

FINANCING AND PROTECTION OF STEM CELLS RESEARCH RESULTS IN EUROPE AND THE USA

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Abstract: Stem cell research is the foundation of the construction of the entire human organism, that is, life arises from them. Research should provide a better understanding of stem cell differentiation and development, with possible implications for the cure of hitherto incurable diseases. The therapeutic possibilities of stem cells are enormous, as are the funds that are invested in their research. Researchers, but mostly biotechnology companies, are committed to securing a monopoly over research results in the form of patents. The number of granted patents related to stem cells has dropped significantly in the last decade, not only in Europe but also in the United States. The question arises as to whether the restrictive stem cell patent policy in Europe or the restrictive public funding policy for research in the United States, has contributed more to this. The issue of who finances the inventor's efforts in this sensitive area is extremely important and has a great influence on the issue of who controls and who is the owner, i.e. the right holder over the patent-protected research results. The stagnation of university research and leaving the leading role to the private sector in this area is not in the interest of the social community. The social community must not allow private companies to play a leading role in investing, then reaping the benefits, but also in the exclusive competence over therapies. Public funding and "opening up research results" will help efficient, ethically responsible, and law-based progress in stem cell research and patenting.

Keywords: *biotechnology, stem cells, researchers, financing, patents.*

INTRODUCTION

Stem, or pluripotent cells, are isolated in the blastocyst stage out of a human embryo for the first time by the researchers from the Wisconsin University in the USA. In November, that same year (1998), in the American Advanced Cell Technology research institution (ACT), a human embryo is cloned for

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the first time. In the blastocyst phase, an embryo's development is stopped so stem cells could be extracted and so that cell lines for cells like nerve cells, bone marrow cells, muscle, and blood cells could be developed. The most important thing for scientists is that stem cells can grow and differentiate into any kind of cell of a human body. Precisely those characteristics provide huge potential for research and treatment of serious diseases like Alzheimer's or Parkinson's disease or diabetes. Stem cell's possibilities are practically unlimited because they can encourage organ regeneration or regeneration of a damaged immune system. It should be emphasized that stem cell research is still in its infancy and that scientists are still working on better understanding the role of those cells in normal human development and disease development as well. Because of that, further research is needed that is, actually, slowed down if not completely stopped after European Justice Court, in the case of *o. Brustle vs. Greenpeace C-34/10*, ruled that stem cell patents are banned because their origin is predicated on destroying embryos, which represents their commercial use by the EU Directive regarding biotechnological inventions legal protection 98/44. (Directive 98/44/EC of European Parliament and the Council as of July 6, 1998 on the legal protection of biotechnological inventions, OJ L, 227).

RESEARCH AND INTELLECTUAL PROPERTY RIGHTS

Biotechnology and intellectual property rights are two areas that played a significant role in research transformation. Intellectual property is generally considered an important impeller of innovation in science and technology because it allows for researchers, institutions, and inventors to regain their investments in the period of monopoly rights ownership. A monopoly enables them to recover from financial and intellectual investments. The patent system protects an inventor from economic failure by giving them intellectual property rights over their invention. That is accomplished by allowing an inventor to forbid other people to manufacture, use, or sell a protected invention for a certain period. These exclusive rights are granted only for a limited period (in Europe, this period is 20 years since the application has been submitted) as well as a geographically limited area; in principle, that is the country in which or for which a patent is approved. European patents could be approved for up to 38 countries (countries party to the European Patent Convention), but they must be confirmed in every country in which the patent owner asks for legal protection.

Despite the contestation that the copyright exclusivity can limit public access to some very important products like medicine or crops, economic studies have shown that biotechnological inventions without patents wouldn't be placed in the market. Patenting biotechnological inventions is necessary primarily because of slow development in biotechnology, and huge resources that are being invested in research and development are regained very slowly. Patent rights and, in general, intellectual property rights, provide the basis for regaining resources previously invested in research and development while getting patent protection becomes the key element in the strategy of biotechnological companies (Burrone, 2014).

PUBLIC FINANCING OF STEM CELL RESEARCH

In Europe, social-economic, therefore political changes, primarily affected patent policy change that refers to stem cells, while in the USA changes were mainly referring to the availability of federal research funding. The number of patents approved that refer to stem cells significantly dropped in the last decade, not only in Europe but in the USA as well. The question then arises whether the restrictive



stem cells patent policies attributed to that situation more, or it was restrictive public research funding policies in the USA.

