8

Crossings on Public Perception of Biomedicine: Spain and the European Indicators

Eulalia Pérez Sedeño and María José Miranda Suárez
CSIC
Spain

1. Introduction

In recent years, there has been an increasing advance in various disciplines such as genetics, biotechnology or information technology. There is almost unanimous agreement that the generation and application of scientific and technological knowledge is playing a key role in the improvement of quality of life in society, productive modernization, and the insertion of some countries on the global stage. However, these rapid changes are also having serious effects, leading to discussions about their current or future use and their social, ethical implications. To date, these changes have also modified our environment.

Universal scientific knowledge and its recent development have been enabling a techno-economic universality. But questions have also been raised about the deepening of social inequalities and the asymmetrical appropriations of knowledge. At the same time, our societies have experienced major political development that has opened up all areas of public policy to social scrutiny and citizen participation. Despite this, science and technology are still perceived as something distant by some citizens. Still, intense activity in the area of scientific communication and popularization in the last decade may be changing that perception. That is why it is necessary to open public policies on science and technology to the sensitivities and opinions of the people who are affected and interested, to facilitate the practical viability of innovation and depth in the democratization of the systems. The studies of public perception of science and technology are taking a leading role in these aspects.

As we saw earlier (Pérez Sedeño and Miranda Suárez, 2008), studies on the public perception of science and technology originate in the Anglo-Saxon world, with the movements *Scientific Literacy* and *Public Understanding of Science*. The first is a North American movement that seeks to measure the degree of scientific literacy in society, designing surveys where basic scientific questions are asked about well-established facts. That is, questions about content are posed, without taking into account the complexity of the scientific activity. But science isn't only knowledge in the sense of 'information' about facts and pieces of information; of extreme importance are procedures, processes and the nature of the knowledge according to the subjects and techniques applied, as well as the social values in which they are expressed.

The second movement mentioned, fundamentally of British origin, seeks to assess the capacity of society to understand science, its applications and its relationships to society, and as such the questions asked aren't of scientific content, but rather of a social, political or economic type. So, the more traditional semantic component of the notion of scientific culture, which is reduced to the level of scientific knowledge, is put into question. This other orientation appears more appropriate, as the notion of scientific culture already includes communicative skills and abilities, which also entail outlining a type of culture relative to the organizational forms of scientific production and, above all, its interactions, which also form part of the processes of the *public perception of science*.

Starting from the 1990s, and owing to some controversies arising around certain technologies, a new movement was added: that of science in society. At times, science appears distant and unconnected from society; its objectives aren't understood. Lack of a common language and the rapid progress experienced in certain areas of investigation has increased public concerns, and has contributed to people viewing, with preoccupation or ambivalence, the role that science and technology play in daily life. But science doesn't work in isolation. It is developed in concrete situations, historical and social, and scientists are subjects that produce situated knowledges. One of the main contributions that favored the growth in objectivity via the democratization of knowledge and scientific practices has been the role of feminist epistemologies, represented by the feminist point of view of Sandra Harding, the contextual empiricism of Helen Longino and the situated knowledges of Donna Haraway. They deny both neutral science practiced by an universal subject, as well as epistemological relativism. And they champion the democratization of science, consistent in the incorporation of a plurality of perspectives, by way of the annulment of personal idiosyncrasies, a process called cognitive democracy. In this, consensus is the result of a critical dialog where all the relevant perspectives are represented and where obtaining knowledge, scientific-technological advances, isn't an objective in its own right. As such, in recent years an interest in public participation and governance has developed, not just in political discourse and academic analysis, but also in scientific and technological development. Controversies like that of Genetically Modified Organisms (GMOs) or important crises like that brought on by Bovine Spongiform Encephalopathy (BSE), the so called Mad Cow Disease, have reduced public confidence in how scientific and technological developments are handled.

The European Union (EU) has made this movement its own to the point of transforming its program *Science, Economy and Society* into *Science in Society,* within the Seventh Framework Programme (FP7). The explicit objective is to "'bring science closer to citizens' (European Commission, 2002: 7), in order to 'provide a space for scrutiny and informed debate on important issues of public concern'"(European Commission, 2002: 17), but also to analyze not only the inherent benefits but also the dangers, limits and failures of science. In this sense, knowing what citizens think of science and technology, of its benefits and detriments, and of scientists, is vital.

One of the best instruments to do this are surveys of the public perception of science and technology. These surveys respond to a dual motivation, theoretical and practical. On the one hand, it's about improving understanding of the scientific/cultural situation as an important aspect of the general culture of a country, a region or a specific collective. On the other, it's also about making relevant information available for practical ends like, for

example, to value the potential popular support for measures that increase public spending on R+D or that establish certain priorities for programs on investigation, innovation, etc.

Works done on the public perception of science have taken form thanks to combined and parallel work relating to North American and European surveys done by Jon D. Miller's investigative groups in the United States and by John Durant in Great Britain. Their emphasis on specifying dimensions of concrete analysis in comparable questionnaires helped these investigations to extend throughout Europe and other countries, so that in the 1990s they were already beginning to have a significant level of empirical foundation.

In the last decades, several researchers have been carrying out periodic surveys on interest, perception and public opinion about science and technology in general, or just some 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 programs like the Forecasting and Assessment of Science and Technology (FAST program). This program sought to predict and analyze the consequences of the incorporation of new technologies in the Framework Programs 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 2010 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 effectively develop and participate in decisions that affect it, 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.

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 (OEI, Organización de Estados Iberoamericanos) and the Network of Indicators on Science and Technology (RICYT, Red de Indicadores de Ciencia y Tecnología) have promoted these types of comparative studies, progressively achieving institutional support such as the Spanish Foundation for Science and Technology (FECYT) or Centro REDES (Argentina), among others. These three institutions now have a priority objective, namely, to attain an Ibero-American 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 Eurobarometers, the topics of biotechnology, biomedicine and health are covered separately. These surveys usually measure three different levels of the 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. Other entities such as the BBVA Foundation have also realized some surveys about specific areas of biotechnology and biomedicine (May, 2008).

A few years ago, a compilation was published that collected contributions from the most representative figures in the study of social perception of science and scientific culture, under the suggestive title of *Between Understanding and Trust. The Public, Science and Technology*. The volume covers a wide range of subjects, conceptual approaches, methodologies and proposals for disciplinary renovation where, despite their diversity, what stands out is a recurrent agreement that is underlined in the conclusion by the editors: analysis of science's credibility and the trust it arouses in citizens should be considered as the most significant points for the future agenda of investigation.

