

**El reto de las enfermedades infecciosas al paradigma biomédico
2004**

[Forthcoming in *Bulletin of Science, Technology & Society*]

The challenge of infectious diseases to the biomedical paradigm¹

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Abstract

The resurgence and emergence of infectious diseases raise questions on how to cope with the situation. The germ or clinical approach is the hegemonic biomedical paradigm. In this article I argue that the spread of infectious diseases has posted a challenge to the biomedical paradigm and show how lock-in procedures maintain alternative and complementary medicine paradigms in the backyard.

Keywords: alternative & complementary medicine; biomedical paradigm; infectious diseases; Public-Private Partnerships (PPPs).

Introduction

The resurgence and emergence of infectious diseases question public health policies. Alternatives to cope with epidemics are based on the different hypothesis of disease causality, but one of them, the germ or clinical approach is hegemonic on world public health. The clinical approach considers that there is a microorganism responsible for each disease. The World Health Organization (WHO) defends the idea that diseases are the main block to development in less developed countries, and if a vaccine or specific medicine can be developed for the main Third World diseases, such as malaria, and extensively applied in poor countries, socio-economic development would be the outcome. On the contrary, the social determination of health approach considers microorganisms as the agents, and lack of development as the final cause of disease.

Although the difference between both hypotheses of disease causality is clear, the hegemonic biomedical paradigm is not challenged. In this article, I argue that the spread of infectious diseases has challenged the biomedical paradigm. This article is divided into four sections. First, it summarizes the main causes of the spread of infectious diseases, showing the paradox between the identified causes and the proposed cures. The second section discusses the hypothesis headed by the WHO that malaria impeded economic development in poor countries, as well as the strategy to address the problem, and critics made by defenders of a social determination of health approach. The third section discusses the hegemonic biomedical paradigm. The fourth and final section establishes the relationship between technological trajectories and the social relations in which they are embodied; showing intrinsic lock-in procedures for non hegemonic paradigms.

¹ This paper was written as visiting research fellow at the Consortium for Science, Policy & Outcomes (CSPO- Arizona State University) www.cspo.org

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1. The resurgence and emergence of infectious diseases

During the last two decades humanity has been shocked by the alarming growth of infectious diseases. These diseases had stopped being an important cause of death in developed countries during the decades following World War II. It was assumed that developing countries would follow the trend in subsequent years. It seemed that detrimental microbes were going away or, at least, were controlled by vaccines and antibiotics. In 1969 the General Surgeon of the U. S. said to the Congress “It’s time to close the book on infectious diseases. The war against pestilence is finished”, and suggested to give more attention to cancer and heart diseases (Patlak, 1996). But the happiness lasted little. Between 1980 and 1992, deaths by infectious diseases in the United States increased by 58% (Hughes, 1998). In addition to the resurgence of old infectious diseases, new ones emerged. By the end of XX century infectious diseases accounted for ¼ of the world causes of death, following cardiovascular diseases. But, if we consider that many deaths by cancer, by problems of the circulatory apparatus, or by respiratory or digestive reasons can have infectious diseases as a more general cause, the burden that infectious diseases suppose is even greater (WHO, 1999).

The resurgence and emergence of infectious diseases is imputed to diverse causes. Table 1 summarizes the main, adding a brief explanation and examples.

Table 1
Causes of the resurgence and emergence of infectious diseases

Cause	Explanation	Example, related disease
New technologies	Changes in food chains. Air conditioning	BSE, Legionaries’ disease.
Changes in ecosystems and land use	New agricultural, mineral and forestry areas	Ebola fever, Lassa fever, <i>Hantavirus</i>
Travel and international commerce	Increase in people and merchandise travelling by air	SARS, cholera, meningitis, Nile virus.
Climate change	Expansion of the ecosystem of certain vectors	Malaria, dengue, yellow fever.
Withdraw of sanitary measures	Russia and diphtheria. Reduction of vaccine covertures in Sub-Saharan Africa. Monetary policies weakened public health systems in the nineties.	Diphtheria, hopping cough, cholera, hepatitis, malaria.
Wars, terrorism, massive migrations	Contamination of the environment. Undermine of infrastructure	Cholera, anthrax, leishmaniasis.
Demographic and behavioural changes	Urban concentration, sexual practices, drugs	AIDS, syphilis, hepatitis B and C.
Weakened of human immune system	Antibiotic over consumption	Multidrug resistance Tb
Microbial adaptation	Adaptation to antibiotics and insecticides	Tb, AIDS, gonorrhoea.

