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Challenges and contradictions of the current biotechnological industry

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ABSTRACT

In the current biotechnological industry there is an increasing tendency towards research, development and production of medicines destined for the treatment of predominating diseases in the developed world and a decrease in those required for the treatment of the diseases that affect the countries of the Third World. Five groups of viral, bacterial and parasitic diseases kill more than 11 million persons a year in the underdeveloped world and there is still lack of an effective treatment for them. The causes of this problem are in mercantilist politicies of the transnational pharmaceutical companies and the lack of a political will of the third-world governments to look for new solutions. Cuba, a blocked country and with diverse material lacks has found a coherent formula to face this problem with the development of a scientific - social project that allows to put to the service of the Cuban society all the obtained scientific results and by means of international projects, to take the fruit of the work of the Cuban researchers to the poorest countries of the world.

Keywords: pharmaceutical industry, biotechnology, monoclonal antibodies, hr3, patents

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RESUMEN

Retos y contradicciones de la industria biotecnológica actual. En la industria biotecnológica actual existe una tendencia creciente hacia la investigación, desarrollo y producción de medicamentos destinados al tratamiento de enfermedades predominantes en el mundo desarrollado y una disminución en los requeridos para el tratamiento de las enfermedades que afectan a los países del tercer mundo. Cinco grupos de enfermedades virales, bacteriológicas y parasitarias dan muerte a más de 11 millones de personas al año en el mundo subdesarrollado y aún se carece de un tratamiento efectivo para ellas. Las causas de este problema radican en las políticas mercantilistas de las transnacionales farmacéuticas y la carencia de una voluntad política de los gobiernos tercermundistas para buscar nuevas soluciones. Cuba, un país bloqueado y con diversas carencias materiales ha encontrado una fórmula coherente para enfrentar este problema con el desarrollo de un proyecto científico-social que permite poner al servicio de la sociedad cubana todos los resultados científicos obtenidos y mediante proyectos internacionales, llevar el fruto del trabajo de los investigadores cubanos a los países más pobres del mundo.

Palabras clave: industria farmacéutica, biotecnología, anticuerpos monoclonales, hr3, patentes

*I*ntroduction

The biotechnological tools for the prevention, diagnosis and treatment of diseases are of big interest for life in the contemporary world. The DNA-sequencing techniques, the new recombinant vaccines, the production of hormones, the cloning of embryos and other techniques have had a beneficial impact in the human health. The biotechnological industry is a sector of the economy where products are generated with a high added value, based on the knowledge and the development of science. The high component of knowledge, as well as the industrial infrastructure for the manufacture has been reflected in its high prices on the market.

The technological premises for the expansion of the productive biotechnological process existed since the decade of the 70's, after the emergence of the cloning technologies and gene expression (genetic engineering) and of the modern development of the techniques of large-scale cell culture, the fermentation and the chromatographic purification of biomolecules [1]. The transformation of these premises in an industry began in the United States at the end of the 70's and beginning of the 80's with the appearance of multiple biotechnological small-scale enterprises that made use of the favorable moment of the economy of this country to mobilize risk capital from private investors or from the stock exchange. In Europe, an equivalent process did not begin until the end of the 80's and the access to risk capital, did not happen until halfway the 90's [1]. At present, it is believed that slightly more than 4 275 biotechnological companies exist in the world, from them: 64% work on the human health [2], 45% is in North America, 38% in Europe and 17% in Asia and the Pacific Ocean (Figure 1). In the rest of the countries this phenomenon is still incipient, which shows the control of the main capitalist potency on the biotechnological markets [2].