2. Spain and Europe: Generalized optimism?

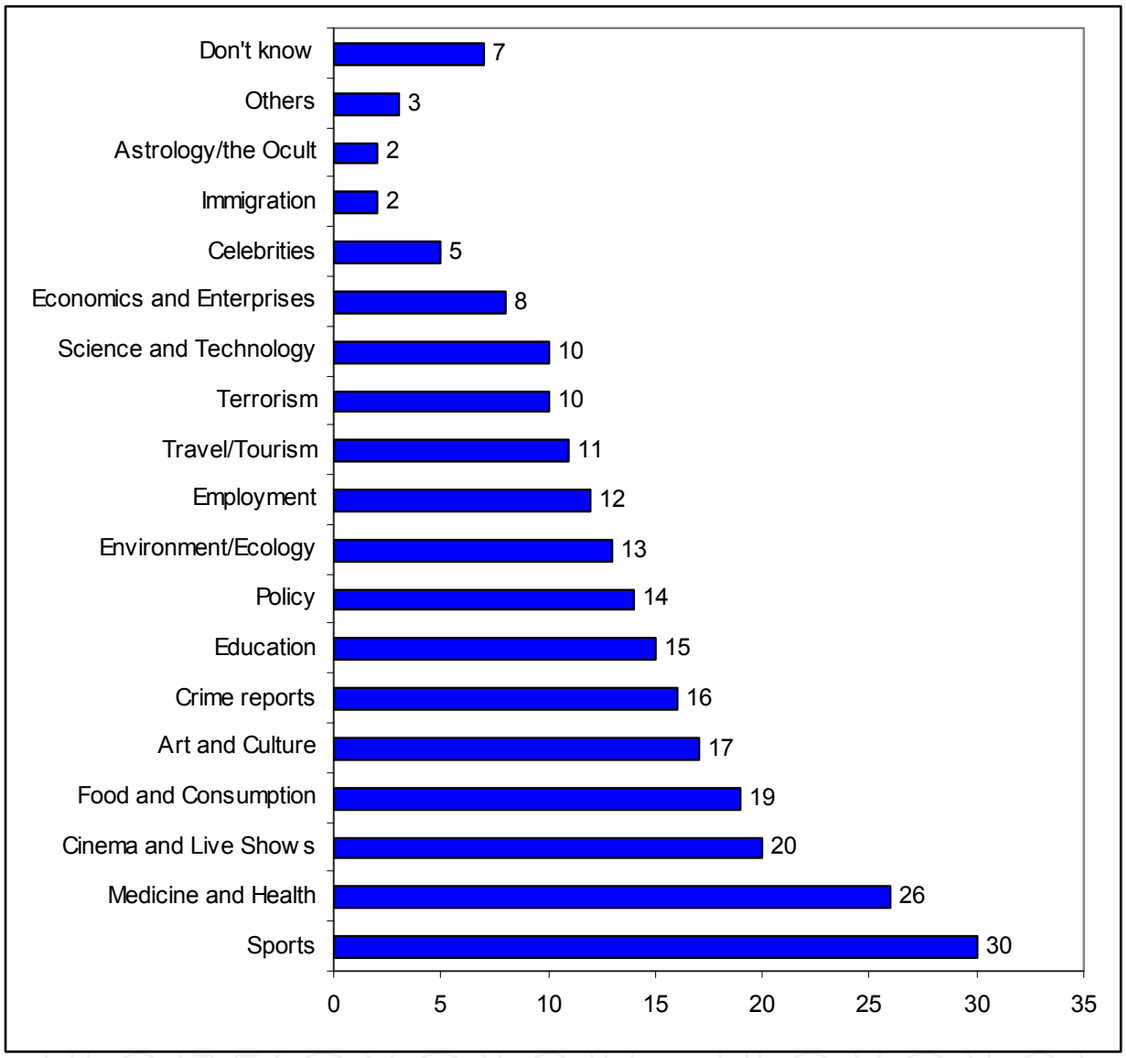
Next, we will see some results from the Eurobarometers and FECYT surveys from 2006 and 2010. The principal objectives of the Eurobarometer have been to measure the attitudes of European citizens regarding collaborative investigative projects in biomedicine, as well as European co-financing of same. They also attempt to connect these issues with the degree of interest in science and technology in general, and in biomedicine in particular (European Commission 2002, 2005a, 2010a). The objective of the *Fifth National Survey on the Social Perception of Science 2010* (*Quinta encuesta nacional sobre percepción social de la ciencia 2010*) carried out by FECYT, was the same as in previous editions in 2002, 2004, 2006 and 2008, that is, to determine how Spanish citizens perceive science and technology. Personal interviews were conducted with 7,744 people of both sexes who had resided in Spain for five or more years and were 15 years of age or more. The field work was done from May 17 to July 9 of 2010, throughout the national territory.[1]

In the case of the Eurobarometer, people were asked, on a Likert-type scale where they had to select two responses, their degree of interest regarding certain topics. Subjects of interest were: nature and environment (84%), medical and health investigation (71%), European and international news (70%), economic and social subjects (68%), sports and outdoor activities (66%), science and technology (60%), art and literature (52%), celebrities and entertainment (42%). The analysis of these results by country shows that 62% of the Spanish population is interested in medical and health investigation, and 50% in science and technology. In spite of dropping approximately 10 points in respect to the European average, the numbers are much higher than those shown in the third national survey done by FECYT on the perception of science and technology, where scientific and technological subjects occupy a modest position on the scale of informational interest in the Spanish population (see Graph 1). Ten percent of those surveyed cite these subjects as being of informative interest to them. It is a similar percentage to that produced by disparate subjects such as terrorism or travel, but remains far below the subjects that lead the chart, such as sports (30%), medicine and health (26%), and cinema and live shows (20%).

The imbalance of data between the European survey and the Spanish one can partly be explained by comparing the response options in both. In the Eurobarometer, the survey-

[1] The sampling error is from +/- 1.14% for a reliability level of 95.5%.

taker is obliged to take a position in each item; however in the Spanish survey they must choose three topics from a much wider variety than in the European survey.



Graph 1. Informational subjects that interest you (máximum 3 responses) (FECYT , 2006)

Among citizens, interest in Medicine and Health (26%) is constant, placing third as a subject of interest in FECYT 2010, behind Work and Employment (32%) and Sports (30%). Regarding the last two, interest may have been influenced by the economic situation, in the first case, and the playing of the World Cup right when the field work was being carried out, in the second. Fifty three point six (53.6) percent of the people are fairly or very interested in medicine and health, although only 29.6% consider themselves fairly or well-informed on these subjects. By subjects of interest, citizens place medicine and health as the subject of most interest, with 3.58 on a scale of 1 to 5. When asked on the survey about which two areas of investigation should take preference in the future, 78.3% of citizens believe that future investigative efforts should center mainly on medicine and health.

