Cultures and Social-Dynamics on Stem Cells Research in Spain

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***Abstract*-Studies of public understanding of science and technology are distributed not only in surveys, indicators, and quantitative and qualitative analysis, but also in a looser sense, which includes analysis of the understanding of the scientific community, advisory committees or even the media and virtual forums.**

Depending on the notion of science and technology being dealt with, we may discuss various epistemologies, policies,and processes of communication and public understanding. Thus, the main dynamics of science and technology are presented here and how studies of public understanding of stem cell research can be addressed in terms of them.

Keywords-public understanding, scientific and technological dynamics, stem cells, material agencies

I. Introduction

Studies of science and technology originate from the Anglo-Saxon world, with the movements of Scientific Literacy and Public Understanding of Science. The first is a movement of American origin which aims to measure the degree of scientific literacy of society, designing surveys in which basic scientific issues on well established facts are addressed. In other words, questions are posed about content, regardless of the complexity of the scientific activity. But as we will see later, science is not only knowledge in the sense of 'information' about facts or data; but also procedures, processes, and nature of knowledge based on the topics and techniques applied, as well as the social values expressed therein.The second important movement, fundamentally of British origin, aims to assess the capacity of society to understand science, its applications and its relations with society, therefore its questions are not issues of scientific content, but are social, political or economic. Thus, this movement calls into question the more traditional semantic component of the notion that scientific culture amounts to no more than the level of scientific knowledge. This begins to highlight a new mode of culture relative to the organizational forms of scientific production, and especially, its interactions, that also begin to form part of the processes of public understanding of science. Work on public understanding of science began to take shape thanks to the joint and parallel development of work on American and European surveys by the research groups of Jon D. Miller in the United States , and John Durant in Britain. Their emphasis on specifying precise scales of analysis in comparable questionnaires aided expansion of this research to Europe and other countries so that by the1990s they had already began to have a significant level of empirical grounding. For several decades periodical surveys have been carried on public interest, perception and opinions about science and technology in general or particular aspects of them. Within the United States, The National Science Board of the National Science Foundation (NSF) prepares the Science and Engineering Indicators report on a biannual basis. With this not only have they continued to carry out surveys on public attitudes towards science and technology since the 1970s, but they also consider promotional strategies and recommendations to incorporate into national policies In the European experience, the role of the European Commission is important in implementing action frameworks through programmes like the Forecasting and Assessment of Science and Technology (FAST programme). This programme sought to predict and analyze the consequences of the incorporation of new technologies in the Framework Programmes of R+D. Hence, the emergence of specific analytical lines, such as robotics or biotechnology, in Eurobarometers allowed to measure questions of understanding of science at European level in recent times. The specific choice of public understanding of science as the study of opinion and attitudes from the Eurobarometer from 1992 to 2003 is essentially due to three reasons. Firstly, decisions influenced by science increasingly make up a more direct part of our everyday acts, albeit unconsciously. Moreover, for an advanced society to develop and participate in decisions that affect it effectively, it is essential that a minimum scientific culture extends horizontally across it. Finally, in the current society of knowledge, scientific training of citizens is increasingly a requirement of democracy. The first general survey carried out in Europe (Eurobarometer 35.1, 1991) had already started to investigate the attitude of European population on biotechnology, but also on science and technology in general. Since then, they have been incorporated in all successive surveys that have taken place (Eurobarometer 39.1, 46.1, 52.1, 58) without any major significant changes in the questionnaire except for the 1996 Eurobarometer (Eurobarometer 46.1). Following the fifth survey, the Europeans and Biotechnology report was edited in 2002 under the direction of G. Gaskell. Despite demonstrating a general attitude of mistrust in relation to biotechnologies, it shows greater support for biomedicine because of the potential health benefits. In this regard, and following the FAST programme proposals one must distinguish between biotechnology, based on the potential use of genetic modification of organisms, from bacteria to animals, and the area of biomedicine and health, which includes research,

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treatment and prevention of disease, healthy lifestyles, etc. This area is the first priority for citizens in the third survey.