The advances in biotechnology are changing the way of working in the pharmaceutical industry. The information published by the Food and Drug Administration (FDA) and the European Medicines Agency (EMEA) show that 50% of the new medicines, approved in 2006, had a biotechnological origin and the regulatory agencies have been forced to regulate the development

1. Lage A. La economía del conocimiento y el socialismo: reflexiones a partir de la experiencia de la biotecnología cubana. Cuba Socialista (2004); 3ra época (30):2-28

2. Portal de la Biotecnología. Beneficios de la Biotecnología (2003-2007);diciembre 2007. http://www.solociencia.combiologia/07071780.htm

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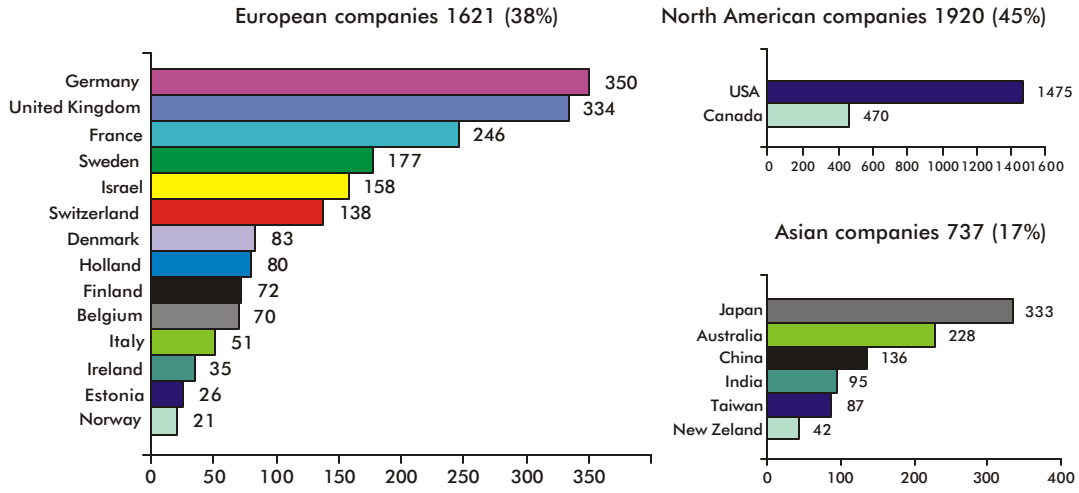

Figure 1. Distribution of the main biotechnological companies in the World.

and introduction of these new molecules [3]. At present, biotechnology is considered as a tool of production of medicines and, in fact, it constitutes a new model in the pharmaceutical innovation.

It is known that the biotechnological products are generally more difficult and expensive to be produced than the pharmaceutical synthetic products, because of the need for complex facilities, equipments and highly qualified personnel, the low yields of production and the high standards of quality needed for its invoicing and commercialization. For this reason, it is not rare the nonexistence of the boom of this industry in the underdeveloped countries, since it is needed also a very strong political will of the governments, the cultural and educational development of the society for its successful advance. Cuba is the exception when talking about biotechnology in the Third World countries, because it has a politics structured from the highest governmental levels, which guides the scientific research on the bases of the problems of health of the Cuban population, and an experience of more than 20 years of work.

When comparing the politics of Cuba with that of other latitudes, it is evident the enormous potentialities of the construction of an economy based on knowledge, creator of the material and spiritual wealth that guarantees the equity of the current social justice. These ideas were already raised in 1961 by Fidel Castro, when he said "… the future of our Homeland has to be necessarily a future of men of science, of men of thought".

It is evident in the Cuban society a new sense in the objectives of the biotechnological company, since its results are put at the disposal of the community, which constitutes an activity with real humanist character, much differentiated from the merciless competitiveness of the transnational pharmaceutical companies of the industrialized countries.

In the present work it is described the current tendency of biotechnology on a global scale, designed to satisfy the laws of the market and not to comply with the demands of the most vulnerable societies, and it is distinguished in the Cuban project of health destined to solve the evils of health that affect the society, when placing knowledge at is service.

The biotechnological products and the tendencies of the world biotechnology

The components of the biotechnological products are produced by a biological organism, among which there can be mentioned: the monoclonal antibodies, the cytokines, the growth factors and many others, as the ones obtained from the use of the recombinant DNA technology, compounds derived from the blood or genetically transferred products. These products differ from the medicines of the pharmaceutical traditional industry in the method of production.