To a large degree, all the segments analyzed cite medicine and health as the priority sector in which to concentrate investigative efforts, although it is cited more by women (82.5%). When dealing with questions related to science and technology, the institutions that inspire the most trust (on a scale of 1 "very little" to 5 "much") are Hospitals (4.16) and Universities (4.07). Next come Public Organizations for Investigation (3.79) and Professional Colleges (3.75).

3. Hopes and fears surrounding biotechnology

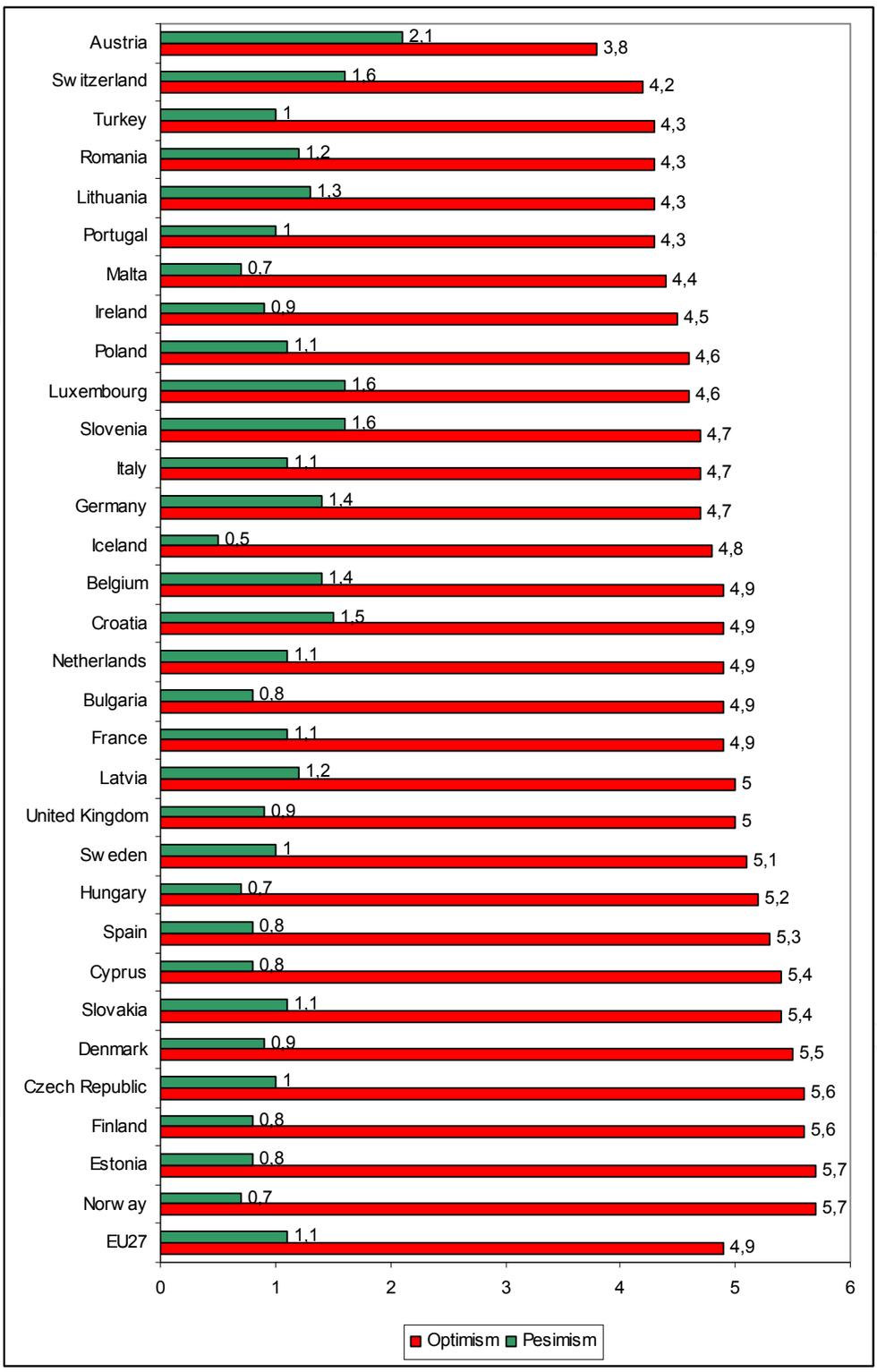
It's interesting to confirm the importance of dividing the temporal period of perception into before and after 1999. With the exception of Holland and Germany, the majority of European countries tend to maintain low levels of optimism regarding biotechnology, or show a drop in it. Nevertheless, with the exception of Austria, all European countries tend to maintain optimism about biotechnology in the second period, especially in Spain at 75 points, with Malta at the maximum with 81 and Greece at the minimum with 19. As such, the given explanations must offer an account of both movements, without having to be exclusively at the national level (European Commission, 2005a).

This inflection also marks a change in stages of development: from Science Literacy during the period of 1960 – 1980 and Public Understanding between 1985 and the 1990s, to Science-in-Society from the 1990s to the present. The changes in these stages have come with controversies that demand a revision of agendas and discourses. Specifically, the Science-in-Society period emerges from the lack of trust following crises such as the controversy around genetically-modified food. As such, activists begin to proliferate whose analysis and investigations are their way of intervening in technological processes. The idea is to change scientific policy.

Period	Attribution diagnosis	Strategy research
Science literacy 1960s-1980s	Public deficit knowledge	Literacy education
Public understanding 1985s-1990s	Public deficit attitudes	Know x attitude Attitude change Education Public relations
Science-in-Society 1990s-present	Trust deficit Expert deficit Notions of public Crisis of confidence	 'Angels' mediators Impact evaluation

Table 1. Paradigms, Problems and Solutions (Bauer, 2009)

One of the ways to explain this change is the concern about genetically-modified food in the first period, and the explosion in biomedical investigation, with its promise to cure illnesses, like the case of investigation into stem cells, in the second period.



Graph 2. Generalised technological optimism and pessimism. Maximum: 8 (European Commission, 2010a)

3.1 The genetically-modified food controversy

During the decade of the 90s, the image of biotechnology was changing. On one side, the controversy on the distribution of genetically-modified food began. One of the milestones in the debate was importations of genetically modified soy, such as Roundup Ready soy from Monsanto in 1996. The analysis and contrast of different studies made at the European and national level on public perception of biotechnology has been an object of study of previous researches. The ambivalence reflected in the work of Luján & Todt (2000) lies in the difference in the response to moral evaluations of a general type and the attitudes maintained towards specific products. This responds in part to the fact that at the center of the controversy on the regulation of genetic engineering are questions such as if the processes or products are the same or not, if they are substantially or functionally equivalents, and if the techniques are old or new.