Source: Based on DH (2002), Kimball (2000), WHO (1999), Morse (1995).

The causes of the spread of infectious diseases question the modern way of life. They question the effects of market production that, driven by profits, force monoculture, the extensive use of insecticides and pesticides, the displacement of rural population and their concentration in urban areas, the concentration of income and increase of poverty. They also question technological trajectories that accelerate international movement of people

and merchandise, generate food chains propitious to the sprouting of new diseases, manage genetic structure creating unexpected results, concentrate cure efforts on the individual but, at the same time, create a less immune human being and supermicrobes.

It is a paradox that most attributable causes of the spread of infectious diseases are social, economic or technological, and not mechanically related to disease, while the world proposals to eradicate those diseases do not face directly those causes, but lay mainly on the discovery of new vaccines or antibiotics in the assumption that a magic bullet will overcome epidemics. At a first glance, a social determination of health seems a more plausible theory. As Milton Terris puts it: “There are no single causes of infectious diseases; their causes are multiple and entwined in a web of causation which is often more complex than that of many non-infectious diseases” (*Quoted by*, Tesh, 1988:61).

But, should a magic-bullet alternative not be considered when facing population collapse due to epidemics?

2. The “disease-blocks-development” hypothesis and its implementation

The anthropologist Peter Brown tested the disease-blocks-development hypothesis.³ He said that this hypothesis breaks the negative feedback loop between disease and poverty by arguing that disease captures the necessary energy that society needs for development, reproducing poverty. Although it is an old argument, it has been revitalized by the Committee on Macroeconomics and Health of the WHO, arguing that when a society is facing population collapse, due to infectious diseases, as is the current case of most sub-Saharan countries, it can not develop. The proposal suggests that combating a specific disease is an economic measure that, if successful, will open, together with the reestablishment of market forces, the path to development (Sachs, 2003; Gallup & Sachs, 1998). This disease-blocks-development approach is accompanied by the clinical approach to diseases⁴ as the technological counterpart necessary to fulfil the goal. In the end, research on vaccines and antibiotics would be the main way to attack poverty. This approach supports the hegemonic biomedical paradigm and the technological trajectories related, as it rests on the hands of pharmaceutical corporations (pharma) to find the right vaccine or drug for each disease. Not surprisingly this is the approach of pharma, but it has also been the approach of the WHO during the last decade.

In order to foster research for neglected diseases, the 46th World Health Assembly of the WHO (1993) decided to call for support on the private sector and Non Governmental Organizations (NGOs) through Public-Private Partnerships (PPPs) (Buse & Waxman, 2001). By the beginning of 2004, the data bank of the Initiative on Public-Private Partnerships for Health registered 91 PPPs, more than 80% created after 1995. PPPs are

³ Brown (1987) tested the hypothesis in Sardinia after the eradication campaign sponsored by the Rockefeller Foundation ended in 1951. By comparing the amount of energy drained from the peasant producer by landowners (macroparasitism) and by malaria (microparasitism), he concluded that while microparasitism accounted for 8.7% of gross production, macroparasitism accounted for 30.6%, showing that social relations are 3.5 times more important for development than disease.

⁴ The clinical approach is similar to the “germ theory”, developed near the end of the nineteenth century. It states that each disease is caused by a particular microorganism. During the twentieth century, due to the extraordinary development of genetics and microbiology, this theory became hegemonic.

non-profit organizations that aim to integrate pharma, philanthropic foundations, national and international public institutions, NGOs, and members of the civil society. It is a mechanism of coordination, R&D, and funding. The goal is to reduce health inequality, stimulate research in the less lucrative areas, and facilitate access for vaccines and medicine for people without the purchasing capacity. PPPs also administer public funds from various countries, the WHO, UNICEF, World Bank and from other organizations. At first glance they are humanitarian organizations based on mutual confidence between the three main actors: pharma, philanthropic foundations and public institutions. There are a variety of PPPs, with different management and administrative procedures. Nevertheless, the most important ones in terms of capital and public profile (e.g., GAVI, IAVI, and RBM) share core values and mechanisms.

The International AIDS Vaccine Initiative, founded in 1996, is a PPP that tries to accelerate the development of a vaccine against HIV/AIDS. Roll Back Malaria started in 1998 with the commitment to reduce the burden of malaria to a half by 2010. The Global Alliance for Vaccines and Immunization (GAVI), founded in 1999, has the commitment to facilitate the immunization of children from poor countries, as well as to stimulate pharma to produce vaccines for neglected diseases. Another example is Medicine for Malaria Venture also founded in 1999 as a result of conversations between the WHO and the Federation of International Associations of Pharmaceutical Manufacturers (IFPMA) to develop drugs against malaria.