As regards Spain, the Centre for Sociological Research (CIS) and other agencies such as the BBVA Foundation have promoted studies and surveys on understanding of specific technologies, such as biotechnology, since the 1990's. Some of are of note as they challenge certain surprising or controversial results of the Eurobarometres. In the Ibero-American area, although they have been conducting studies of understanding for more than twenty years, it is only recently that they began to conduct standardized surveys on a regular basis. In this sense, the Organization of Ibero-American States (la Organización de Estados Iberoamericanos) and the Network of Indicators on Science and Technology (la Red de Indicadores de Ciencia y Tecnología) have promoted these type of comparative studies, progressively achieving institutional support such as the Spanish Foundation for Science and Technology (FECYT) or Centro REDES of Argentina, among others. These three institutions now have a priority objective, namely, to attain an Iberoamerican standard of indicators of social understanding and scientific culture, which is in the development stage. In Spain, the FECYT has carried out national surveys on public understanding of science and technology biannually since 2002, and as in the Eurobarometres the topics of biotechnology and biomedicine and health are covered separately. These surveys usually measure three different levels of public relationship with science: degree of interest and information on issues of science and technology, level of scientific knowledge and attitudes towards science and technology. However, in recent years, the studies of public understanding of science have been developed not only through surveys with their respective indicators, quantitative and qualitative analyses, but also distributed in analyses of understanding of the scientific community, advisory committees or even the media and virtual forums. This reflects the kind of notion of science and technology on which they are based. Now, we will address the main models or dynamics of science and technology and how the understanding of stem cell research based on them sheds light in one way or another.

II. Cultures and Social – Dynamics of Stem Cells Research

A. Model of Knowledge

In this model, science is the high priestess of knowledge and judges what genuine knowledge is, given that it is that which is accessible to the world, or what amounts to the same thing in this model, reality. It has a tendency to prioritize demarcation criteria of scientific knowledge. It is the vision found in positivism or logical empiricism or also referred to as the received view of science. In this, scientific products are theoretical or observational propositions, likely to form networks amongst themselves. Thus, the actors are scientists, as according to this model they are the only users with a competent command of these proposals as opposed to technicians, teachers, and it goes without saying, civil society. So, they have the moral commitment to prevent fraud and develop science, through mutual scrutiny and critical analysis of scientific community research. Thus, the discussion space consists of seminars, conferences or magazines, among others. According to Callon, there is no unanimity in considering what constitutes the decisive test, since it may be in experiments, as well as predictive capacity or the acceptance of new conventions (Callon, 1995).Traditional scientific policies can be considered as policies of promotion, in which social welfare is understood in terms of economic growth depending primarily on the processes of technological innovation, in other words, the promotion of applied science. This is the so-called old social contract for science, which occurs at a time in which science and technology project an image of excessive enthusiasm in society. One need only recall the ENIAC in 1946, the contraceptive pill in 1955, the first organ transplants in 1950, among others. In this sense, the report of Vannevar Bush, Science, The Endless Frontier is the main reference for this type of policy at the end of World War II. The main engine of social progress is basic science because it ensures the continuity of process in a linear and automatic way. In this type of model of scientific policy, technological innovation is directly supported by scientific knowledge and potential risks are perfectly calculated. The Neoclassical economy would lay the foundations for these types of policies, where funding of basic research depends primarily on public authorities. Accordingly, Federal agencies were founded, such as the National Science Foundation in 1950, which receive a great part of public funding. In fact, the latter have not only been responsible for administering much of U.S. scientific funding, but also for disseminating such policies of promotion at international level through the OECD (López Cerezo, J. A., and Luján, J. L., 2004). Communication processes are outlined in a way similar to the models of cognitive deficit of the first movements of public understanding of science. In these, scientists are the only experts, and so, are those who have the authority to transmit scientific knowledge to the media for its dissemination. Thus, reported knowledge would have an 'inferior' epistemological status in these models. The more traditional semantic component of the notion of scientific culture is reduced to the level of scientific knowledge. In that sense, the first indicators of scientific culture used by the American National Science Foundation, the European Union or the Institute of Scientific Policy and Technology of Japan, were indicators such as GDP spent on research or the number of scientists available in each country. Thus, scientific culture depended essentially on the number of scientific and technological resources of a society (Miller, Pardo, Niwa, 1998). In this sense, rather than public understanding, this dynamic gives priority to the sample of indicators such as those presented below.

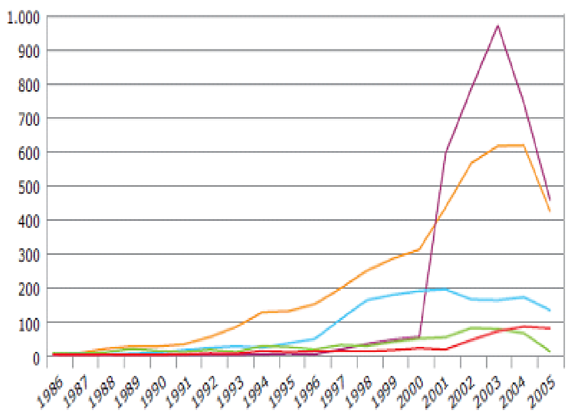

Figure 1. Evolution of patents and patent applications in technologies related to stem cells. Source: (Genoma, Spain, 2008: 78)