The first results of the Eurobarometers in the 1990s celebrated the idea that the public perceived distinctions between diverse biotechnologies. At the same time, regulations throughout Europe were distinguishing between agri-foodstuff technologies and biomedical applications. The regulation of foodstuffs and pharmaceutical products has led to the establishment of procedures which are institutionalized in diverse organizations, unlike the process in the United States with its Food and Drug Administration. Thus, the European Food Safety Authority (EFSA) was set up in January 2002, following a series of food crises in the late 1990s, as an independent source of scientific advice and communication on risks associated with the food chain. For its part, the European Medicines Agency is responsible for the scientific evaluation of medicines developed by pharmaceutical companies for use in the European Union. In Spain, the Spanish Food Safety and Nutrition Agency (AESAN in Spanish) was created in 2001 with the mission to "guarantee the highest level of food safety as a basic aspect of public health and to promote the health of citizens so that they have full confidence in the food they eat and adequate information available to be able to choose[2]. Whereas the Spanish Agency for Medicines and Health Products (AEMPS in Spanish) is "responsible for guaranteeing for society, from a public service perspective, the quality, safety, efficiency and correct information of medicines and health products, from their investigation to their utilization, in the interest of protecting and promoting the health of people, animals and the environment.[3]"

On the other hand, the allocation of funds for investigation is delegated to different organisms that project diverse images of biotechnology. This recognition of the distinct attitudes of the public and of the diverse institutions involved in these technologies contrasts with any type of unifying discourse that can be found in other fields. Or, for example, the declared support of the majority of governments for biotechnology as a "strategic technology for the 21st century." Or when they speak from a sociological standpoint of a "genetic revolution"or of "bioeconomics." That is, phases where it is biotechnologies that would define the future of our societies. One of the umbrella concepts under which diverse interests await is that of "life sciences." It's a concept promoted to cover the university scientific community as well as small companies and

[2] http://www.aesan.msc.es/AESAN/web/sobre_aesan/sobre_aesan.shtml. Last consulted in September 2011.

[3] http://www.aemps.gob.es. Last consulted in September 2011.

pharmaceutical corporations, feigning a certain control over all of them at once. Or even Monsanto, which appears to want to encapsulate an integrated vision of chemical activities, seeds and pharmaceutical activities united with the farmer. Something which favors investors, that is, having a unified image of the technological process and its products (Bauer, 2002).

Quantitative studies showed the ambivalence of the perception in Spain. In them it can be confirmed how Spaniards maintain a positive image of science and technology and the professionals involved in these areas (European Commission, 1993; Moreno, 1996). In the Eurobarometers, these types of perceptions are also maintained (Marlier, 1991). It is the same in comparative analyses, where scientific work is considered fundamental to improve the conditions of life (Bauer & Schoon, 1995).

But one of the principal points of ambivalence detected in this first period refers to the consumption of genetically-modified food. Despite the optimism shown toward science and technology, more than 76% of Spaniards reject genetic engineering, and 72.1% are against its application for human consumption. One of the reasons can be found in the gastronomic culture, which doesn't much accept industrially treated foodstuffs. Also influential were the controversies over poisoning from the ingestion of colza oil not suitable for human consumption. On the other hand, in this period of analysis, the Eurobarometer never asked about the evaluation of the application on different organisms, nor about obtaining different products. Rather, it described a generic type of investigation by way of some examples and questions about the level of agreement or disagreement with affirmations like "investigation (on plants, microorganisms and farm animals) should be supported." That is, they asked about the processes and not about the products of investigation. Moreover, when the question was about support for applications of biotechnology and genetic engineering on different types of organisms, a moral evaluation was made; and when the question was about a specific application, its utility was evaluated. Hence, the ambivalence is the result of the conflict between evaluation of the process and evaluation of the product. So, while the application of genetic engineering on plants and foods received a positive moral evaluation, the usefulness of the products obtained from these processes lacked support.

"Question (Q): Do you agree that genetic manipulation should be used for. . . ?"

	"Yes"	"No"
Diagnoses for hereditary diseases	96.2	3.8
Herbicide resistant plants	69.5	30.5
New gene therapies	66.6	33.4
Bigger fish for consumption	27.8	72.2
Faster growing livestock	23.8	76.2

Unit: percentages.

Table 2. Attitudes towards applications of genetic engineering (IESA, 1990 in Luján and Todt, 2000)

"Q: Nowadays it is possible, for example, to introduce genes of corn in potatoes to increase their nutritional value. Would you be willing to consume this type of potatoes?"

Yes	39.6
No	48.3
DK/NA	12.1

Unit: percentages.

Table 3. Attitude towards the consumption of transgenic products (Atienza & Luján, 1997)

"Q: Please tell me whether you tend to agree or tend to disagree with the following statement: I would buy genetically modified fruit if it tasted better."

Tend to agree	28
Tend to disagree	50
DK/NA	22

Unit: percentages.

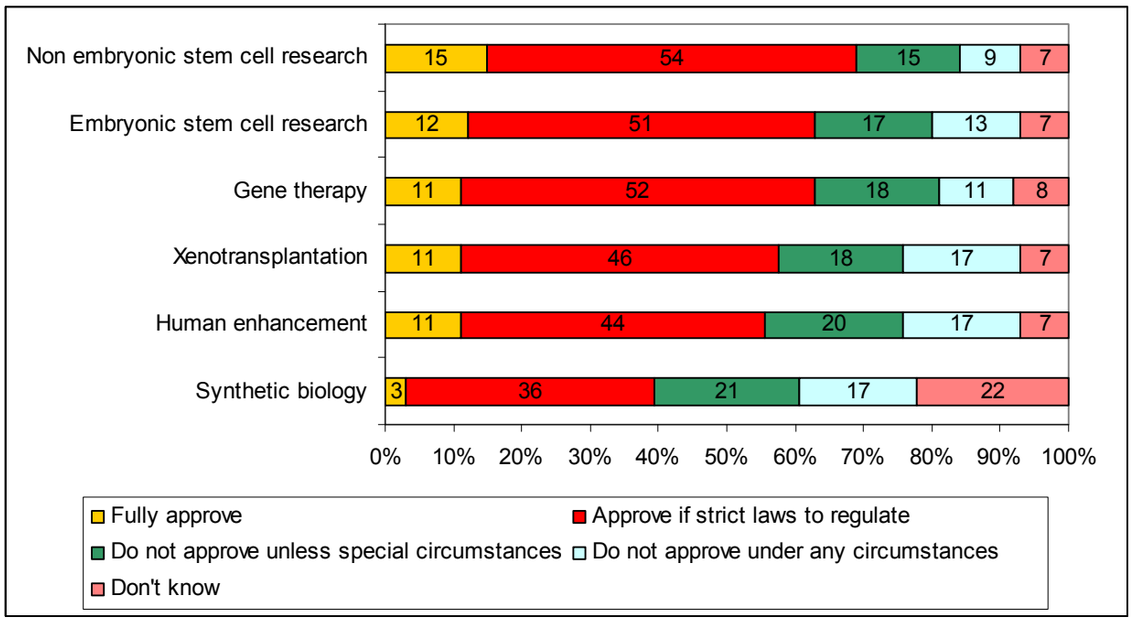
Table 4. Attitude towards the consumption of transgenic products II (European Commission, 1996)