Nowadays, the biotechnological industry is in a phase of boom and expansion in its cycle of industrial life, demonstrated by the wide presence of its products on the market as well as, the perceived entrance of a new wave of last generation products in the next years. Nevertheless, they inform that the operational profit is relatively low and many companies keep on producing with negative cash flow [1, 4].

The international market offers today more than 80 biomedicines, among them: the human insulin, the vaccines against the hepatitis B and G-CSF, the human growth hormone, the erythropoietin, the monoclonal antibodies and the interferons, which generated in 2007 about 73 billion dollars, with a projection in the next five years of increasing in 50%. The world market of the biotechnological industry in 2007 was led by the United States with 71% of the world sales. In less than ten years, the biotechnology sector has experienced a growth in Europe of almost 800% in benefits, of 200% in the number of employees and of more than 60% in the number of companies [2, 4]. Only in Spain, the invoicing and the direct, indirect employment induced by biotechnology during 2006, was approximately 4 100 million euros and more than 37 000 persons respectively [4]. According to a report of *Datamonitor*, in October, 2006 there were reported 274 biotechnological compounds directed to 198 biomolecular targets, which market is being estimated

3. Wisconsin Technology Net Work. 06/05/07. (11/12/07): http://wistechnology.com/article.php

4. Honorato J. Medicamentos Biotecnológicos: características fundamentales; Madrid, diciembre 06-07. http://www. plannermedia.com/inesme/pdf medicamentosbiotecnológicos.pdf

with an increasing development to be trebled, from 7.5 trillions of dollars in 2005 to 25.2 trillions in the year 2015 [4].

Bearing in mind the polarization of the biotechnological researches towards pathologies that are habitually in the developed countries (where the researches are financed by the transnational biotechnological companies) it is obvious that a wide group of diseases, located principally in the tropic and in the Third World countries, escape from the attention of the investors.

Biotechnology and the third world

In the underdeveloped countries there is a group of diseases that provoke annually the death of 11.3 million persons. The main ones are: the malaria, the tuberculosis, the diarrheic diseases, the acute respiratory infections, the Human Immunodeficiency Virus / Acquired immunodeficiency Syndrome (HIV/AIDS), the hepatitis B, the measles, the polio, the leprosy, the chacra, the fever of the Nile and the sleeping sickness. The lack of effective medicines for their cure and of political will to develop national systems of health and sanitation campaigns, together with the absence of interest of the transnational biotechnological companies, are the ones responsible for these unnecessary deaths [5, 6]. Only 10% of the researches on health at global scale is dedicated to solving sanitary problems of developing countries. Nevertheless, there are medicines that are effective in the treatment of many typical diseases of the under-developed countries and nevertheless, more than one third of this population -and more than the half of the population of Africa- does not have regular access to the basic medicines necessary to treat these diseases [7]. The massive exclusion of the access to vital medicines is inevitably linked to the insufficient economic resources available that the underdeveloped countries have [8]. The infectious diseases are as a whole responsible for 63% of the deaths of children younger than five years and although the HIV/AIDS is an increasing threat for the world, its effects are disproportionately felt in the developing countries with 99% of the global load of these diseases [9].

The price is one of the factors that restricts the access to the new medicines. The commercial interest of the market in the rich countries has led to the absence of research on more obtainable, therapies including the vaccines to treat diseases that affect the poor people. The low expenses of the governments in health reflect a lack of political commitment with the public health. Nevertheless, habitually this is related simply to the lack of money [10]. In the presence of such circumstances, even the governments well-meant can spend very little in health and as consequence, millions of poor persons die every year because of diseases that, according to the World Health Organization (WHO), might have been preven-ted in many cases at a cost below 5 dollars per saved life [7].

Patents and biotechnological products

The protection of the intellectual property through the patents is a key factor that influences also the accessibility of the new medicines. When there has been restricted the right of the governments to allow the production, commercialization and import of low cost copies of the so-called "generic" patented medicines, the rules of the world organization of the commerce affect the competitiveness, increase the prices and reduce even more the already limited access of the poors to vital medicines [11].