III. Cultures and Social – Dynamics of Stem Cells: Model of Institutions

In this model, science is the high priestess of knowledge and judges what genuine knowledge is, given that it is that which is accessible to the world, or what amounts to the same thing in this model, reality. It has a tendency to prioritize demarcation criteria of scientific knowledge. It is the vision found in positivism or logical empiricism or also referred to as the received view of science. In this, scientific products are theoretical or observational propositions, likely to form networks amongst themselves. Thus, the actors are scientists, as according to this model they are the only users with a competent command of these proposals as opposed to technicians, teachers, and it goes without saying, civil society. So, they have the moral commitment to prevent fraud and develop science, through mutual scrutiny and critical analysis of scientific community research. Thus, the discussion space consists of seminars, conferences or magazines, among others. According to Callon, there is no unanimity in considering what constitutes the decisive test, since it may be in experiments, as well as predictive capacity or the acceptance of new conventions (Callon, 1995).Traditional scientific policies can be considered as policies of promotion, in which social welfare is understood in terms of economic growth depending primarily on the processes of technological innovation, in other words, the promotion of applied science. This is the so-called old social contract for science, which occurs at a time in which science and technology project an image of excessive enthusiasm in society. One need only recall the ENIAC in 1946, the contraceptive pill in 1955, the first organ transplants in 1950, among others. In this sense, the report of Vannevar Bush, Science, The Endless Frontier is the main reference for this type of policy at the end of World War II. The main engine of social progress is basic science because it ensures the continuity of process in a linear and automatic way. In this type of model of scientific policy, technological innovation is directly supported by scientific knowledge and potential risks are perfectly calculated. The Neoclassical economy would lay the foundations for these types of policies, where funding of basic research depends primarily on public authorities. Accordingly, Federal agencies were founded, such as the National Science Foundation in 1950, which receive a great part of public funding. In fact, the latter have not only been responsible for administering much of U.S. scientific funding, but also for disseminating such policies of promotion at international level through the OECD (López Cerezo, J. A., and Luján, J. L., 2004). Communication processes are outlined in a way similar to the models of cognitive deficit of the first movements of public understanding of science. In these, scientists are the only experts, and so, are those who have the authority to transmit scientific knowledge to the media for its dissemination. Thus, reported knowledge would have an 'inferior' epistemological status in these models. The more traditional semantic component of the notion of scientific culture is reduced to the level of scientific knowledge. In that sense, the first indicators of scientific culture used by the American National Science Foundation, the European Union or the Institute of Scientific Policy and Technology of Japan, were indicators such as GDP spent on research or the number of scientists available in each country. Thus, scientific culture depended essentially on the number of scientific and technological resources of a society (Miller, Pardo, Niwa, 1998). In this sense, rather than public understanding, this dynamic gives priority to the sample of indicators such as those presented below. The scientific production system does not differ to a great extent from the previous model, except for the incorporation of the social framework, although in specific contexts and preserving the autonomy and demarcation of the scientific institution. One of the best representatives of such interaction is Merton: the idea of scientific ethos is that which best characterises social context in this model of science. Merton defined scientific ethos as a complexity of conditions, values and mandatory standards that are legitimized through institutional values, and are reinforced by sanctions and internalised to varying degrees by the scientific community. The scientific community are still the producers but social mechanisms that encourage their work are considered, such as the reward system (Merton 1986).

The type of agreements or consensuses that they form remain 'internal' or under strictly scientific criteria, but this does not mean eternal. Given the clear demarcation between 'internal' and 'external' aspects, the importance of social organization becomes clear, in this sense. In so much as the Mertonian reward system serves as the stimulus of scientific production. Quantitative analysis of this production such as that carried out by Solla Price becomes fundamental in this model. Thus, the scientific publishing system also has a central, as well as a well delimited role. It promotes the sharing of recognition, and the dissemination of scientific work. Accordingly, such mechanisms are considered fundamental in preserving the autonomy of science, since it highlights the fact that this publication system is formed by scientists. Other social institutions may grant values and uses to scientific theories, or even encourage some over others, but this does not mean that scientific knowledge is not clearly demarcated. Thus, there is more growth in those areas where higher yields are obtained.