3.2 The promise of stem cell research

Biomedical investigation has had more support than agricultural applications of biotechnology, and has a huge social and economic impact. Its hopeful aspect as a cure for illnesses and improving people's quality of life has been influential in this. However, it appears that regenerative medicine, specifically, also arouses controversies and social, political and religious tensions.

As we see in Graph 3, levels of acceptation are high. Around 68% are favorable towards investigation with non-embryonic stem cells and 63% for the use of embryonic stem cells. However, it's not unconditional support. It varies by country and depends on the legislation and control that governments exercise over the investigations. It is limited by the subordination of research to its respective legislation and controls. In fact, approval percentages under strict laws reach 44% for human enhancement and 54% for investigations with non-embryonic stem cells. Thus, governance is essential in these investigations. And as such, regulation of stem cell investigation varies in European countries. A striking aspect of these investigations on an international level is the diversity they have achieved in a short period of time. There are many countries, like Israel, Sweden and Singapore, that concentrate their economic efforts in specific niches of these technologies. Others, like China and Korea, lacking experience in biomedical investigation and development, have constructed investigative installations that are competitive. Nevertheless, other countries like the United States, Germany and Australia, among others, have seen their investigations hindered due to religious and political

debates on the use of human embryos for investigation, therapeutic cloning and the generation of hybridoma cells.



Graph 3. Levels of approval of biomedical research and synthetic biology, EU 27 (European Commission, 2010b)

In fact, although research with stem cells (embryonic or adult) appears to be an important source of knowledge to improve therapies and fight against illnesses, moral aspects exist that determine the support of some citizens for embryonic stem cell research. The policies of scientific popularization assume that a higher level of scientific knowledge among citizens can help in having greater support for investigation. In fact, some studies have shown that the opinion that citizens have about certain controversial investigative subjects, as is the case with stem cells (SC), isn't influenced by the information they receive but rather by moral or religious aspects (Nisbet, 2005). Nor does it seem correct to assume that a higher level of scientific knowledge is associated with more support for SC research. It's possible that individuals who are more informed have a firmer position, whether in favor or against SCs (Bauer, Allum y Miller, 2007).

In Spain, there is an average understanding of the properties of embryonic stem cells. According to the BBVA study, 2009, 41.9% of those surveyed knew that stem cells can be transformed into various types of different cells and change into specialized tissue like muscles or nerves, but didn't know that the extraction implies the destruction of embryos. Spain (along with the Czech Republic) is the country that most supports research with embryonic stem cells that are only a few days old, in hopes of finding effective treatments as soon as possible for illnesses such as Parkinson's, Alzheimer's or diabetes, at 6.8 (on a scale of 0 – 10 where 0 means complete disagreement and 10 means complete agreement). This can be interpreted to mean that acceptance increases when medical benefits are specified in possible treatments for illnesses that citizens consider important. And this is consistent with Spain being one of the countries that least considers research on days-old

embryos as being an unacceptable interference in the natural processes of life (4.9; only Denmark is lower, 4.7).

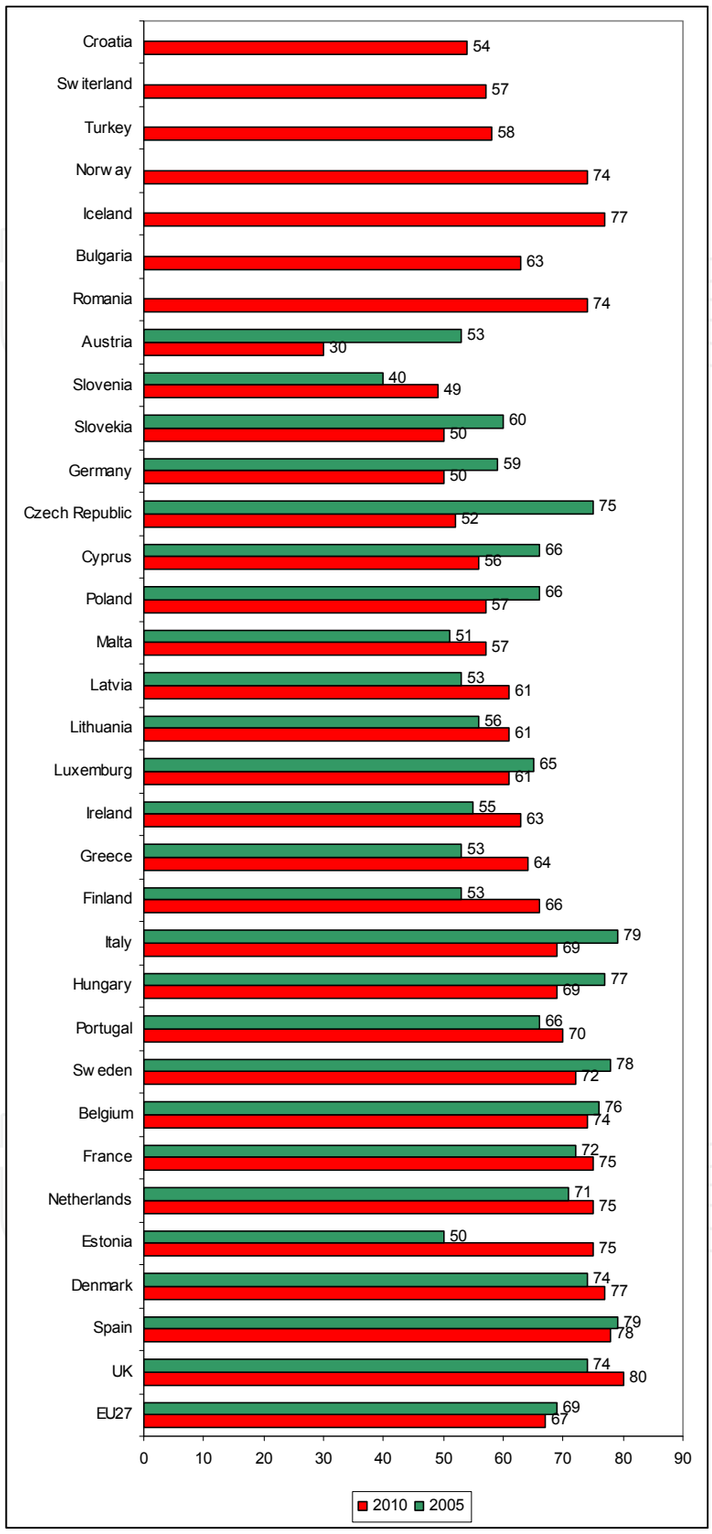
Spain is also one of the countries where research with embryonic stem cells is considered very useful (6.4 on a scale of 1-10, only superseded by Denmark and Sweden, 7.0) and isn't imbued with important risks (5.0), superseded only by Denmark (5.5), Holland (5.2) and the Czech Republic (5.1). The idea of usefulness is quite established, although this doesn't suppose the disappearance of the perception of risk or immorality. Only in certain countries (such as Austria, Germany and Poland) is immorality a more significant feature than usefulness, according to BBVA, 2009.