The Declaration of the IV Ministerial Conference celebrated in 2001 in Doha (Qatar) establishes as compensation of the previously stated a series of elements for the negotiations on diverse topics and other works, which might be an option for the developing countries. In it, the developed countries also request that the developing countries open their markets before accepting better conditions for their exports [11].

The application of most strict norms on patents to the medical products is already causing serious problems, especially regarding the treatment of the HIV/AIDS. The patent versions of the antirretroviral therapies that are used to keep the HIV under control, and of other effective medicines against the diseases that accompany it and cause opportunist infections, cost habitually 15 times more than their generic equivalent ones. In countries with a high number of affected individuals and a chronic saturation of the sanitary budgets, the difference of prices can suppose the exclusion of million persons from an effective treatment [9].

The WHO thinks that less than 5% of the patients that need treatment for the HIV/AIDS is receiving highly-active antiretroviral therapy. In the developing world, only 230 000 patients (from 6 millions that are calculated as needing to receive this treatment) receive it at present and almost the half of them live in Brazil [9].

The prices of the medicines are influenced by a wide spectrum of factors, including the costs of distribnution, the tariffs, the indexes of monetary exchange and the local economic circumstances. Nevertheless, the extension that reaches the competition on the pharmaceutical market performs a fundamental role in their determination. The prices tend to the fall and the products are accessible when there is 5 or more equivalent products competing on the market. The protection of patents limits the level of competition during a specific period, so the prices and the benefits are higher during this time, that is why it operates as a mean of stimulus to the innovation in the market economies [9].

The global dimension of the health problem of the countries of the Third World is shown statistically: the mortality among children younger than 5 years has a mean of 75 per every 1 000 in the entire World, but it goes from 6 in the developed countries to 151 in the Third world; the average life expectancy in the planet is 65 for men and 81 for women, but the existing disparity is made clear when it is compared with the poor countries of the African continent, where the life expectancy is only 49 and 52 years respectively; in Africa, the infectious and parasitic diseases represent 60% of the deaths, in Europe, nevertheless, it represents only 5% of the whole of deaths, whereas 70% of the deaths are caused by cancer and cardiovascular diseases (which are releated to the age and factors inherent in the way of life) that represent less than 15% of the whole of deaths in Africa [12].

For many years, among the non-governmental organizations there was established the idea that the

5. Bernstein K. Third world solutions. Biocentury (2005); 28 de marzo:1-23.

6. Heymann D. Bulletin of the World Health Org. (2002); 80(3).

7. OMS. Informe sobre Enfermedades Infecciosas (2007); 24 de agosto; Año 8: 2649. http://www.larepublica.com.uy/comunidad/272367-las-enfermedades-infecciosas-son-el-mayor-peligro-actual-para-la-oms

8. OXFAM. Documento Informativo sobre la empresa PFIZER. Una receta para la justicia. Los derechos de las patentes frente a los derechos de los pacientes. julio 2001.www.ontermon.org.

9. PhRMA-Pharmaceutical Industry Profile (2007); diciembre. http://www.phrma.org/files/Profile2007.pdf

10. Informe Mundial sobre Desarrollo (2000-2001):274-5

11. OMC. Acceso a medicamentos esenciales y de alto costo (2007). http://www.secretariasenado.gov.co/estudios-ARD/019Accesoamedicamentosesencialesydealtocosto. pdf

12. "Removiendo Obstáculos para un Desarrollo Saludable" OMS, Informe sobre Enfermedades Infecciosas 1999. http://www.intermonoxfam.org/unidades información/anexos/7924/061114_patentes vs_pacientes.pdf. Diciembre 07

vaccines for the underdeveloped countries should always be donated or provided to its populations at low prices, idea rejected by the private sector since, this way they could not exploit economically the results of the development of new vaccines [5]. This thought had no setback up to a few years ago because the vaccines donated to the persons both in developed and underdeveloped countries were the same and the private companies could recover their investments in regions that were capable of paying the high prices that the market [5] was dictating. Considering the insolvency of the underdeveloped world, the vaccines for these countries have been paid commonly by organizations as United Nations (UN), United Nations Children's Fund (UNICEF), PanAmerican Health Organization (PAHO), WHO and other non-governmental organizations. The buyers have used their domain always to negotiate cheapest possible prices with the threat of a coercive license in the back-ground, which has dissuaded to the private sector [5].