Both this and the previous model represent the underlying dynamics of what is often referred to as macroscience or Big Science, where basic science is a key factor in disciplines such as physics, chemistry, biology and mathematics. Moreover, this model represents the preambles of the subsequent proliferation of literature on the change in production in post-industrial societies. In fact, some of these traits can already be detected, as we shall see later. Such developments are fundamentally political and economic. The excessive enthusiasm of science and technology to which we referred in model A, soon began to collapse. There were numerous scandals that took place in Europe in the 1960s: the nuclear accident in Windscale in England, the ban on Thalidomide in Europe, the sinking of nuclear submarines like USS Thresher or USS Scorpion, and so on. Not only could science lead to negative effects, but the market was insufficient to regulate them. Thus, more interventionist policies, requiring new tools of regulation, were developed. The aim was to open new spaces of regulation of technological change that incorporated public control, while still relying on scientific understanding when assessing risk and developing regulation. To do so, a legislative framework was created under which new Government agencies could be formed and support new preventive measures for risk. However, it should not be forgotten that it is also a period in which the drift of basic research in applied science began to be strengthened to foster economic growth. There were several developments that were introduced in these policy models, such as public review of regulations, as well as full access to such documents, which facilitated the possibility of generating mechanisms for citizen participation. In addition, citizens could also take legal action against agencies and industries in case of violation of their rights or public interest. And risk assessment became incorporated within scientific investigation, although it was also normally carried out also by government agencies or financed by them. Thus, what Sheila Jasanoff called 'regulatory science' established itself, that is, scientific research that would be of use in developing public policies in health, environment, education, economy, etc. However, perhaps one of the most striking aspects, and the reason we put such policies in this model, is the presence of a technocratic conception of public risk management. Indeed, despite attempts to point out citizen participation in decision-making, we must not ignore the dependence on scientific knowledge that regulation had and how this factor blocked any other alternatives or even the possibility of political debate. So, paradoxically, it was producing a new depoliticization of technological change (Lopez Cerezo, J. A., and Luján, J. L., 2004). The only change that scientific communication models undergo is that they become two-dimensional. They are still linear communication models although they now consider the type of reception they may have among the public. They are also called diffusion or propaganda models and retain the characteristics of communication in a top-down direction, where the scientific context where the information is generated differs greatly from the reception in the public one (Gregory Miller, 1998; Miller, Pardo, Niwa, 1998). As noted in Model A, there is a strong demarcation between scientific and reported knowledge. It probably becomes stronger in this model, since reported knowledge is politically exploited knowledge or a transmitter of ideology, as well as being distorting. Indeed, the first analyses about the type of transmission given to scientific and technological processes in the media begin to develop after the Second World War. However, no published work about it is to be found until Krieghbaum published Science and the Mass Media in 1967. Such initial studies have the demand for greater responsibility in journalism when writing news and scientific reports as a common denominator. In this model aspects relating to economic policy of the media are particularly relevant. In this sense, it is important to consider oscillations between public and commercial values in media companies. Advertising becomes important as a factor, where, for example, there can be no contradiction in the products advertised and the newspaper's editorial line, for example (Miller, 1998). The parameters of traditionally elaborated scientific culture, as seen in model A, are transferred to civil society in this model. Something like, an individual will only be more cultured the more knowledge they accumulate. In this context, it may be worth emphasising the studies on the existing dispute over nuclear power in Sweden. Before trying to develop a national policy to promote the use of nuclear power in Sweden, the Government funded the organization of a public debate in the 1970s.

IV. SURVEYS OF PUBLIC UNDERSTANDING OF BIOMEDICINE

Next we examine the main results of the Third National Survey on Social Understanding of Science and Technology by FECYT in 2006, in collaboration, in this case, with the CIS. And we relate it to the Eurobarometer Medical and Health Research, A special Eurobarometer public survey published by the European Commission in 2007. In this regard we appreciate the institutional context which frames the public understanding of stem cell research., 2008)

The main objective of the FECYT survey, in line with preceding ones, is to analyse the way in which Spanish society understands Science and Technology as well as the evolution of this understanding over time. To make this longitudinal comparison possible, the survey maintains most of the previous indicators.The Eurobarometer, for its part, took place in a context in which biomedical research is one of the priorities of European research, as can be seen in the programme framework worked out for the period 2007-2013 approved by the European Commission on 6 April 2006. Let us not forget that the increase in investment in this area is always conceived together with the ability to successfully transform the results of research into new products, services and processes, by promoting collaboration between countries.The main objectives of the Eurobarometer have been to measure attitudes of European citizens on collaborative research projects in biomedicine, as well as the European co-funding of them. And at the same time connect it with their level of interest in science and technology in general, and biomedicine in particular. Among the results we find that the topics of interest were: nature and environment (84 %), health and medical research (71 %), European and international news (70 %), economic and social issues (68 %), sports and outdoor activities (66 %), science and technology (60 %), art and literature (52 %), celebrities and entertainment (42 %).Analysis of these results by country shows that 62 % of the Spanish population is interested in medicine and health research and 50 % in science and technology. While approximately ten points lower than the European average, they are much higher figures to those shown in the third national survey of understanding of science and technology of the FECYT, where scientific and technological issues occupy a discreet position on the scale of newsworthy items of the Spanish population. 10 % of respondents cite them among their news topics of interest. It is a percentage similar to that aroused by disparate issues such as terrorism or travel topics, but is much lower than topics that head the table, such as sports (30 %), medicine and health (26 %) and film and shows (20 %). As for the type of sources of information they use, as expected, a large majority of European citizens surveyed indicate that television is the main source of information, namely, 70 % of the sample which claims to be interested in biomedical research. Some 39 % say they consult newspapers, and even more, some 24 %, say that medical and research personnel are a source of information too. In the national survey on understanding television appears as the main means of communication used to address issues of science and technology, while Internet is also beginning to be an increasingly used resource. Still, a critical view is generally reflected as regards the amount of information obtained from the media in general, since it is considered inadequate, both on television (45 %), in daily newspapers (47 %) and also radio (48 %). As for confidence in the quality of information received from these sources, the Eurobarometer shows that overall most citizens trust medical and research staff (53 %), although this is not directly related to the research being reported. It also shows a high degree of confidence (47 %) in university or research centre staff. In any case, both are followed by specialised journalists (31 %) and international institutions (25 %). However, when the results are broken down by country, Spain is one of the countries that show least confidence in medical or research personnel (27 %).