The financial restrictions on embryonic stem cell research in the United States may have inspired other countries, many of them in Asia, to promote this investigation through specific initiatives for regulations and financing. In spite of the limitations on federal financing, the United States has developed good alternatives such as, for example, through industry or philanthropic investment. In Europe, nevertheless, many countries show strong support for stem cell research. A good example of this is the United Kingdom and their efforts to create transparent policies. Their main installations are located in London, Cambridge and Edinburgh. Sweden has developed dozens of cell lines, carrying out the first studies on the transplant of fetal cells in the treatment of Parkinson's disease, thus stimulating the use of these cells in the treatment of neurodegenerative disorders. Germany, which has legal barriers on research done with embryonic stem cells, has established excellent centers in Berlin and Munich for the study of somatic cells and their potential use in regenerative medicine.

Cooperation and diffusion among countries is one of the characteristics of this research at the European level. The European Science Foundation launched a program, *EuroStells*, for the analysis of comparative research between stem cells obtained from different sources. The *Sixth Framework Programme* backed the development of a database for embryonic stem cells. Currently, scientists and communicators from 90 laboratories are gathered for the *VIIth Framework Programme* to do collaborative work. Nevertheless, European policies haven't managed to smooth over the different policies between countries.

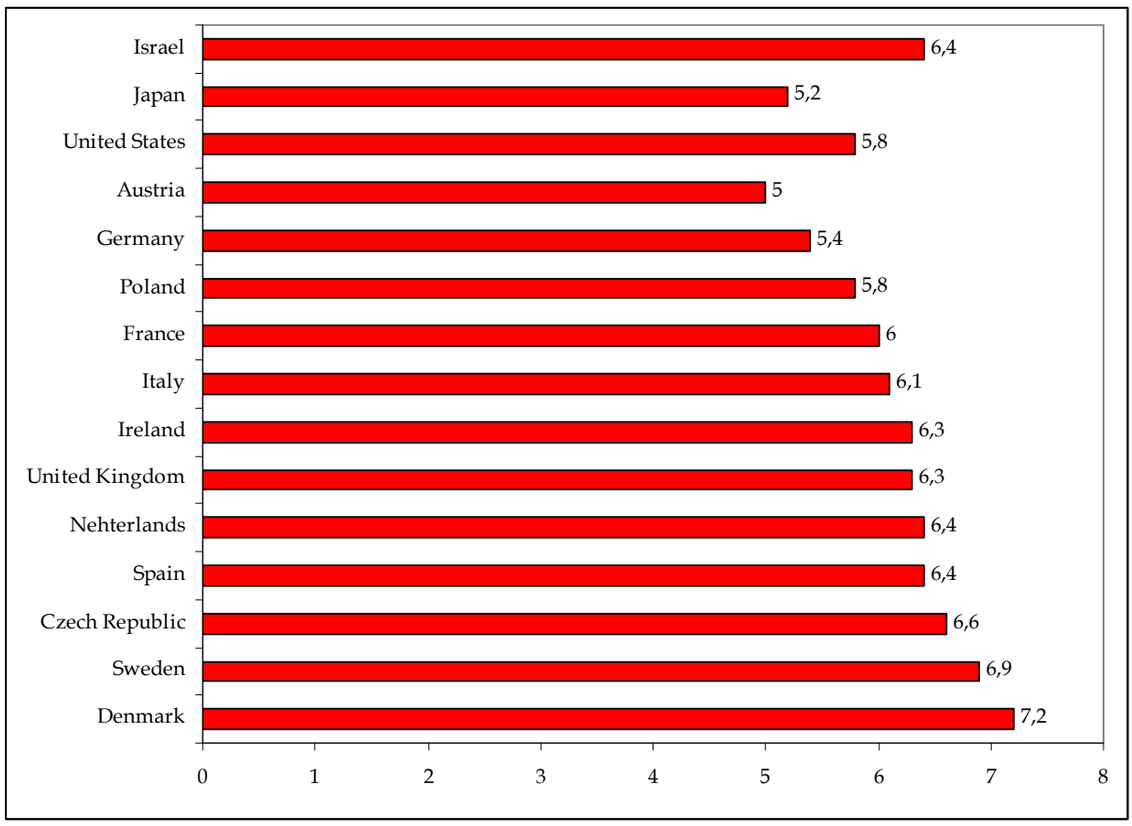
The governments of many countries in Asia and Oceania have demonstrated extraordinary support for the development of stem cells and their application. China, Korea, Singapore, India and Taiwan have invested in this research since 2001. Japan and Australia have built large foundations in basic biology and clinical development in order to create the main stem cell institutes in Kyoto, Kobe and Melbourne. In 2007, a research network was created between Asia and the Pacific (SNAP), launched by scientists in eight countries, but without reaching competitive levels. At the national level, many of the Asian countries have organized strong national societies, which is the case in Singapore, Taiwan and Korea.