The social determination to health approach offers a different point of view about the causes of epidemics, for which no lineal causation is possible. In the end, lack of development is the cause of disease, being the microbe only the agent. From this point of view, diseases will always co-evolve with humans in a dialectical relationship; but an equitable development would render society less vulnerable to disease (Terris, 2001; Levins, 2000; Tesh, 1988; Farmer, 1996; Evans *et al*, 1994).

From this last approach the policy of the WHO could be firmly criticized, and also the idea of a linear relation between disease and development. Concerns and critics on the engagement of the WHO in PPPs arose. Most of them refer to financial, economic, institutional, or ethical considerations. An abstract is shown in the following table.

Table 2
Concerns on PPPs

Item	Argument in favour of PPPs	Concerns	Authors
R&D orientation	PPPs could deal with neglected diseases for less developed countries. For the public sector it will be more costly and inefficient to develop skills on R&D that pharma already have.	Pharma will only participate on new drugs or vaccines that could be patented. Old infectious diseases where patents for their vaccines do not exist could re-emerge. Benefits will only reach less developed countries with reduced markets. Pharma will not permit low prices to reach important markets such as India, Brazil, or China. Poor people from developed countries will not be considered. Public R&D had historically been capable of producing vaccines and new drugs (polio, cancer, meningitis), or replicating others (AIDS).	Evans, T, 2001 Hardon, 2001 Orbinski, 2001 Hancock, 1998
Reduce risk & increase resources	R&D on drugs and vaccines is economically risky. PPPs could lower the risk	Market mechanisms (pull & push) will be necessary even with PPPs. Nobody is accountable for PPPs' outcomes. Shareholders do not participate in decisions. Some studies show that PPPs increase costs. There are other ways than philanthropy to deal with R&D, such as taxation, public production and distribution of vaccines and medicine.	Pollock <i>et al</i> , 2002 Kettler & Towse, 2001 Lob-Levyt, 2001 Orbinski, 2001 Walt, 2000 Hancock, 1998
Sustainability	The U.N institutions (e.g. WHO) need to increase their budgets. PPPs are a way to raise funds	R&D on drugs and vaccines need a long term budget. It is doubtful that PPPs could be sustained by donations. Experience shows the opposite. The WHO splits world health policies into several PPPs, which raises doubts about efficiency.	Muraskin, 2002 Yamey, 2001, 2002 Kettler & Towse, 2001
Mutual confidence between UN and corporations	U.N. pretends to promote corporate responsibility (The Global Compact).	History shows corporations using the U.N. for private interests. The U.N can not monitor corporate responsibility. There is a hidden agenda for corporations: political influence, set the global public agenda, enhance legitimacy, promote image, market penetration.	Boseley, 2003 Ollila, 2003 Richter, 2003 Dukes, 2002 Yamey, 2002 Buse & Waxman, 2001 Hancock, 1998
Are there alternatives for PPPs?	PPPs represent the way to address world health problems	PPPs will only deal with diseases of pharma interest. ¼ of PPPs are for AIDS and for less developed countries. Some critics (Richter, 2003) have called for a moratorium on new PPPs on health when the WHO participates. There are alternatives: public R&D and delivery of medicine and vaccines.	Ollila, 2003 Richter, 2003 Muraskin, 2002 Vakhovskiy, 2001 Hancock, 1998

In spite of the concerns and critics mentioned above, up to my knowledge no basic critics are addressed to the biomedical paradigm that the WHO promotes; this is awkward, since the recognized causes of epidemics claim for a broader approach. Due to the adaptation of microbes to antibiotics, the emergence of new diseases and the lost of human immunity, philosophies that tend to reduce people's vulnerability seem more credible, instead of the reductionist biomedical approach that bet the success on pharma through a magic bullet.

The clinical approach could seem reductionist. But, once socio-economic and health conditions of a given country have deteriorated, to the point of reducing life expectancy almost to a half in less than 30 years, as is the case of many sub-Saharan countries, there won't be easy alternatives and to attack diseases one by one might seem necessary. But even to recognize the need of an immediate magic bullet alternative should not despise the fact that the reason why those countries reached a population collapse could not be explained by health causes alone. The history of international economic relations, politics and market oriented production has the main responsibility.