On observing national survey preferences on key issues around which the work of Spanish researchers needs to be targeted we again find that traditional and utilitarian image of science and technology in general, and biomedicine in particular. Medicine and health clearly stand out among all areas, with 80 % of responses. Environment and energy are two other fields considered priorities by a good number of citizens. However, neither aerospace research (barely 1 per cent of replies) nor that in transport (4 %) is understood to be a priority. Nor is great importance attached (6 %) to research in security and defence, despite the fact that this was an area for which the majority requested an increase in expenditure.

V. Cultures and Social – Dynamics of Stem Cells: Model of Praxis

The increase in the tertiary sector or academic and professional expertise were just some of the indices that characterized what was already beginning to be called the post-industrial society. Science has become one more social practice. In this model science participates in the opening of the world, in the sense that it dilutes any possible hierarchical structuring of itself. Thus, science is not only another cultural or social practice, but it is also in a horizontal dimension, relative to others. The context becomes so important in the production of scientific knowledge that it is also involved in its construction in a direct or intrinsic way. Science is no longer exclusively discovery of the world or worldview. It is carried out and is nothing other than its use. Therefore, knowledge is more than relationships between facts and theories. It implies tacit aspects and therefore, the cultural context and its transmission come to the fore.It is in the U.S. where we find the impetus of pragmatist studies that result in social psychology and symbolic interactionism. Studies that were able to dissolve the central role of knowledge as reason (and therefore logic) into a new plurality of practices. They began to call themselves instrumentalists, developing a functionalist dimension of thought as learning essentially through solving problems.Two main levels of action in scientific praxis are proposed, and we can see them explained in the structural fracture present in social studies of science and technology: a macro dimension and a dimension micro. Therefore, the scientific community extends in this model to a plurality of actors: government agencies, media, philosophers, sociologists, feminist movements, civil society, among others; but also to laboratories, users, instruments, etc. Scientific production is above all contextual and situated. Hence,

the ethnomethodology of Lynch, and the cultural anthropology of Hess are effective analyses and, like Knorr Cetina, we can even speak about epistemic cultures.The type of scientific dynamic generated in this model type does not differ from the proposed syntactic model except for the “dethronement” of science. This is no longer the only producer of scientific knowledge. Thus, scientific consensus will be mediated by this plurality of epistemic agents. This means that it can be generated by other types of actors. This model incorporates, as in model D, the main underlying dynamics behind the development of so-called techno-science, which tends to be characterised as a praxiological revolution where there is an increase in private funding in research, a greater intermediation between science and technology, techno-scientific enterprise formation, the emergence of research networks, or a greater plurality of techno-scientific agents, among others. This model proposes the need to consider the social impact of industrial restructuring, where globalisation has become the mediator, taking the place of welfare states or regulatory policies. Such types of approach are incorporated in what would be the second axon in mode 2 of Gibbons, (Nowotny, Scott Gibbons, 2001)

Both the notion of scientific culture and the processes of public understanding of science and technology already incorporate not only issues of content, but also methodological aspects, given the multiple practices to consider in scientific production. In this regard, the variability and flexibility of the source domains to be considered in the scientific publication system are also expanded (Wynne 1991). Scientific communication studies begin to consider the social groups involved in a dispute and their influence on the transmission of scientific news. This is the case of Goodell and Nelkin, who seek to expose the ability of scientists to impose their values in the media, or that of Wilkins and Patterson who try to emphasize the importance of political processes when covering technological risks. In that sense, the work of authors like Grunig, who introduces a model of situational communication, that is, one in which the social contexts in which scientific journalism occurs take centre stage.

