses, the first in August and the second three weeks later. If this vaccine version would obtain good results—as it did later—Argentina could have been in a place of preference at the time of contesting access to the necessary doses (Esteban 2020b). Argentina represented 13 percent of the global study in that phase (Lavieri 2020).

In a first stage, the drug passed the safety and toxicity examination that began in Germany in late April and in the United States in early May, with which it received approval from the FDA to

advance towards the following phases. Phase III was carried out in Argentina, Brazil, South Africa, Turkey, Germany, and the United States (Lavieri 2020; Mulligan et al. 2020). Offering a platform and logistics to test vaccines for large transnational companies, meanwhile, seems to be the negotiation tool for poor, peripheral, or semi-peripheral countries, to access a preferential position on the waiting list for a vaccine or a partial transfer of technology from a multinational (Navas 2020b). In Polack's words, "Traditionally, countries that have the privilege of participating in trials of this nature open the door to receiving priority vaccine shipments and that is what everyone participating in the trials wish" (Infobae 2020a), something that as of February 2020 did not materialize. Medical foundations, NGOs, and the media played the role of legitimizing clinical tests carried out at an unusual speed, without conducting extensive animal tests and avoiding long times to monitor side effects and/or adverse reactions, usually between two and five years. Among Infant's main contributors are the Gates Foundation, the National Institute of Health of the United States (NIH) and the Molecular Research Council of England, the PATH Foundation, MITS Surveillance, Georgetown University and the Thrasher Research Fund—institutions with a global reach (Foundation Infant 2020).

This platform was completed in Argentina, with the logistics capacity of the Central Military Hospital. In this sense, it is questionable and quite shocking that this capacity and organization—strategic for the interests of the nation such as the Argentine Army—is put at the service of clinical trials in humans for Big Pharma. Finally, it is troublesome from a political and economic point of view that its storage requires a special refrigeration of minus 70 degrees celsius (O'Donnell 2020), a technology most of the non-central countries lack, and that requires electrical power and logistics that peripheral countries do not have; and if they acquire it, they would have to do it abroad.

SinoPharm-ELEA Laboratory. The China National Biotech Group (CNBG), affiliated with the China National Pharmaceutical Group (Sinopharm)—a Chinese public pharmaceutical company—in collaboration with the Beijing Institute of Biological Products (BIBP) developed a vaccine based on the inactivated SARS-CoV-2 virus (Sicilia 2020), an older and simpler technology than the two previous cases. The BIBP is the main vaccine manufacturer in China, a prequalified institute by the WHO and the only one that has the regulatory approval of Biosafety Level 3 for the manufacture of vaccines based on virus culture (Reyes 2020; Romero 2020).

During Phases I and II, this candidate vaccine was found to be safe and elicited an immune response. Three hundred and twenty volunteers—18 to 59 years old—received their doses and, according to the results, produced enough antibodies to neutralize the virus. The *Journal of American Medical Association* (Xia et al. 2020; Esteban 2020b) and *The Lancet* (Xia et al. 2021) published the study; they found the vaccine was "safe" and "capable of generating an immune response" (BAE Negocios 2020a). Phase III of the trials with 15,000 volunteers is underway in Bahrain, the United Arab Emirates (Esteban 2020b), Peru, Morocco, Pakistan, Serbia, and Jordan (Cunzolo 2020). A two-dose scheme is used and more than 150,000 doses have already been applied in Chinese territory (BAE Negocios 2020b). Sinopharm's industrial plant in Beijing could produce 200 million doses per year (Esteban 2020b).

Through efforts carried out by the Ministry of Health (MinSal), at the end of August, Argentina reached an agreement allowing the Chinese state firm to carry out Phase III trials in Argentina (Esteban 2020b; Disposal ANMAT 2020b). The Huésped Foundation was the local organization chosen to manage Sinopharm's study Elea-Phoenix laboratories sponsorship (Cunzolo 2020), a national capital company belonging to Insud Pharma, which also owns mAbxience. The trial was done at the "Vacunar" and "Proteger" centers. This was a 12-month study and included 3,000 volunteers, over 18 years of age, in good health. The objective was to complete the recruitment phase in two months, finish the study phase by the end of the year, and have the data analysis for the first quarter of 2021 (Romero 2020). Huésped Foundation has been supported by global institutions and multinational companies: WHO, PAHO, UNICEF, European Union, the World Bank, and the NIH. There is also support from large international laboratories, such as Pfizer, GSK, ViiV Healthcare (Foundation Huésped 2020).