But new factors affect the approach of the "non-governmental" organizations, because of which the diseases of high incidence with the populations of the underdeveloped countries for whom appropriate vaccines are needed, do not coincide with the diseases of the industrialized countries, therefore, there is no market that impels the research and the development of new vaccines. Also the old model, that includes the delivery of funds for research to "non-corporate" entities, has not turned out into novel products [5].

The impotence that torments the survivors of the emergent diseases has a significant weight in the society, but due to the poverty of the individuals in risk there has not been an incentive based on the market to develop the preventive vaccines that have eradicated similar diseases in the industrialized countries. The fact of the matter is that there are vaccines that are cheap to produce; but this is not incentive enough for producing them [5].

At present there is a generalized tendency towards research, development and production of medicines for the treatment of the diseases and a decrease in the research of new preventive vaccines. This tendency is led by the natural laws of the market and the populations of the most affected underdeveloped countries are the ones not having economic weight on the world pharmaceutical market. Dr. Fidel Castro in a speech in the Latin-American School of Medical Sciences in Havana denounced: "… today, without having defeated yet old diseases, new plagues arise, as the AIDS or the fever of the Nile, which already prowls around this hemisphere, that did not exist a number of years ago; the resistance of bacteria and diseases to certain products; the application of a mercantilist policies that avoids the prevention for preferring what produces more economically, that is the creation of medicines with therapeutic purposes. All these circumstances have been aggravating the risks for the health and the sanitary problems of the world" [13].

The pharmaceutical industry has been growing in a value superior to 700% since 1980 [3]. Significant scientific advances have been reached, but the developing countries are not sure of the benefits. Less than 10% of the pharmaceutical sales of the world aim at the developing countries and only 1% of the sales, at Africa [9]. The consumption in research and pharmaceutical development is also slanted developing countries of the World with only 10% of the global expense directed to diseases that respond to 90% of the load of the diseases of the world [9]. There has never been a pronouncement so that the industry makes its contribution and fulfills its social responsibility.

The reports of last two years of the Pharmaceutical Research and Manufacturers' Association of America (PhRMA) show a wave of new biotechnological products, which in a few years will invade the world market; but as it has already been stated they do not reposnd to the most serious health problems of the underdeveloped countries [14].

The biotechnological industry in Cuba

The Cuban biotechnological industry has before it self the challenge of resisting the outbursts of the economic blockade of the United States. All these years, it has not only survived but it has managed gain the admiration of the international scientific ommunity. Since the victory of the Cuban Revolution in 1959, the direction of the country arranged the resources necessary for the development of the Cuban science, based on the historical legacy of great Cuban scientists of last centuries, like Tomás Romay and Carlos Juan Finlay among others.

Under the orientation and conduction of Dr. Fidel Castro, the Biological Front was created in 1981 and there began a process of foundation of research-production centers that included the decade of the 80's and the first half of the 90's, and gave place to what is today the Scientific Comunity of the West in the capital of the country, a complex of more than 40 institutions that groups more than 12 000 workpeople and more than 7 000 scientists and engineers. With a smaller volume, biotechnology extended also its activities to other provinces, mainly Camagüey, Sancti Spíritus, Villa Clara and Santiago de Cuba [1]. Some of the main biotechnological products obtained in Cuba in the health field are [15]:

- Recombinant interferons (Alpha and Gamma) and interleukin-2.
- Proteins from the AIDS virus for diagnosis.
- Recombinant epidermal growth factor.
- Monoclonal antibodies.
- Ateromixol (PPG).
- Restriction enzymes and modification of nucleic acids.
- ELISA ultra microanalytical system for massive diagnosis.
- Recombinant Streptokinase (unique in the World through genetic engineering) capable of stopping the infarction up to six hours after having initiated.
- Vaccines and vaccine preparations, among which stand out: the vaccine against the meningococcal meningitis group B (unique in the World) with sanitary record or undergoing approval arrangements in more than 19 countries of all the continents and invention patent in other 25, and the recombinant vaccine against the hepatitis B.