It is necessary to point out that the significant drop in patent applications in Europe does not imply less interest in stem cell research. Science publication analysis has shown that there have been changes in the research approach and that researchers have started relying more on other sources of funding rather than patents (Bregman, *et al*, 2014:270). Research will enable the discovery of new medication, and it is possible that thanks to the embryonic stem cell research the problem of chronic sufficiency of transplant tissue that is used in the treatment of degenerative diseases will be solved.

Thoughts on the legitimacy of experiments that use embryos are divided across different ethnic, religious, and philosophical traditions in which they are rooted in. Because of that research on embryonic stem cells is regulated differently in Europe. The law mostly regulates the question of acquiring embryos for research, as well as the question of deriving embryonal cell lines from IVF embryos and embryos created for research purposes. Despite the difference in the view of legislation about stem cell research, the ethical concern is what unites them. Therefore research of primarily embryonal stem cells is allowed in all European countries according to basic ethical principles and human rights regulations. Fundamental right that is protected is the right to defend human life, certain political rights are protected afterward, and finally social and economic rights. That tells us that the research has to put the interests of society and science first.

STEM CELL RESEARCH FUNDING IN EUROPE

Europe has shown a liberal policy in terms of funding stem cell research. In the year 2000 a research program has been formed as a part of the European Research Area (ERA). One of the main challenges of this program was exactly stem cell research development, mainly because of the existing differences between European countries regarding research policies. The EU's stance was to enable a unique legal framework for stem cell research so "health tourism" and eventual business speculation would not emerge.

Sixth and seventh framework programs (FP6 and FP7) were the main legal and financial instruments for the implementation of the ERA Program. Seventh framework program was designed by the Group of Ethics in Sciences and New Technologies, which constituted Guidelines for ethical human embryonal stem cell research. According to those Guidelines, research can be conducted only on "overabundant" embryos. The Group of Ethics in Sciences and New Technologies consisted primarily of encouraging responsible research funded by the mentioned program (Eschet, *et al*. 2014:255). In the FP6 and FP7 program, later on, funding was forbidden for research that has created embryos for research purposes and reproductive cloning funding as a goal.

Even though there is little data about patents that emerged from research projects funded by the EU, it is fairly certain that the ruling of the European Justice Court (*Brustle vs Greenpeace*) from 2011 made future research uncertain. Opponents of stem cell research used that ruling right away to stop funding stem cell research by the next research funding program in the EU, which is The Horizon 2020. Considering that the ruling abolished patents on inventions that imply destroying embryos in any development phase, Parliament's Committee on Legal Affairs and the EU Committee thought that funding the research whose results cannot be patented should not be approved (Barrow, 2017:676). However, the EU Parliament decided in 2011 to continue with stem cell research funding. European Committee continued with the application of strict ethical rules and limitations regarding the men-



tioned research, for which Europe spent \$156.7 million in the period between 2007 and 2013 on 27 projects in the areas of healthcare that include stem cell use (Cassidy, 2017:756).

PUBLIC FUNDING OF STEM CELL RESEARCH IN THE USA

On the ground of the USA, many different opinions overlapped regarding stem cell patent protection, and above all else regarding granting federal funding to the research related to stem cells. The USA also has a significant number of opponents of stem cell patent protection, and they believe that the benefits of the research shouldn't justify the action necessary for acquiring embryonal stem cells. Starting from the stance that an embryo possesses life from the moment it is fertilized it would be "deeply disturbing" if political officials approve and fund the research. Certain authors because of that insist on finding other ways to promote economic interest while keeping human dignity. They believe that is the responsibility of science to find new sources of stem cells without destroying embryos (Harris C, 2005:129)

Supporters of funding approval and patent protection, on the other hand, believe that it would be immoral to suppress research by limiting the funding and by disapproving patent protection because that path would discourage or even smother research in that perspective area, and many patients would be left without any hope in recovery (Wang, 2005:40).