Table 2: Vaccine Agreements Concerted in Argentina

	Vaccine agreement		
	AstraZeneca	Pfizer-BioNtech	Sinopharm
Type	Tech-transfer (viral particle-active principle)	Clinical Trial	Clinical Trial
Local counterpart/ sponsor	mAbxiencie (local private capital)	Infant Foundation/ Pfizer Argentina Ltd.	Huesped Foundation/ Elea Laboratory (local private capital)
Clinical Phase in Arg./ Platform	/	III/ Argerich Military Hospital	III/ "Vacunar" center
Number of volunteers	/	5762 (+18)	3000 (+18)
Tecnology employed	Viral Vector	mRNA	Inactivated Virus
Global Financing	Slim Foundation	/	/
Development	Oxford University	BioNTech RNA Pharmaceuticals GmbH	Beijing Institute of Biological Products
Doses	2	2	2
Phase I/II	1077 UK volunteers – aged 18 to 55	Germany and United States 45 volunteers - aged 18 to 55	China 320 volunteers – aged 18 to 59
Security/Antibody production	Yes -two stops in the protocol-	Yes	Yes
Journal (Phase I/II)	The Lancet	Nature*	Journal of American Medical Association - The Lancet
Global Phase III	Brazil, UK, South Africa, United States	Argentina, Brazil, South Africa, Turkey, Germany, United States	Argentina, Bahrain, the United Arab Emirates, Peru, Morocco, Pakistan, Serbia, Jordan

Table 2: Vaccine agreements concerted in Argentina.

Table 2: Elaborated by the authors based on Folegatti et al 2020; Mulligan et al. 2020, and Xia et al. 2020

Conclusion

Corporate interests of large pharmaceuticals and their local partners block semi-peripheral research and production. Big Pharma demands states compromise sovereign assets in negotiations, sometimes based on public health emergencies (Davies et al. 2021). Local medical corporations and laboratories find a strong niche for their know-how; partnering with global value chains, oriented local foundations, and institutions, they swap the chance to develop a national vaccine for

the privilege of providing logistics for tests, hospitals, patients, and knowledge. By the time vaccines finally became available, the main pharmaceutical companies of advanced economies have provided the doses to immunize the population, obtaining royalties from the treasuries of semi-peripheral countries that did not bet on their own national system of science, technology, and industry. The research, development, and production capacities of a semi-peripheral economy such as Argentina would be diminished by each batch of vaccines purchased from states or foreign companies, which would defund the National State and its public science and health system, with millions of dollars transferred abroad for vaccines.. Each dose of the few main vaccines to be available in the market will be $4 to $37 per unit (Hooker and Palumbo 2020). Even though the price per dose is established in secret negotiations between a state and the pharmaceutical companies a rough estimate can be made asserting $20 per dose as an average. Each two doses-vaccinated citizen in Argentina will cost the treasury $40. If half the population were vaccinated, it would cost the state $800 million per year; which, by investing steadily in development, the approval by regulatory authorities, production, and placing on the market, the state could have had a vaccine manufactured locally.

It is a fact that the international market for vaccines for Covid-19 is unfair. Rich economies have hoarded a large portion of vaccines in their stock, while the peripheral countries face a shortage, expressing the contradictions of the world-system. However, this gap is further accentuated when we observe that the production, design, and management of vaccines is concentrated in central countries. Likewise, a quarter of the world population will not receive vaccines until 2022 due to the central countries vaccines' hoarding (Gutiérrez 2020). Moreover, pharmaceutical companies have requested modification of the legislation as a condition for the sale of vaccines, imposing conditions on countries such as Argentina (Ibáñez 2020), setting the rules of the game on semi-peripheral and peripheral countries that exclude possibilities for future innovation and development.

In the last four decades, the biopharmaceutical sector underwent profound structural changes. It developed new heuristics and organizational capacities around modern biotechnology, molecular biology, and genetic engineering. The oligopolistic appropriation of these technologies was a consequence of the "R&D privatization" process that took place after the World Trade Organization (WTO) TRIPS, restricted peripheral or semi-peripheral countries access (Gadelha et al. 2020). Second and third generation vaccines, whose development involves the use of molecular biology, genomics, and genetic engineering tools, remained, through aggressive intellectual protection strategies, in the hands of few world players. Many poor countries found access to, but especially the production of vaccines linked to modern biotechnology difficult.