The areas of public understanding of science and around the notion of scientific culture are considered as open and social processes of scientific construction. Indicators of understanding begin to address the diversity of roles that civil society experiences as citizens, workers, consumers, among others. Thus, they include discussion groups, interviews or citizens panels (Lewenstein, 1995)

The notion of scientific culture now incorporates communication skills and competence, which brings about a kind of three-dimensional scientific culture outline: cultural, civic and practice. While the civic is the ability to handle scientific concepts, practice requires the incorporation of a functional and contextual dimension to the first. Miller also speaks of three dimensions to consider: "a basic vocabulary of scientific terms and concepts sufficient to read divergent opinions in newspapers, an understanding of the scientific reinvestigation process, and an understanding of the impact of science and technology on individuals and society." "A reasonable command of these three dimensions would show a sufficient level of ability to understand the issues of scientific and technical policy disseminated by the media" (Gregory, Miller, 1998: 106). In fact, the incorporation of the understanding of the social impact of scientific and technological processes led to an advance in the analysis of public understanding as soon as the need to incorporate the social context, according to the country being studied could be shown. (Miller, Pardo, Niwa, 1998).

VI. Analysis of Print Media in Spain

In this instance, we use the analysis of the periodical press to address the numerous actors involved in different stem cell research. In spite of the supposed delicate nature of the Human Genome Project and the Assisted Reproduction Act 1988, there was no kind of public debate about the emergence of these technologies in Spain. In fact, press coverage in the media was neutral and not at all critical. Not only because of the lack of social actors in the biotechnology news, but also because there were no editorials or opinion articles. At the same time, the origin of assisted reproductive technologies was a media interpretation of these technologies in which sexual selection and genetic manipulation were associated concepts. In this regard, assisted reproduction technologies began to be represented as possible eugenic technology by some conservative sectors that rejected their development (Moreno, Luján, Moreno, 1996). The mode of production of biotechnological news did not stop being a linear process during the period 1988-1993. However, this type of knowledge production mode has changed rapidly in recent years. Biotechnological communication began to occur in a context where top priority was given to the various praxis involved in it. Scientific experts began to change their role in the period 1997-2004 and socio–political context began to be considered in the communication of stem cell research. This was something which led to the dissolution of scientific arguments in a social epistemology. Scientific journals were no longer resources of news production and went from being 60 % of the sources in the year 2000, to 25 % in the period 2001 to 2004. The controversy of therapeutic cloning in the years 2003 to 2004 began to be led by the opposition between conservative and religious actors versus the scientific community and left-wing policies. Hence, the latter group introduced the distinction therapeutic cloning / reproductive cloning to empower the first type of cloning. However, both sides of the controversy continue to take a stand between patriarchal dichotomies such as: reason / feeling, objectivity / subjectivity, truth / superstition. This type of discursive framework has been one of the constraints that have limited production of other alternative discourses, such as gender studies. When speaking of therapeutic cloning, fundamentally in the press, the depth of its various applications and technical possibilities are evaded. A procedure that enabled the possible emergence of legal loopholes. The most publically visible contextual values were of a legislative kind and techno-scientific nature. Only occasionally did arguments appear referring to the availability or otherwise of eggs with which to carry out nuclear transfer techniques. Considering eggs as an alternative locus of tension between cloning and stem cell research, we then did another study by collecting a sample of 98 texts from 2006 on the interface between assisted reproduction technologies - stem cells - cloning. This was the period in which the new Assisted Reproduction Law (Ley de Reproducción Asistida) was passed and the draft bill of the Biomedicine Law (Ley de Biomedicina) began to be discussed. The texts collected were from the newspapers El País and El Mundo, the two newspapers with the largest national circulation according to the "Oficina de Justificación de la Difusión". They were encoded with Nvivo 7 qualitative analysis software, to clarify the dynamics in which eggs appeared in the news of assisted reproduction, stem cells and cloning. Analysis showed, among other things, how embryos are not the only notable biomaterials in controversies related to these technologies and how the analysis of eggs in the press shows another type of rhetoric. There is a significant difference between the representation of eggs in assisted reproduction (33 %), stem cell (22 %) and cloning technologies (11 %). The rest of the texts fluctuated between two different dynamics, with the relationship between stem cells and cloning predominating more than assisted reproduction and stem cells. The types of actors involved in the news were divided into: scientific community, institutions, civil society, users and politicians. The analysis found how the scientific and political community expressed themselves through speech acts and declarations with which they generate interest in this research, and the users group only appeared in the context of cloning, calling for more funding.