The patent system in the USA is very complex. The main organization that deals with patents is USPTO, which controls the process of patent approval on the USA territory. The main legal regulation is The Patent Act, which has been incorporated in the Title 35 of United States Code, and in the court decision in the case of *Diamond vs. Charabarty* (447 United States 303, 206 USPQ 193(1980)) living organism patent period started. In the time of the Supreme Court of the United States ruling, no one could predict what the pace of the development of the biotechnological industry would be, so it can be freely claimed that the Court took the futuristic approach in understanding biotechnological development, which will take place in the future. It is understood that there were also religious and other interest groups in the USA that were opposed to that idea. However, those questions had less to do with patent rights and more with the ethical limitation definition in science development. The biotechnology industry is vital for the American economy and this area in general greatly depends on the stimulus that the patent protection provides. Because of that the patent protection of biotechnological inventions in general, and particularly stem cell patent protection, is recognized for practical reasons. However, as the time went by, problems were starting to arise in the USA Patent System, regarding stem cell patent protection. There was a significant increase in patent applications which led to an increasing number in the cases that were falling behind because of the patent office workload and the increasing complexity of patent applications. Low quality of patents and increased number of litigations have additionally increased uncertainty in stem cell patent area. Because of that, today it is more and more insisted on narrowing the scope of patent requests regarding stem cells, and on avoiding conflict between free access to scientific discoveries on one side, and the protection of inventor's rights on the other. That is out of key significance in moving science progress forward, because as science progresses, the law must keep up with it, in order to keep stability. On the other hand, the article about intellectual property in the USA Constitution gives courts the freedom to interpret patent consistency, not only mechanically, with the legislative provision, but with explicit political goals that animate the patent system.

President Obama issued The Executive Order (13.505) in March 2009 that removed all limitations for funding stem cell research. Since the moment The Executive Order has been issued, federal financial



resources for embryonal stem cell research became available. The Executive order is being considered as an important step in the development of the USA because the country secured world leadership in scientific development. Funding, however, has been exclusively for stem cell research on “overabundant” embryos which originate from artificial insemination clinics and which were created for reproductive purposes and thus the research on stem cells that have been derived from other sources (like SCN technique or parthenogenesis) was not suitable for funding.

Since 2011 Weldon Amendment has become a component of the America Invents Act (AIA) of 2011, Pub L. No. 112-29 - 2011, and it represents an integral part of American patent law. Amendment forbids issuing patents for human embryos (Article 33. AIA), however, the stance on stem cell patents remained liberal.

It needs to be pointed out that not all of the USA states do not regulate the question of research in the same way. Some of them, like Arizona, Nebraska, or Virginia, passed laws that forbid funding stem cell research from the state funds, while California, New Jersey, and Massachusetts have taken the opposite view and they allow stem cell research funding. As a response to restrictive policies of President George Bush, in California, Proposition 71 has been adopted, which set aside \$3 billion for stem cell research, and the California Institute for Regenerative Medicine (CIRM) was formed. The California Act provided \$295 million in bonds each year, while funding should be directed in the direction of research centers and universities. California is, therefore, the first state in the USA in which the main patron of research was the state. California Institute for Regenerative Medicine is in charge of awarding all companies and institutions that participate in creating inventions.

Question about who funds researchers' efforts in that sensitive area is of extreme importance and has a great influence on the question of who owns and who controls, that is, who is the holder of patent-protected research results. Based on everything that is mentioned so far, we conclude that financial resources for those expensive and complex research could not be provided from a single source. It seems like the private companies will take a lead role in investing, and consequentially, harvesting fruit, but they will be in the exclusive control over therapies as well! It is quite certain that the stagnation of universities and research centers, like yielding a leading role in that sensitive area to the private sector, is not in the social community's best interest. Therefore, a higher level of engagement of universities and research centers is necessary, as well as “sorting out” ownership claims in such a way that reflect funding sources. (*O Connor, 2005:702*).

People who hold power have to consider that when creating policies on stem cell research funding. Current American president, Donald Trump, hasn't taken any stance regarding embryonal stem cell research funding, although he promised that he “will cancel all unconstitutional executive orders, memorandums, and other orders that were issued by the former president of the USA”. President's Obama Order stimulated biotechnological companies and researchers to continue stem cell research.

ACADEMIC RESEARCH

The road of creating innovative therapies and the medication based on stem cells is very difficult, long and it requires the cooperation of academic researchers, industry, and patent organizations. Academic institutions became “main players” in the patent arena, considering that a sudden increase in academic patents that protects mainly biotechnological inventions is obvious. In the USA for example, the number of patents granted to academic institutions is constantly increasing, so that in the last decade 50% of all patents are granted for research centers in the science field. Europe does not fall