Place assignment of countries in global value chains responds to certain geopolitics. The link in which a country locates itself within global value chains is a consequence of geopolitics. Pharmaceutical multinationals, large for-profit corporations and interests in R&D form an intricate link of lobbying and States relations, international organizations, and civil society organizations imprinting their interests in health and vaccination purposes. However, is the role given to the countries of the periphery and semi-periphery the same as those of the dynamic centers

of capitalism? Argentina, a country in the semi-periphery, is part of that geographic order assigned as a vaccine testing hub whose accumulated knowledge is raised in other geographic centers, and with whose population the final tests are carried out to stop the global pandemic. Discourses of scientific excellence and national productive capacities may have played a central role in the choice of the country for vaccine production by these corporations; and their potential benefits will be global in health and corporate in terms of knowledge, profits and profitability. Argentina does not have access to full local production—the complete value chain—capacity and with free manufacturing availability as it is conditioned by international laws and contracts. Argentina, finally has got access to vaccines to mitigate the disease in the national territory[1].

However, only one part of the vaccine production is carried out locally. The vaccine developed by the University of Oxford, produced and marketed by AstraZeneca, only produce the active ingredient—modified chimpanzee adenovirus—in Argentina but the final packaging and completion of the serum will take place in Mexico. The country must buy them at a price between $3 and $4 a dose. In the case of the Pfizer mRNA vaccine, the agreement does not provide for local manufacture. In the case of the Chinese Sinopharm vaccine, it is unknown if there is a technology transfer agreement for a local company to manufacture the inactivated virus and packaging of the vaccine.

We need to ask ourselves about vaccine production dependency in the global value chain, questioning whether it satisfies the logistic needs of a multinational with the purpose of placing its production in one of the largest markets in the world. The strategic objectives of the Argentine state in health terms appear fuzzy in this agreement, since it did not intervene in the negotiation; not publicly at least. Moreover, in the context of vaccination against Covid-19, third generation vaccines are being produced but they had never been tested in humans before—in the case of Pfizer—and on top of the pandemic urgency it raises questions not only of a medical nature, but of a political one, because of the role of the populations used voluntarily for these tests.

In an unequal geopolitical order, the periphery and semi-periphery are limited in their development capacities of local knowledge, trial matrix, and market access, deepening the scientific and technological gap with advanced countries. To achieve certain levels of technological autonomy and sovereignty, it is necessary to achieve local R&D levels, scaling, and distribution capabilities. The vaccine as public policy is developed and produced by domestic state and private laboratories. Scientific institutions and regulatory agencies prevent other states and pharmaceutical corporations from blocking access to the necessary technology that can be

1 The first batches of vaccines that the country was able to obtain in the first months of 2021 were from Sputnik V of the Gamaleya Institute, Russia. Several weeks later it was announced that Argentina's Richmond laboratory would produce Sputnik domestically, strengthening Argentine-Russian bilateral relations, and Argentinian reliance (except for AstraZeneca) on non-Western vaccines. Richmond laboratory has the technology to package the doses produced in Russia, receiving a technology transfer similar to the contract with AstraZeneca, without participating in its development. On the other hand, the Pfizer vaccine had not reached Argentina because the contract was not signed due to legal differences between the Argentine State and the American multinational. Subsequently, the president of Argentina signed a decree in July 2021 to receive doses from laboratories in the United States. Days later, Moderna vaccines arrived in the form of donations (Centenera 2021).

profitable for the national economy and, eventually, be exported in order to position domestic actors with the capacity to generate income and substitute technological imports.

Since the 1970s, simultaneously with this concentration process, a network of global institutions and multilateral organizations specialized in health has been set up. These networks do not legislate in international matters, but "advise" on certain health policies. The universal vaccination initiatives, promoted by the WHO, played a decisive role in consolidating the most concentrated players in the industry; later, new organizations such as PAHO, UNICEF—placing supplies in Latin America and peripheral countries—GAVI, CEPI, and the most recent, COVAX, completed the scenario. The decline in the productivity of new drugs observed in the 2000s contributed to increased industry interest in investing in vaccines (Gadelha et al. 2020). On the other hand, the WTO has sanctioned countries for not complying with TRIPS. For example, for producing any type of medicine outside the rigid intellectual protection system—which limits the shortening of the biotechnological gap based on imitative paths of industrialization—with which the large transnational companies protect their developments (Correa 1997).