13. Discurso pronunciado por el Presidente de la República de Cuba, Fidel Castro Ruz, en la Escuela Latinoamericana de Ciencias Médicas, el 3 de diciembre del 2002. http://www. cuba.cu/gobierno/discursos/2002/esp/f031202e.html. Diciembre 2007.

14. Holmer Alan F; PhRMA. "Medicine in development biotechnology"; 2004. http://www.pharma.org/filesprofile 2004 pdf. Diciembre 2007.

15. Lage A. Donde la ciencia se transforma en industria. Cuba Foreing Trade (2005); 1:6-20.

- Vaccine based on the synthetic antigen of the virus of the influenza, the first vaccine obtained by entire chemical synthesis on a global scale.

The experience of the Cuban biotechnology has been successful with any indicator that it is desirable to use for measuring it: generations of products (biomedicines and vaccines), impact in the public health, patents, exports, cash flow, cost per peso weight, return of the investment or others. The sector goes on in expansion and in fact an inflection was foreseen towards higher economic yields since 2007. These results constitute a peculiarity of the Cuban experience, since more than the half of the biotechnological companies arisen in the United States at the beginning of the 80's have not been able to reach profitability and have ended up being acquired by others (mainly by big pharmaceutical companies) and it is believed that in the current moment scarcely 20% of the North American and European biotechnological companies manages to be financed by their own product sales [1].

The main centers of the Cuban biotechnology were designed as research-production-commercialization centers. This meant that the complete cycle was under the same administration: to investigate, to obtain new products, to mount the productive process, to produce, to distribute the products in Cuba, to export them and then, feeback the complete process with the resources and also, with the information that comes from the commercialization. In fact, the great majority of the biotechnological companies of North America and Europe, although they call themselves companies and register as such, do not have any productive capacity and obtain it through manufacture contracts, which has been creating a huge "bottleneck" due to the limited productive capacity for the majority of the biotechnological products that are being evaluated in clinical trials [1].

Many have been the problems that the Cuban researchers have had to face, difficulties in the acquisition of indispensable sophisticated equipments to keep the high standards demanded by the offices that regulate the quality of the biotechnological products; delays in the purchases and increase of the reagents as well as, hindrances in the materialization of agreements and collaborations with friendly institutions, among others. The last variants for preventing the undeniable acknowledgement of the Cuban scientists has been the unsuccessful proposal of passing a law to prevent the North American publishing houses from publishing the scientific articles sent by the Cuban institutions, as well as the denial to grant visas to Cuban scientists and to prevent their presence in the scientific congresses in the American territory, all of them in detriment even of the same North American citizens who have been deprived from the Cuban inventions at the disposal of improving the health of all the human beings, without distinction of country or religious group.

The politics of the Cuban government is explicit with regard to science and health. When the Cuban economy was suffering a deep crisis, after the fall of the socialistic field and of the USSR (its only economic associate), under these precarious conditions the scientific community of the capital was still making projects and expanding, since it was regarded as a promise of health for the Cuban people, according to the words of Fidel Castro in the opening of the Center of Molecular Immunology in the year 1994 "… It is a pride being in full special period to inaugurate this center, which is not a luxury; it is a promise of health and well-being for our people and a promise of incomes for our economy …".

Everything previously stated was translated into a big commitment of the workpeople of the science sector, since the country had a few resources to create the necessary conditions for this industry. Thanks to the effort of many scientists throughout almost two decades, today the fruits of all this work are being collected and there have been obtained medicines and vaccines that guarantee the high levels of health of the Cuban society at the height of the industrialized countries, in some aspects even higher than those of the United States.