Graph 4 shows the level of support that embryonic stem cell research had between 2005 and 2010. Around 55% of people in 19 countries support this research. Support has risen eight points or more in Estonia, Finland, Greece, Ireland, Latvia and Slovenia. On the other side, it has gone down another eight points or more in Hungary, Italy, Poland, Cyprus, the Czech Republic, Germany, Slovakia and Austria. As such, the graph points to future controversies.



Graph 4. Levels of approval for human embryonic stem cell research, 2005 and 2010. % of respondents (European Commission, 2010b)

One of the factors not included in the Eurobarometer, but adds clues to the perception of this type of research, is the evaluation of the use of induced pluripotent stem cells (iPS), which would avoid the use of embryonic cells and, as such, close many debates. According to the study by the Fundación BBVA, acceptation increases in the case of techniques that don't harm or destroy the embryo.



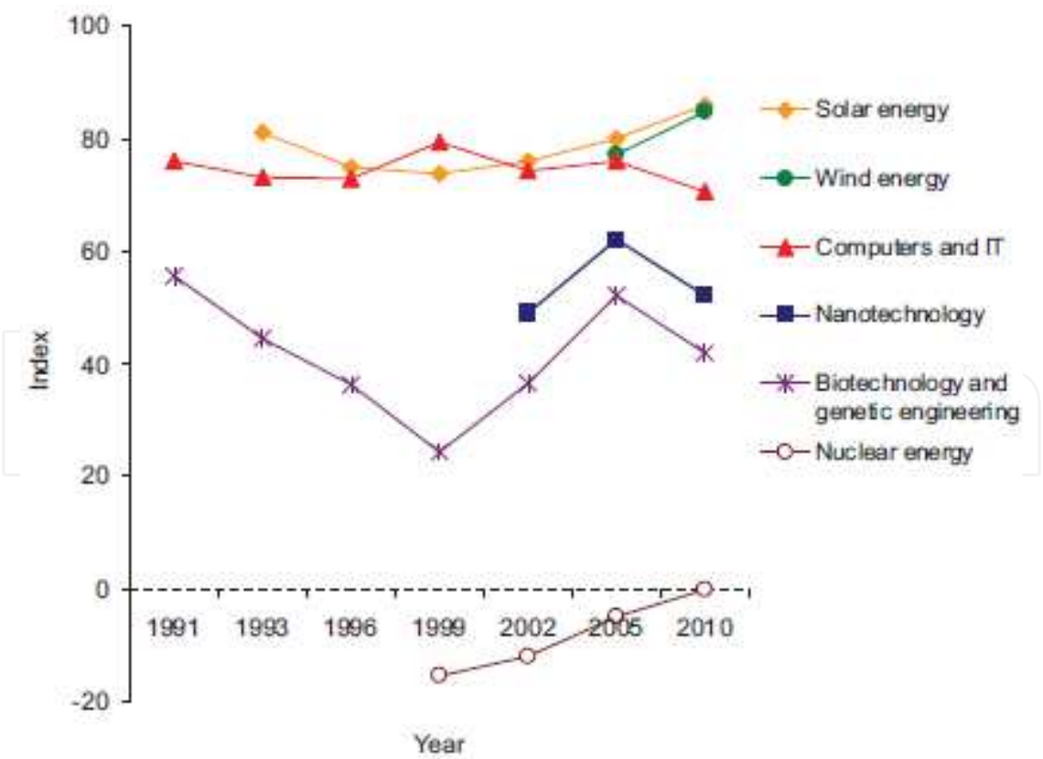
Graph 5. Situation without destruction of the embryo. 0 signifies completely unacceptable from a moral perspective and 10 completely acceptable. (Fundación BBVA, 2008)

The polarization of political and public opinion around the ethical questions related to research with embryonic stem cells has contributed to the growth in interest in obtaining adult stem cells. The defense of the use of embryonic cells tends to ride on its potential future use for cellular transplants. If there were equivalent alternatives, it would be more complicated to defend the use of human embryos in order to get stem cells from them. In this sense, induced pluripotent stem cells could change the terrain of the ethical debates. Those opposed to the use of embryonic stem cells might interpret the results of the research done with stem cells (adult or derived from umbilical cord blood) in a more optimistic way than the experiments show. In the same way, defenders of human embryonic stem cells might be less open if the potential risks of these cells in clinical use were considered. Private clinics operate precisely in this confused space, confronting a medical necessity that millions of patients with incurable diseases demand. Commercials for stem cell clinics often represent the patients as being responsible for their own destiny, while portraying standard clinical medicine as reactionary. They appeal strongly to the needs of patients, some with

chronic illnesses or disabilities, whose current medical treatment doesn't offer a solution. As a result, patients and their families spend many hours surfing the internet looking for stem cell treatments for their particular illness. They're attracted by advertisements on the internet, blogs, articles in national and local magazines and other press, while treatments are publicized as having been successful in Mexico, Russia, India, China, Africa and other countries. Often they'll find not one, but dozens of options, generally in countries where there isn't legislation that controls the activity. Clinics also know how to change their name and country quite rapidly if there's an attempt to discredit them. A patient's secondary effects are often difficult to prove, patients are reluctant to show they've gotten worse, and they rarely admit that they have not benefited from the treatment. One of the reasons is the feeling they have of having paid a huge sum of money for something that hasn't worked, or also the placebo effect that for some ailments can lead to significant, if temporary, improvements.

3.3 A future third period?

The report from 2010 seems to open a third period of falling optimism between 2005 and 2010, at least by one point, as can be seen in Graph 6 (European Commission, 2010). We can continue talking about optimism, but the changes that arise in biotechnology and genetic engineering, and the tendencies the surveys are currently showing, is what especially interests us. If we pay attention to Graph 6, the rise in optimism for wind, solar and nuclear energy in this last period contrasts with the fall in optimism for Computers and Information



Graph 6. Trends in the optimism index of certain technologies (European Commission, 2010a)

Technologies (IT), nanotechnology, biotechnology and genetic engineering. On one side, alternative energies show a rise because of the "Copenhagen Effect." The controversy surrounding climate change, global warming and carbon emissions has helped feed optimism in renewable energies. Regarding the rise in nuclear energy, it must be taken into account that while those who support solar energy also support wind energy, their opinions are divided regarding nuclear energy, between optimism (46%) and pessimism (42%).

How to explain, then, the drop for computers and IT, nanotechnology, biotechnology and genetic engineering? The 2010 report considers that nanotechnology as well as biotechnology show this drop because of the rise (from 12% to 20% in biotechnology) in the response "make things worse." The disenchantment society feels seeing highly promising announcements that later don't materialize in products, therapies, etc., has a lot to do with it. The possibility for future conflicts, especially between the Spanish food industry and consumers, derives from the gap between the perception of the industry toward consumers, mainly as being passive, and the attitudes of the consumer (Todt et. al., 2009).