3. The hegemonic paradigm

Since Kuhn (1962) "normal" science is science pursued by scientists sharing a paradigm that is hegemonic during a period of time. The paradigm supposes a consensus on certain solutions or ways of interpreting phenomena. Scientists are trained within and adopt the values of the paradigm. Commitment to the paradigm determines the way the phenomenon of research is selected, the instruments and method to use and the literature to be based on.

During the 1970s the "paradigm theory" started being used within different sciences. Later, it was applied to technology, arguing that it evolves similar to science (Nelson & Winter, 1982; Dosi, 1982). Within the rationality of a scientific paradigm, diverse technological trajectories could be developed. Far from something neutral, technology is embodied in a scientific paradigm that prevents, by lock-in procedures, the evolution of technologies that do not correspond to the normal science paradigm. Other paradigms are difficult to evaluate or even to compare and usually disregarded as non scientific.

Over the last two decades consumption of alternative and complementary medicine has grown steadily in several developed countries (Fisher & Ward, 1994). Roy (2002) considers this acceptance of healing practices as an ongoing silent revolution in developed countries. In the United States, Eisenberg, *et al.* (1998) compared 16 alternative therapies used by adults in the year of 1997 in relation to 1990. The result showed an increase in the use of alternative medicine. The generic concept of Folk Remedies increased 2000%. Homeopathy occupied the second place with 386% of that increase, following medicinal herbs with a similar rank. An article in *JAMA* reported that 40% of families on a U.S sample used some form of alternative health care during the previous year (Astin, 1998). But this is not normal medical science, and do not receive resources, time and space that consumers demand. In another *JAMA* issue, the readers of the journal —supposedly students and health professionals— ranked "alternative medicine" in 7th place of importance for articles on the topic to be published in the journal; although "experts" —possible peer reviewers of the journal— considered its importance in 68 and 73rd place (Lundberg *et al.*, 1998). The control by "normal" scientists on complementary and alternative medicine research groups has been denounced, as in the case of the National Institutes of Health (Marwick, 1994), and demands against alternative medicine increased sustainable after the outbreak of the use of these medicine in the 1980s (Skolnick, 1994). Strategies of social and scientific closure are a way to keep the normal paradigm free from competition.

Alternative or complementary medicine offers a good example of the difficulty to evaluate paradigms that do not match with normal science. Acupuncture, for example, based on the principles of Yin and Yang could not respond to the causal explanation of modern Occidental science. Instead of looking for a causal relation between phenomena and events, acupuncture looks to achieve cohesiveness and appropriateness within things (Kim, 1998). Quoting Saks, Frank (2002) shows how acupuncture was completely rejected in Britain up to the 1970s, but gradually gained legitimacy within mainstream medicine. In order to maintain hegemonic medicine free of contamination, acupuncture was adapted by separating it from the theoretical framework and allocating it to the area of pain therapy as a technique. Acupuncture is incorporated to the therapeutic arsenal of normal science maintaining the biomedical paradigm unchallenged. Research on ways to improve traditional healing practices using advance western techniques are rare, but promising, as in the case of ultrasonic acupuncture (Jones, 2002).

A similar example comes from homeopathy. During the nineties, homeopathy had an increased reception between patients in many developed countries (Crawford, 2002; Feder & Katz, 2002; Cant & Sharma, 1996) that raised critics from normal medicine (NCAHF, 1994). Several institutions tried to evaluate the validity of homeopathic remedies from normal science criteria, but the outcomes were ambiguous due to the different paradigm (Jonas, *et al*, 2003; Cucherat, *et al*, 2000; Linde, *et al*, 1997; Ernst, 1995). While normal science expects that a drug cures a disease, disregarding other characteristics of the patient, for homeopathic medicine the same disease in different patients might require different remedies. While normal medicine is standardized, homeopathy is individualized, which makes very difficult to use similar procedures to test different paradigms (Feder & Katz, 2002; Ernst, 1995). Dürr (2002) argues that modern quantum physics could offer a plausible explanation for properties of biological processes that arise from relations, but could not be detected directly from the material base which is the focus of conventional medicine. This could be a path to explain holistic medical approaches using modern science frameworks.⁵

In spite of lock-in and economic power, the spread of infectious diseases have challenged biomedicine's paradigm in the last decades.