One of the angles of research directed to the health problems of the Cuban population is centred on the treatment of cancer. The Cuban health system has a group of biotechnological products under research, such as the monoclonal antibodies and already registered vaccinse, and some candidates that show a change in the quality of life of the oncological patients; a product like the colony-stimulating factor, which is destined for the recovery of the leukocytes in the chemotherapy of cancer, which allows carrying out more complete treatments and increasing the probability of healing, principally in neoplasias that affect children. There are also monoclonal antibodies for the diagnosis of tumors and the human recombinant erythropoietin, medicine against the anemia provoked by the chronic renal failure and other complaints as cancer. These two medicines, although they are technological assimilations from other products, constitute originalities in the process of obtaining, which allows their use in Cuba, previously impossible since it was under the monopoly of North American pharmaceutical transnational companies that imposed prohibitive prices [15].

Another completely novel product obtained by the Cuban biotechnology, is the monoclonal therapeutic antibody hR3. This product of Cuban patent has showed very encouraging results in tumors of the head and neck and cerebral tumors in children, in clinical trials carried out in Canada, Cuba, China and Germany among other countries [15, 16]. It has been recognized by the regulative North American office FDA and has managed to transgress the blockade of the USA against Cuba, requested to be administered in pediatric patients from diverse parts of the World.

A group of vaccine candidates of Cuban invention for the treatment of several types of cancer are in different development stages. Among them we can quote the vaccines of the epidermal growth factor system, which have showed antitumoral activity and it is thought to obtain its registration in Cuba during this year. This fact constitutes the first vaccine against lung cancer registered in the country and in the World. The vaccine against gangliosides is another project that is being tested in tumors that overexpress this structure, present in the membrane of the tumor cells. This one will constitute in a short time the second vaccine against cancer registered in Cuba and the first one against the breast cancer in the World [15].

16. Wilkinson S; "Biotech for all". Revista Cuba Sí; spring 2004. www.cubasolidarity.org/cubasi-article.asp?articleid. Diciembre 2007.

Another group of studied diseases are the autoimmune diseases, for which therapies are being tested with immunosuppressive antibodies that look for cure to pathologies like the rheumatoid soriasis and the arthritis. The immunosuppressants are already used for the rejection of organs having a proven effectiveness.

The Finlay Institute is a center of research-production of vaccines with vast experience in the production of human vaccines. This institution develops diverse variants, in agreement with the most advanced world tendencies in this sphere. One of the vaccines obtained in this institution is the unique effective vaccine in the World against the meningococcus B, which protects also against the serogroup C. More than 55 million doses of it have been applied in different countries [15].

The exporting activity of the Scientific Comunity finances the component in foreign currencies of the productions that are destined to the Cuban health system. The society benefits from the dividends of this fruitful industry, it allows it not to give character of "market" to the relations between the biotechnology centers and the health system, which reflects a very important ideological concept: the Cuban people is not "a client", on the contrary: the Cuban people is the socialist proprietor of the institutions and as proprietor, it is served [15].

There are other social plans in which biotechnological scientific institutions are involved, for example, the work of the Center of Immunoassays in the maintenance and development of a national network of laboratories for the perinatal diagnosis, the epidemiologic alertness and the safety of the blood, or that of the Center of Neurosciences in the social attention programs to the disabled. In many other cases, the Cuban centers are leading actors of national health programs, as it is the case of the vaccination programs, AIDS, cancer and hepatitis [1] .C With a social optics, the Cuban biotechnology from its clearly national own origin is a source of employment for a workforce of high qualification, and if the system continues its expansion, as it is to be expected, it will work as a "locomotive" of the Higher Education and in the creation of employments that are not budgeted, but direct contributors to the national economy. All this activity happens in the frame of a state socialist entity, property of the Cuban people, expression of the principle inscribed in the Constitution, of the social property on the main means of production [1].

Even if they do not constitute for Cuba a health problem, the country invests numerous resources to look for an effective cure for a series of diseases that constitute a health problem for the poor countries, although it is not less true than the main weapon to fight them back would be eliminating the more and more increasing poverty, teach to read and write and to encourage hygienic habits in the population, for which there is necessary to carry out deep structural changes. Among the group of biotechnological products directed to the cure of this evil of the poor countries, we have been working on vaccines to eradicate the cholera, tuberculosis, hepatitis A, dengue, entamoeba hystolítica, leptospirosis and the malaria.