behind judging the numbers on academic patents, so, for example, on average, 75% biotechnological approved by European Patent Organization (EPO) in the period between 1958 and 1999 were for Belgian universities. The number of Italian university patents has also increased. Patent activities on universities were tripled after the enactment of the Bay Dol Act in 1980 in the USA, that had the encouragement of academic inventions patents as a goal (*Singh, Hallihsour, Rangan, 2009:222*). On the other hand, cooperation between universities and the private sector increased by funding research and assignments of intellectual property rights with license contracts and creating spin-off companies. Because of that the period after the Bay Dol Act was put into force was called the period of “open and collaborative” research, which resulted in creating first of all genome databases, and stem cell databases right after. (*Winckoff, Saha, Graff, 2005 :54*). Many of the research in this area is still “basic” and the patents are undertaken primarily, as we stated before, on the universities that are funded, at least in part, from public resources, and that is why cooperation with the private sector is necessary as well as forming public-private partnerships, in order to exploit private financial resources for the mentioned research. It should be pointed out that there is a concern about patenting research results effect in the earlier stage and how it affects further research, as well as the effects of the patents on the final price of products, especially considering what the data show: a small number of universities own protected inventions and large income, while the university patent quality in the USA overall, is in decline (*Hescot, 2014: 29*).

Bay Dol Act prescribes that institutions conclude contracts with inventors based on which inventors give the right to apply for a patent to those institutions. An institution, on the other hand, approves a free license to the USA government for using inventions for their own purposes. The usage of that kind of invention is especially granted to researchers whose research is funded by the USA government.

Next to the primary interest of the university, which scientific interest, there is more and more talk about the financial interest. One of the university goals, next to the progress in the scientific community, becomes monetization. Because of that, universities are looked upon as “services”, and not organizations, trying to monetize their research (*Nelson, 2001:17*).

Looking up to the USA example, many European countries created their own versions of the mentioned law.

In Great Britain, since the moment of the first patent application regarding stem cells in 1989, the number of patent applications was constantly increasing. Universities are especially active, so almost half of all patents regarding stem cells belong to universities (42%), while corporations own 48%. Today, therefore, universities are not expected only to do research and teach. Exchange of knowledge is traditionally done through publishing scientific papers in magazines, conference presentation, etc., but today, universities are expected to earn money from manufactured knowledge, so they could primarily justify investments.

Lisbon Agreement states that the EU’s goal is the empowerment of the scientific and technological foundations in order to achieve European research space in which researchers are free to allocate scientific knowledge and technologies, thus encouraging competition in the industry. We already mentioned the Horizon 2020 Project, the EU program for research and innovation. This program represents an instrument for accomplishing the main goals of the Europe 2020 strategy, and above all, its initiative, Innovative Union. The goal is to ensure the creation of world-class European science and to simplify cooperation between the public and private sector in the field of innovative work. With its goals, Horizon 2020 still aims at further developing European research space as a unified market of knowledge and innovation.



As a part of its global competition strategy, the EU strives to invest an additional 800 billion euros until the year 2025. In the current, 80 billion euros worth research project Horizon 2020, a goal has been set - investing 3% of the European GDP in research and development. Patents represent one of the key measurements of success for the EU. (*Plomer, 2014:16*).

RESEARCH AND STEM CELL PATENTS IN SERBIA

Serbia signed the Agreement with the EU regarding joining the Republic of Serbia to Horizon 2020 - framework program for research and development (2012 - 2014). By signing the mentioned Agreement, our country achieved the status of the country associated with the Horizon 2020 Program, which was gradually implemented starting January 1st of 2014., and it was put into force in accordance with the Law that confirmed that Agreement. Status of the associated country means that all legal entities originating from that country have equal rights and obligations as legal entities from the EU country members. Innovations are in focus because they are the most efficient mean of successfully solving social challenges like climate changes, energy shortages, and public health. By commercializing research, the return on the investment is enabled, which can be later invested in further development. Considering that all relevant provisions of domestic law do not give clear enough answer to the question of whether stem cells of the human embryo are patentable or not, our view is that lawmakers could explicitly normatively edit stem cell protection in the future Patent Law. That would enable the development of academic research result patents that refer to stem cells, that is, universities and other public research organizations would be enabled to increase their research and encourage the creation of innovative spin-off companies.

CONCLUSION

In the past, wrong approaches in research as well as poor public informing resulted in the emergence of doubt towards security and justification of the stem cell usage to cure diseases. Today, however, it is known that regenerative medicine uses stem cells in the treatments of incurable diseases like cancer and that the treatment in the future will be individual, based on the genetics of the patient, in which stem cells play a huge role (*Kraljinović, Stojković, Babić, 2016:6*).

Stem cell patents cannot be stopped and that is why it would be better to control it, for the benefit of all mankind. Laws in this area must be permanently adjusted in accordance with continual changes in science, and to strive to keep up with the fast development of scientific research.

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