4. Conclusions

Biotechnology constitutes a good indicator of the governance of science and technology. For the plurality of its practices, periods can be analyzed to see which show distrust, optimism, fear, and in function of which technologies. The main ambivalences found in this study are:

- European and Spanish indicators show certain divergences in respect to certain processes, as in the case of the perception of science and technology. The lack of homogenization in the surveys, their units of measure and objectives make a comparative analysis of same difficult. The divergence in the results makes it necessary to pay attention not only to the analytical differences they present, but also the qualitative aspects of the processes analyzed.
- In spite of the political, economic and media dominance of unifying discourses in biomedicine (i.e.: life sciences, genetic revolution, bioeconomics), the public shows a complex and plural perception regarding these processes. Positioning and evaluating the different biotechnologies analyzed such as genetic engineering, regenerative medicine, cellular therapy, etc., and modifying their perceptions, attitudes and actions in function of the course taken by them. It is precisely this flexible aspect that obliges institutions to maintain transparent policies in which citizens keep taking an ever more active part in the decision-making.
- A moral evaluation on biomedical processes and the utility of their products continues to be posed. The case of the perception of stem cell research is a clear example of this. The positive evaluation of research with induced pluripotent stem cells, or even with adult cells, in contrast to research with embryonic cells shows a moral reflection about these processes. That is, that the use of the products from these technologies, as well as the hope placed in them to cure illnesses, is accepted independent of the moral evaluation of said technologies.

To sum up, analysis of the processes of the perception of biotechnology put into question the homogenization of national and European tools when approaching the same questions. At the same time, diversity, the capacity for change and the complexity of the perception of citizens about these biotechnologies requires giving incentives to European and national

mechanisms to favor greater public participation in the regulation and risk prevention of them.

5. Acknowledgment

This chapter was carried out as part of the Cartographies of Science and Technology: Ethnographies, Images and Epistemologies (FFI 2009-07138-FISO) project.

6. References

Atienza, J. Luján, J.L. (1997), *La Imagen Social de las Nuevas Tecnologías Biológicas en España,* CIS: Madrid (*The Social Image of New Biological Technologies in Spain*)

Bauer, M. W., (2009), "The evolution of public understanding of science-Discourse and comparative evidence", *Science, Technology & Society*, 14: 221 – 242

Bauer, M. W., (2003), "Controversial medical and agri-food biotechnology: a cultivation analysis", *Public Understanding of Science*, 11: 93 – 113

Bauer, M., y Schoon, I., (1993), "Mapping Variety in Public Understanding of Science" *Public Understanding of Science*, 2 (1993): 141–155

European Commission, (1991), *Eurobarometer 35.1.* Commission of the European Communities: Brussels

European Commission, (1993), *Eurobarometer 38.1. Europeans, Science and Technology: Public Understanding and/ Attitudes*, Commission of the European Communities: Brussels

European Commission, (1996), *Eurobarometer 46.1.* Commision of the European Communities: Brussels

European Commission, (2002), *Eurobarometer 58.0. Europeans and Biotechnology in 2002*, European Commission.

European Commision, (2005a), *Eurobarometer 64.3. Europeans and Biotechnology in 2005: Patterns and Trends*, European Commission: Luxembourg

European Commission, (2005b), *Europeans, Science and Technology*, European Commission: Luxembourg

European Commission, (2010a), *Europeans and Biotechnology in 2010. Winds of change?*, European Commission: Luxembourg

European Commission, (2010b), *Science and Technology*, European Commission: Luxembourg

FECYT (2006): *Tercera encuesta nacional sobre percepción social de la ciencia*, Madrid.

FECYT (2010): *Quinta encuesta nacional sobre percepción social de la ciencia*, Madrid.

Fundación BBVA, (2008), "Actitudes hacia la investigación con células madre", *II Estudio de Biotecnología de la Fundación BBVA* ("Attitudes Toward Stem Cell Research", *II Study of Biotechnology from the BBVA Foundation*)

IESA, (1990) *Biotecnología y Opinión Pública en España,* Instituto de Estudios Sociales Avanzados: Madrid (*Biotechnology and Public Opinion in Spain*, Institute of Advanced Social Studies: Madrid)

Luján, J. L. y Todt, O., (2000), "Perceptions, attitudes and ethical valuations: the ambivalence of the public image of biotechnology in Spain", *Public Understanding of Science*, 9: 383-392

Marlier, E., (1991), "Eurobarometer 35.1: Opinions of Europeans on Biotechnology"in *Biotechnology in Public*

Moreno, L., (1996), "La Opinión Pública y los Avances en Genética," in ed. Borrillo, D., *Genes en el Estrado*, CSIC: Madrid ("Public Opinion and Genetic Advances")

Pérez Sedeño, E. And Miranda Suárez, M.J. (2008): "Percepción pública de la biomedicina en España", *Medicina Clínica*, : 131 (Sup. 3) : 6-12 ("Public Perception of Biomedicine in Spain," *Clinical Medicine,* : 131 Sup.3)

Todt, O., Muñoz, E., González, M., Ponce, G., Estévez, B., (2009), "Consumer attitudes and the governance of food safety", *Public Understanding of Science*, 18: 103-116

Biomedicine

Edited by Dr. Chao Lin

ISBN 978-953-51-0352-3
Hard cover, 200 pages
Publisher InTech
Published online 21, March, 2012
Published in print edition March, 2012

Comprehensive and systematic scientific researches in cell biology and molecular biology have promoted the evolution of traditional medicine. Scientists are now able to interpret a few perplexed medical difficulties with the emphasis on molecular levels. This book focuses on frontier progress in modern biomedical science dealing with regenerative medicine, gene medicine, nanobiomedicine, and medical devices. Each chapter is intently chosen and written by professional experts in the field of biomedical science. Biomedicine is a valuable guide for the readers to become aware of current advancement in rapidly moving field of biomedicine.

INTECH
open science | open minds

InTech Europe
University Campus STeP Ri
Slavka Krautzeka 83/A
51000 Rijeka, Croatia
Phone: +385 (51) 770 447
Fax: +385 (51) 686 166
www.intechopen.com

InTech China
Unit 405, Office Block, Hotel Equatorial Shanghai
No.65, Yan An Road (West), Shanghai, 200040, China
中国上海市延安西路65号上海国际贵都大饭店办公楼405单元
Phone: +86-21-62489820
Fax: +86-21-62489821

IntechOpen