Another different way with which Cuba shows to the world the peculiarities of its scientific-social project, is constituted by the willingness with which the Cuban scientific community always responds offering their knowledge for the carrying out of social projects from internationalist projects, it is as well as it has taken the fruit of his work to the poorest countries, in addition to founding in Cuba, the Latin-American School of Medicine, which without place to doubt will have repercussions in the process of sanitary change, which necessarily will happen in the peoples of the third World.

There has been demonstrated that the cooperation and the "recombination" of knowledge is a more efficient way of putting into practice the new knowledge generated even in other spheres of research. The speed to which new knowledge is generated in the sectors of high technology is superior to the one with which there can be explored the consequences of every new piece of the knowledge (or of every technology) in fields and institutions different from those in which it arose [15].

The Cuban biotechnology system was from its beginnings precisely that: a system united by the social property according to the interests of the common "proprietor" who is the Cuban people represented by the socialist state. Thus, the cooperation and the integration is prioritized between its institutions and not the competition. This of integration concept spreads out of the limits of the Biotechnology sector and includes other institutions from the Public Health, Agriculture, Higher Education and others, in an extensive and increasing network of cooperative interactions. The construction of cooperation networks is a concrete form of growth of the system, which is should be more accelerated than the own organic growth of its institutions [1].

The Cuban policy of integration and collaboration with the underdeveloped countries has been materialized by means of the exportation of the generic biotechnological products, at accessible prices for their impoverished economies. As an example, since 1996 Brazil buys from Cuba 100 thousand annual doses of vaccines against the hepatitis B and 1 million doses a year of vaccines against the meningitis B. Also, we can mention the sale of EPOCIM and the LeukoCIM (products for cancer with higher prices and demand on the market) to Latin-American countries as Venezuela, Brazil, Colombia and other countries such as Iran, China and India, as well as the construction of plants and cooperated (mixed) manufacture of these products.

The setting of barriers to the circulation of knowledge (in the shape of patents, industrial secrets or others) sacrifices efficiency for the sake of the private property and it will end up by turning into a barrier to the technological progress, imposed by capitalist relations of production that do not match the level of development of the new productive forces. Under the conditions of socialism, it is the opposite, a high intensity of circulation and recombination of knowledge is possible. Organizing it and stimulating it is the concrete task for those whodirect the scientific-technical activity [1].

Conclusions

The seriousness of the health problems of the developing countries is alarming. The developed countries concentrate the whole human capital and the necessary material for facing the situation, but there reigns the individualism and the mercantilist character with which the health of the human beings is being managed. The development of biotechnological products is one of the most risky operations to finance, since it has a very high cost and is an investment in the long term, whose results, if satisfactory, take between 10 and 15 years. Considering the inherent uncertainty of the research for a novel product to be successful (the research is by definition, the scope of a result unknown a priori) the transnational companies are tempted by those areas of research where in addition to positive results that are foreseen, the recovery of the invested money is guaranteed. It is obvious that the most lucrative market is in the first world, and therefore, its problems are the ones that attract attention of the investors.

The world organizations should take part in the matter and sensitize the international community so that funds are created for the "excluded" researches. If only the half of the money invested annually in weapons and in the genocidal wars sponsored by the United States and its Allied Forces was used for the research of new products for the pandemics that affect the Third World, much could be achieved in a few decades. The scientific project in Cuba is an example to be followed that shows its altruistic spirit and the advantages of the socialist economy for building links between the scientific research and the economy, protecting the strategic decisions and the social problems from the fragmentating effect of the private property and from the distorting effect of the short-term vision of the market.

The development of biotechnology is not a purpose per se, it is a part of the man's objective of improving its quality of life and it cannot be used as a tool for the acquisition of wealth and its concentration for the sake of few individuals. The profit obtained from the biotechnological products must be used for research, development and manufacture of products that solve the main health problems of humanity, paying attention to the needs of the majority and not only the mercantile interests of the biotechnological companies.

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