VII. Cultures and Social – Dynamics of Stem Cells: Model of Networks

Since the interactions and relationships between the practices of various scientific players are the basis of this model, concepts such as the translation of Latour acquire a special significance here. The variety of operations that take place in the processes of scientific and technological construction are collected together through it, and potential translation networks formed in the process. In that sense, Latour introduces concepts such as 'graphic inscriptions' to refer to written marks, and through which it is capable to establish such networks and chains of translation: instruments - brands – diagrams - tables - curves - observational propositions 1 – theoretical observational propositions 2 - theoretical propositions 3 - etc. interact through networks of translations that are shaped and reconfigured in different ways in each context. Such networks are dynamic, open and contextual, which means they sometimes do not extend outside of the laboratory or the scientific community or a determined socio-cultural context, but on other occasions they may do. Hence, their dynamics are open, but above all contextual.

In these networks the players are any type of entity, be it a person, a collective, a technical instrument, a proposition or the environmental elements themselves. In that sense, all scientific research depends particularly importantly on the state of the network by which it is framed, the type of translations presented and contextual dynamics it has had, namely its socio-historical courses. Thus, there will be divergent, but also converging translations in the socio-dynamics of these networks. Talk of consensus or dissent is meaningless. There is talk of alignment or dispersion of translations, the discursive aspects of science and technology production, and above all, the visibility of those features hidden in the dominant discourse.

Analysis of the organization is important even from the standpoint of internal administration. Even more so when the limits of networks come prescribed with rules of confidentiality, by possible restrictions exercised by evaluation committees, or by mechanisms to promote the appointment of legitimate spokespersons who directly influence the dynamics of translations.

Thus, the dynamics of translation are diverse. We may find entrenchment of some networks, when their translations are consolidated, or what Callon calls irreversibility. It also features dynamics of extension, which are characterized by the plurality of actants involved in them; and dynamics of variety, from which the diversity of disconnected networks should encourage increased translations between them. Diversity is fostered by the diversity of built-in actants, or even the existence of mediators allowing the coexistence of mutually exclusive networks.

In comparison with the traditional approaches of the U.S. National Research Council and the British Royal Society, assessment and risk management processes begin to be set out as hybrid processes. Quantification of the likelihood of fatalities and making decisions on them are interspersed. It is not possible to talk about risk assessment, especially in domains of epistemic uncertainty, without introducing variable values in each of its processes such as risk selection, the very methodology of analysis or even its communication. In that sense, it becomes necessary to consider evaluation processes as open processes, rather than restrict them to the domain of the ideal of a pure and conclusive science. In this way, the hybridisation of regulatory science and risk management is achieved. Thus, contextualization is the guarantor of scientific reliability in these models. In that sense, the plurality of scientific and technological knowledge producers appear integrated. Nowotny et al argue that they are 'peripheral' researchers and their proliferation advocates a greater distribution of what has traditionally been seen as the core of scientific and technological production (Nowotny, Scott Gibbons, 2002). The interrelationships between these new researchers and their role in the contextualization of production, regulation and scientific and technological management take place in 'transaction spaces', or as part of the dimension explained previously, 'translation spaces'. These new spaces emerge in the interrelationships of the various actors and the communicative processes established between them. Thus, a new forum is opened, where the asymmetries in communication between actors tend to be eliminated by the translation networks themselves, which is conducive to the democratisation of decision-making. The boundaries have become borders of exchange.

Hence, the talk of the emergence of a new context of implication rather than a context of application. It speaks of socially and politically robust knowledge that occurs in a new space, sometimes called agora (Nowotny, Scott Gibbons, 2002). Within this there are dialogical contexts of open policies, market exchange, as well as social movements.

In that sense, we may find several models that incorporate these features: post-academic science (Ziman), mode-2 science (Gibbons et al.), Triple-Helix (Etzkowitz, Leydesdorff), academic capitalism (Slaughter and Leslie), post-normal science Ravetz (Funtowicv), science in the Agora (Nowotny et al.), etc. There is no doubt that there are several lines of argument which they share in that sense, some of them critical of neo-liberal market dynamics which are promoted by such changes in production systems.

The processes of communication proposed in the first two models were to reflect the idea that the concepts of scientific culture and social responsibility were directly related. The idea was that existing hierarchical and asymmetrical relations between the scientific community and the public had not been broken. In that sense, this model incorporates other types of theories that seek to break that demarcation, as is the case of the culture of agencies (Agential Literacy) proposed by Karen Barad. This theory argues that "scientific culture becomes a matter of agency culture - to learn how to interact responsibly in the world" (Barad 2000: 237). This theory proposes the analysis of the multiple interactions between the dialectical processes that exist in scientific instruments in a material and discursive sense, according to Barad. But, perhaps the most interesting thing about this proposal is the role played by its own interactions with other practices, other instruments, other disciplines... and that would lead to a transdisciplinary space comprised of numerous agents.