Thus, a set of pliers is formed between the WHO and the WTO in which deindustrialized countries or those with a medium industrial level in the pharmaceutical sector, such as Argentina, are trapped. One pushes for health policy functional to the large pharmaceutical conglomerate—the WHO—and another ensures that the blocking capacity is not violated—the WTO. As the globalization process has progressed, the capabilities of R&D, development, production, and scaling around the production of vaccines has been dismantled in Argentina. Argentine pharmaceutical production capacities were decimated proportionally to the speed with which vaccines were added to the National Vaccination Plan (Corvalán 2017). A clear example of the loss of technological and health sovereignty vis-à-vis multilateral health organizations and multinational pharmaceutical companies is the sanction by Congress of the "Law on Vaccines Intended to Generate Acquired Immunity Against COVID-19" in October 2020[2]; it offers an "extension of jurisdiction in favor of arbitral and judicial tribunals based abroad" and financial indemnity regarding compensation and other claims (Lombardi 2020). Later, the Ministry of Health reported that Pfizer demanded a new law and that the contract should not be signed by the minister of the area, but by the president himself—a request considered "unacceptable" (Infobae 2020a). The safety of vaccines approved in record time is not assured, and the large corporation has demanded guarantees from states that there will be no economic consequences if there are serious adverse reactions to the vaccine or problems with the conservation regarding to logistics and delivery.

Likewise, the domestic pharmaceutical sector consolidated in the last three decades makes low or null investments in R&D (ENDEI II 2020); it aims to maintain its profit margins based on price increases, guaranteed purchase of vaccines by the state, and technology transfers from global value chains while remaining totally disconnected from the local biomedical knowledge-generation ecosystem. The situation is completed with Big Pharma and global governance bodies,

2 Law No. 27573 was promulgated on November 6, 2020 by the Presidency.

medical foundations, and NGOs funding—Infant and Huésped—ensuring the moral and "scientific" scaffolding that legitimize the actions of the big players. The medical corporations play a prominent role in enforcing these policies.

Argentina signed three agreements with AstraZeneca and mAbxience, among others, to produce the active component of the vaccine developed by the University of Oxford; the one that Pfizer and BioNTech have with the Infant Foundation to carry out Phase III trials of their vaccine; and the one agreed by Sinopharm with the Huésped Foundation to carry out Phase III, sponsored by ELEA Phoenix. The three vaccines have different technical characteristics: a recombinant chimpanzee adenovirus vaccine, an mRNA vaccine, and another attenuated virus vaccine. The Ministry of Health sought to ensure—directly or indirectly—the provision of numerous different vaccines, eclectic from a technological point of view, with the stated aim of ensuring a sufficient supply and of having technical alternatives in the event that one (or several) fails. AstraZeneca's and Pfizer's vaccines are modern, third-generation vaccines with high technological value, while the Chinese vaccine is traditional. However, the new technology had never been used in humans before. An mRNA vaccine had never been approved to treat any infectious contagious disease, and there is no history of clinical trials carried out outside of a pandemic. Applying this technology in a health crisis is not the most advisable from biosecurity viewpoint, because the pressure prevents a clear assessment of the possible side effects and unwanted adverse reactions that may be harmful to health and that may appear in the medium or long term. However, an mRNA vaccine is easy to scale industrially and it's a flexible platform, which means it's easy—cheap and fast—to redirect towards new strains of SARS-CoV-2 (Schlake et al. 2012).

On the other hand, the AstraZeneca vaccine is based on an adenovirus that causes colds in chimpanzees. The presumption is that, given this characteristic, it could not cause any pathology in humans; a viral particle is being introduced to the body that has never received it before. From an immunological point of view it carries a risk because there are no guarantees that it cannot cause another pathology. For this reason, there was a controversy, regarding the Russian vaccine against Covid-19, Sputnik V, designed by the Gamaleya Center; which uses two doses of a modified human adenovirus vaccine (Sputnik V 2020; Infobae 2020b). For this type of platform, there were already three globally approved vaccines, with more than 60,000 people injected against Ebola fever in Africa, China, and Russia. It is a technology of proven efficacy and safety, even used against cancer (Sputnik V 2020).

It is expected that, in the near future, zoonotic events—infectious contagious diseases travelling from animals to humans—will grow as a result of ecological degradation and the consequent elimination of natural barriers—jungles, forests, large masses of ice—between humanity and different types of non-human animals and microorganisms (Wallace 2016). Having local platforms for the production of vaccines with a diversified range of technologies will be essential to prevent the large pharmaceutical industry and central countries from unloading the global costs of each health crisis, in human, social, and economic terms, on peripheral and semi-peripheral nations. This will require regional planning, because the blocking capacity of transnationals and multilateral organizations cannot be dealt with solely from Argentina.

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