a) Antibiotic resistance and vanishing of human immunity

The sign that antibiotic's technological trajectory is dying comes directly from pharma. Only two antibiotics with novel mechanism of action have been approved since 1998. Some firms, like Eli Lilly and Co., or Roche Holding AG are moving out of the antibiotic arena. Others are reducing investment. The reason is the rapid adaptation of microbes to antibiotics (Hirschler & Pierson, 2004). The cost of developing a new drug may be more than 500 million dollars (Kettler, 2002). This amount has to be recovered during the patent's life of 20 years. During the first 12 years the company recovers costs. The last 8 are profit years (Grabowski & Vernon, 1994). The problem arises when microbes adapt

⁵ In a previous issue of the *Bulletin of Science, Technology & Society* (2002, 22-5) several articles show the possibility of a relationship between modern holistic scientific frameworks and healing practices. Other articles, from the same issue, discuss the absorption of energy from the external environment by the human body, which could explain ancient Chinese healing practices.

to antibiotics during the first 12 years. Once the medicine does not work, the company will not sell nor profit, or even not cover costs. This seems to be the normal situation, since microbes are adapting faster. Besides, overuse of antibiotics increases the rhythm of microbial selection, mutations and resistance. A vicious circle is created: pharma needs to sell more antibiotics; increase consumption accelerates resistance and resistance makes antibiotics worthless.

The resistance of microbes to antibiotics has been known for practically 50 years, when *Staphylococcus aureus*, a microbe resistant to penicillin appeared (NIAID, 2000). The boom in the production and consumption of antibiotics has increased microbe resistance and created a world-wide public alarm by the middle of the nineties. In 1994, *Newsweek* published the article “The End of Antibiotics?” (Begley & Brant, 1994). A cover of the *Times Magazine* of the same year carried the headline “Revenge of the Killer Microbes” and one of the inside articles mentions the challenge that bacteria resistant to multidrugs represent. In 1954, 2 million pounds of antibiotics were produced in the U.S. Nowadays, 50 million pounds per year are produced (EMS, 2003). It is calculated that half of the antibiotics used in the U.S. are for animal production. Part of this amount is used to treat diseases, but 90% is for prevention and promotion of animal growth (CDC *quoted by* ACP, 2003). By 1992, 13 300 hospital patients died in the U.S. due to bacteria resistance to multidrugs (whyfiles). Nowadays, multiresistant strains exist for all major diseases (ACP, 2003; NIAID, 2000).

The most common response of public institutions and NGOs worried about this problem is to reduce antibiotic consumption. It is estimated that 75% of the antibiotics used have questionable therapeutic value (Wise, *et al.*, 1998) and, depending on estimates, up to 50 % of antibiotics prescribed within communities are unnecessary (Viksveen, 2003). On the other hand, pharma react to resistant microbes by producing stronger and more wide use antibiotics —Cephalosporins and Fluoroquinolones—, through which even stronger super-microbes are created (Wise, *et al.*, 1998).

The same process that leads to the fortification of microbes weakens the human immune system, due to direct and indirect consumption of antibiotics through fruits, meat, salmon, etc., and the emergence of strains resistant to multidrugs. The poor and patients are the most susceptible to see themselves caught in the vicious circle (Follansbee, 2003).

It could be argued that antibiotics have saved millions of people, but it is also evident that this technological path implies the development of side effects that could not always be evident in the short term. The collateral effects of antibiotics are so widely recognized that drugs must label the known side effects in order to enter the market. Due to antibiotics, resistance reached epidemic level. No doubt this has to do with the technological path. Natural medicine, acupuncture, homeopathy, for example, hardly has collateral effects. The hegemonic paradigm is in challenge.

b) Vaccines

Vaccines represent a different technological path. In spite of the efforts of some PPPs, vaccines are not the main target of biomedical research. Vaccines are given once or twice

in the life of a person, drugs much more often. Vaccines are a preventive procedure; drugs are a way to cure. Drugs are, for pharma, a technological path much more promising than vaccines. Vaccines do not represent more than 2 % of pharma's sales, which demonstrates the limited interest they have in prevention.⁶ Nevertheless, when a vaccine is mandatory producers could profit highly. In addition, pharma and PPPs are not interested in production of already known vaccines, for which patent is not possible. GAVI, in its 2002 report, shows 63 % of its expenses destined to the development of new and expensive vaccines —as Hepatitis B—, disregarding health service coverages and distribution of old-known vaccines. This creates the possibility of a country being immunized against a disease for which a new vaccine has been developed, at the same time that lax the immunization for old-known diseases (Hardon, 2001).