In that sense, the dimension relating to the organizational forms of scientific production, and especially, their interactions becomes part of the concept of scientific culture and the processes of public understanding of science. Thus, the lack of conceptual content does not compromise the concept of scientific culture, if the presence of this culture of interrelations is detected (Wynne 1991). Talking about mediation in science means talking of a complexity in which co-operation, competition and interconnection of various groups and social factors such as institutions, media organizations, assorted public, etc. intervene. Thus, many of the criticisms raised on these new spaces of scientific communication are dissolved. Sometimes, it is considered that these network models tend to dilute any distinguishing or marked aspect in accordance with the defence of an abstract and amorphous area of interrelations. And in this, information and communication technologies and communication (ICT) have played an important role, by making these new spaces more adaptable. So, in these contexts, knowledge would be reduced to mere information or transmission of codes. Something similar to the idea of nomadic knowledge production and that is the result of an idealised conceptualisation of cyberspace. But certainly one thing is consideration of the way technology is enabling and encouraging a higher transmission of codes, and another that we reduce the processes of communication to that level, thus removing its cognitive translation. Underestimating this dimension is to circumvent the access to resources, tacit tools or own cognitive skills and interrelations that require an infrastructure that supports such dimensions. In a word, overlook the context of both collective and individual appropriation and all that it implies. Thus the defence of an amorphous and interstitial space is supported only under the assumption of a strong technological determinism that unifies both technical reconfigurations and contexts of appropriation. Hence, another aspect that is introduced into the concept of *scientific culture* is its significant appropriation (Lopez Cerezo, Luján, 2004).

VIII. Material Agencies in the Processes of Public Understanding

In the actor - network theory, it is possible to set aside anthropocentrism, or what is the same,

proceed philosophically, if we do not acknowledge that we are built and identified in processes of (self-) material agencies. The questions we ask ourselves on this occasion are: What is a stem cell? Why do we call it mother? In what sense is it (self-) agency? And if it is, what kind is it? What acts and subjectivities does it assemble? Does it shape identities? Let's ask ourselves about the agential of a stem cell.

While images have always been part of the construction of scientific knowledge processes, the philosophy of science has not considered them relevant or as elements characteristic of this type of rational knowledge. However, there are post-structuralist currents that hold a different view where the image becomes the text. Without doubt, this is the time of disembodiment in multiple identities and disguises, that are transformed and are convertible in complex networks. Bodies flow, move on and are materialised or crystallised in implants, crops, therapies, etc., where technological development is focused on management, transportation, storage and production of such fragments. One of the changes attributed to the fragmentation of the body in post-modernity, is that it shifts the modern body from the axis. There is a post-humanism, which is really a post-anthropocentrism. And multiple, fluid, dynamic fragments with their niche markets, services and demands begin to proliferate. Cell therapies, foetal treatments, donation of biomaterials, genetic selection are some of them.

The crux of all this, is that rule, difference, denial, contradictions are still performed from institutions, practices and representations which seem apparently devoid of power relations, such as sex and gender, but show the same type of monitoring and objectification trends of "the other" (Lynch, John, 2009).

In this case, any schema representing cellular differentiation processes continues perpetuating the main premise of most theories of evolution and therefore the iconography that Gould analyses, namely the idea of progress based on a teleological directionality: "the straitjacket of linear progress goes beyond iconography to the definition of evolution: the word itself becomes a synonym for progress." (Gould, 1999: 30). Branching schemas impose a vertical hierarchy. Not only a temporal distribution, but relations of power ranging from simple to complex, or primitive to advanced. Hence, the locus dealing in time is associated with a value judgement about its complexity. They also perpetuate the representation of the exile of the mother. The necessary denial of family, of the maternal. Matricide as the step required to be autonomous. Psychological and biologically. The skill required to detach oneself from the maternal phantasmagorical environment. And the crisis posed by the radical acceptance of the loss as a first contingent step of subjectivity (Kristeva, 1982).

In this way a "diasporic space" is configured where identities are positional, unstable and contingent but supported by the requirement for negotiation while reiterating that identity is constructed in and through difference (Ahmed, 1998).

IX. Conclusion

The processes of communication and production of scientific and technological knowledge proposed in the first two models reflected the idea that existing hierarchical and asymmetrical relations between the scientific community and the public had not possibilities of being broken. In that sense, the last models incorporate other types of theories that seek to break that demarcation, and improve social epistemology with its political implications. Through these different kinds of understanding stem cells research –or another kind of scientific and technological processes- we can achieve the complexity of the different epistemologies in which knowledge is produced. Depending on the context, sometimes one of the models will be the dominant and sometimes some of them will be connected and correlated. Returning to the hypothesis posed at the beginning of this study, it is now possible to state that depending on the notion of science and technology being dealt with, we may discuss various contextual epistemologies, policies, and processes of communication.

X. References

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