Vaccines have long been considered as the main mechanism to prevent infectious diseases. Nevertheless, the WHO recognizes that every year nearly 4 million people die from diseases that could be prevented with vaccines; and, although the percentage of world coverage for the main child vaccines is nowadays approximately 80 %, it is very poorly distributed around the world. In addition, during the last two decades of the 20th century, in many Latin American, African and Asian countries, the economic policies of structural adjustment implemented by the International Monetary Fund forced the reduction of budgets —health and educational being the first—, so vaccine coverage fell significantly (Olilla, 2003). In 19 African countries the fall in immunization reached 50%. In Nigeria, for example, the general coverage fell from 80% in 1990 to 27% in 1998; in Togo, from 100% to 54% (Hardon, 2001). In China the health budget fell significantly during the nineties (WHO, 2002).

But, vaccines have other problems. Most of them must be injected, transported and kept in refrigerated conditions that are not always accessible for the less developed areas. Increase in poverty and social inequality means that the poorest have difficulty in accessing existing vaccines. Many vaccines are expensive and require special laboratories for their production or do not exist in sufficient amounts.

It is not clear if vaccines are, in effect, a succeeded technological path. In most developed countries infectious diseases were declining before massive vaccination, due to improvements in sanitary conditions, nutrition and housing (Dublin, 1948, McKeown, 1988; Delarue, 1977). Even for polio there are doubts about its effectiveness (Delarue, 1977). Vaccines are not free from controversies. Numerous concerns and uncertainties exist, especially with vaccines given to children. Vaccines are cultivated in chicken, monkey or other animal weaves. The capacity for genetic transference of viruses is sizable and swift, so vaccines can be introducing foreign genetic material and even unknown animal diseases into the patient, compromising their immune system, and causing unforeseen genetic changes. As sweeping and compulsory vaccination is relatively recent, it is possible that their generalized effects will not be understood until future generations. The system that reports the adverse effects of vaccines in the U. S. registered 128 717 accounts of adverse reactions to vaccines in the nineties. Since the end

⁶ Remedies that have to be taken regularly are more profitable. “the great thing about AIDS drugs is you have to keep taking them” reported a pharma executive (Gellman, 2000, A01).

of the seventies, the MMR vaccine (measles, mumps and rubella) has been associated with problems of autism in children. Since 1998 on, a series of articles were published, debating the merits of the vaccine, with a fallout that many professionals were pressured to leave their positions and several legal lawsuits ensued (Ho, n/d). Again, the resurgence of infectious diseases challenges this second line of normal science.

c) Neglected diseases and property rights

It is well known that pharma do not research on diseases for poor people. According to the WHO, by 2002, 80% of the world drug market was concentrated in North America, Europe and Japan, a geographic area where only 19% of the world population lives. But, 90% of the burden of disease is located in poor countries, where patients do not have the purchasing capacity to buy medicine. It is estimated that 18 million people died in 2001 of communicable diseases, because of lack of money to buy medicine or because of lack of appropriate medicine for particular diseases. A leader of IFPMA said: “Even at the lowest prices, many of the world’s poorest people cannot afford or obtain low-cost generic treatments for malaria, TB and other common diseases (Bale, 2001). He uncovered a harsh reality: without money access to medicine could not be possible under market-oriented production. He could not imagine any different way (as public health is) for patients with no resources to access medicine.

According to a report by Doctors without Borders, between 1972 and 1997, nearly 1450 new drugs were commercialized. But only 13 of them responded to communicable and tropical diseases, and are considered essential drugs according to the WHO. Two of those 13 were updated versions of pre-existing ones; two came out of military research, five from veterinary research, and one from the Chinese pharmacopoeias. So, only three drugs can be considered as genuine products of R&D from pharma (Trouiller, *et al.*, 2001).

Some people speak of a market failure, to refer to the fact that patients do not have enough money to buy medicine or pharma does not research on medicine for neglected diseases (Brundtland, 2001). This argument considers market as neutral and natural; helping the market helps poor people.

In the same vein is the “patents” problem. Due to patents, price of medicine is monopolist during 20 years. This makes impossible for poor people to buy medicine that hold patents. When an epidemic occurs, some countries could not afford to cover the cost of remedies. One of the most alarming historical cases, illustrating the behaviour of pharma against public health, was the action brought by 39 of the major pharma against the government of South Africa, to prevent it from producing generic medicine for AIDS’ treatment. The lawsuit, which the South African government won, showed total insensibility to human rights, on the part of pharma. As stated by the representative of the pharma after losing the case, the problem is of precedent: “while South Africa may represent less than 1% of world drug sales, the precedent of allowing a government to step on drug companies’ patent rights would have far-reaching effects, beyond the questions of cost and crises” (Block, 2001).

Again, PPPs came to rescue normal paradigm and technological trajectories. Market forces are considered neutral, and the participation of for profit companies in public health as normal.

IFPMA sees its participation in world health public policies as positive. In a 2000 document IFPMA offers some arguments in favour of their participation in PPPs and an answer to critics. It should be emphasized that PPPs defend implicitly or explicitly International Intellectual Property Rights and their regulations (TRIPs –Trade Related Intellectual Property Rights) so the discussion on PPPs cannot be separated from the one on TRIPs.

Table 3 shows the main arguments used by IFPMA to justify their participation in PPPs, collaborating with the world public health institutions, and in favour of the guarantee on TRIPs. The table also incorporates some of the main critics made.

Table 3
Arguments used by IFPMA to participate in PPPs and in favour of TRIPs, and critics

Item	IFPMA's arguments (2000)	Critics
TRIPs	It is very expensive to discover and develop new drugs and vaccines. Only pharma do. Only 1/1000 of drugs produced reach market and must recover the cost of R&D of others.	Actually, approximately half of the funds for R&D on health are public (Kettler & Towse, 2001). Although they are mostly in the first stage (discovery), pharma is subsidized with public funds. It is very difficult to evaluate the cost of a new drug. Estimations vary from 100 to 600 million dollars (Kettler, 2002).
National R&D	TRIPs attract capitals, and helps national R&D (ex: Korea).	There is little evidence that patents will induce greater indigenous innovation in developing countries or greater technology transfer (Sampat, 2002). TRIPs will increase costs in developing countries with industrial capabilities (Watal, 2000)
Innovation	60% of inventions by pharma would not have been developed absent patent protection Mansfield (1986)	Prioritizing new drugs and vaccines could withdraw attention from distribution of existing vaccines and health services, leading to the resurgence of old infectious diseases (Richter, 2003; Hardon, 2001).
Safe products	Compulsory licensing does not guarantee safe products	Brand corporation medicine does not guarantee safety products. There are hundreds of suitcases against medicine that provoke collateral effects or do not cure at all (Berenson, 2003). The increasing lobby from pharma on countries' governments, and on international organizations, debilitates independent control and leads to auto-censorship (CRP, 2003; Collier & Iheanacho, 2002; CAFMR, 1995).

Critics are directed to economic, financial and ethical aspects. As in the case of PPPs, no critics are directed to the scientific paradigm or technological trajectories. Behind these critics are the general believes that the current mainstream medical paradigm is the only possible.

4. Capitalist social relations constrain and select technological trajectories

Microbial resistance to antibiotics, side effects of antibiotics, unseen consequences of vaccines, the existence of neglected diseases and the patent's property right confrontation are all well recognized health dilemmas. What is not recognized is that these problems are challenging the biomedical paradigm. In order to hide evidences the market failure

hypothesis is used. If antibiotics do not work, or pharma do not research in neglected diseases, more money should be given to pharma. PPPs are the instrument to revitalize markets and pharma. Funds will come from philanthropic institutions. Markets and pharma are seen as neutral. But this is not the case. Markets are not neutral; they are the expression of certain social relations, where some gain and other loose. A technological trajectory does not survive if its production outcome does not sell. Pharma make use of several non market mechanisms, questionable from an ethical point of view, to impose its hegemony. Table 4 presents examples and references.

Table 4
Pharma influencing world public health institutions or acting against public interests

Examples	References
Independent determination of standards compromised or auto-censored by influence of pharma.	Ferriman, 2000; Woodman, 1999
Concentration on drug donation and its development instead of developing research capacity in countries of low income.	Buse & Walt, 2002; Hardon, 2001
Donations and influences on world health policies dealing with diets, pesticides use, additives, sugar, trans-fat acids, etc.	Richter, 2003; Shretta, <i>et al</i> , 2000
Giving funds to universities in order to have influence on decisions in R&D and gain the right for subsequent licenses. Bankrolling academic studies that downplay their interests.	Montaner et al, 2001; Press & Washburn, 2000
Fraudulent or doubtful laboratory trials.	Shah, 2003; Bodenheimer, 2000; CAFMR, 1995; Braithwaite, 1984
Copy of prototype medicine (me-too drugs) instead of research in new ones.	(Garantini, 1997).
Monopolistic policies and corruption. Political lobby.	Federal Trade Commission, 2001; Galeria, 2001
Incite physicians to use governmental forms fraudulently in order to obtain reimbursements for medicine obtained for free from pharma.	Hensley, 2003
Pressure on researchers to impede detrimental information to reach the public.	(Collier & Iheanacho, 2002).
Evergreening patents (extending the patent's life) by means of registering the same drug for different treatments. Legal claims for actions upon undergoing patents that can extend the period. Mechanisms to extend an already approved medicine for different treatments without the necessary new bureaucratic procedure, helped by loopholes within the law.	Armstrong & Forelle, 2002; Henry & Lexchin, 2002; Barret, 2001; Angell, 2000

These cases can easily be expanded on, since there is not a single month of the year in which the major world newspapers do not offer new examples of the unethical behaviour of pharma, while the testimonials of patients that took drugs detrimental for their health are growing steadily (Berenson, 2003).

This is not only an ethic concern; it is the normal outcome of a multimillion market. Any of the examples also show that social relations and class struggle is of great importance for the understanding of the way a paradigm becomes hegemonic.

There are also other powerful reasons embodied in capitalist social relations that reinforce the hegemonic paradigm. Products that can be sold massively and directly to the

consumer are better than individualized remedies and than services. Products that can hold a patent represent monopolist profits and are better than products that can not hold patents. Comparing biomedicine, homeopathy and acupuncture, those differences arise.

In biomedicine, the remedies could be clearly separated from the service of the physician and could also be bought directly by the patient. The medicine is standardized and the patient could skip the physician buying it directly. In acupuncture there is no medicine. The service of the physician can not be avoided. Homeopathy stands in between; the practice of the physician is necessary because the medicine is individualized, so the possibilities of the patient to buy the remedy directly are not as simple as in biomedicine.⁷ Besides these differences is the patent question. Already known medicine could not be patented. Neither acupuncture nor homeopathy could hold patents as biomedicine can. Table 5 illustrates these differences.

Table 5
Relation between therapy and market viability

Therapy path	Final product	Character of the product	Scientific knowledge of the product's properties remains on:	Patents
Biomedicine	Mercantile	Massive	Pharma & weak in physician	yes
Homeopathy	Mercantile	Individualized	Pharma & strong in physician	no
Acupuncture	Service	Individualized service	physician	no

The table goes beyond pull and push market mechanisms, showing the intricate relation between the production-circulation-consumption process and capitalist social relations. Holistic philosophies of alternative and complementary medicine are not relegated only because of its usefulness or scientific loops, capitalist social relations choose those technological trajectories that could easily be subsumed to the working of the market.⁸ Not surprisingly the “Complementary and Alternative Medicine Institute” only received 0.42% of the budget of the National Institutes of Health of the United States in 2003 (AAAS, 2003).

Final remarks

The biomedicine paradigm is facing huge transformations. Since middle eighties the molecularization of the technological basis permits new techniques as high-throughput screening, which makes it possible to screen vast compounds with automated mechanisms, increasing the velocity to assemble molecular entities in potential components and test them. New technological trajectories are been developed, but the basic scientific paradigm remains. The reduction of the human organism into parts, the study of the properties of each part, and the belief that the sum of the properties of the parts explains the whole is the philosophical dogma that persists.

The resurgence and emergence of infectious diseases has challenged this reductionist approach in several ways. Unseen consequences of biomedical medicine, evolution of

⁷ Homeopathic schools that combine several medicines in one remedy will reach the market easier.

⁸ Other healing practices could be an even more difficult task for markets to penetrate (see, for example, several articles on the Theory of Bigu in *Bulletin of Science, Technology & Society*, 2002, 22-5).

microbes and adaptation to antibiotics, side effects of medicine or loss of human immunity are but the more visible. But the mere spread of epidemics is the most clearly demonstrated that poverty, inequality and ecosystem changes must be taken in account in order to surpass the health crisis. Even in the case that a magic bullet eradicates a disease, other microbes will fill in the empty space. This is why pharma bet on this technological path; it is a never end source of profits.

At an individual level something similar happens. The reductionist approach is searching for individualized remedies according to the genetic pool of the patient. This individualization will raise health care costs, deepening inequalities and spreading diseases even more. Treating diseases one by one raises the vulnerability of the patient to medical knowledge and pharmaceutical corporations.

Lock-in procedures leave in the backyard scientific paradigms and technological trajectories that have been increasingly demanded by patients. They are paradigms that work from a holistic approach and whose technologies are more difficult to be subdivided in merchandised parts.

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