

## NANOBIOTECHNOLOGIES: TECHNOLOGY TRANSFER AND COMMERCIALIZATION IN SPAIN

*Esteve Juanola-Feliu<sup>1</sup>, Josep Samitier<sup>1,2</sup>*

<sup>1</sup>CEMIC-Universitat de Barcelona, Martí i Franquès 1, Planta 2, Barcelona, Spain,

[ejuanola@el.ub.es](mailto:ejuanola@el.ub.es)

<sup>2</sup>IBEC-Institute for Bioengineering of Catalonia, Baldiri Reixac 10-12, 08028 Barcelona,

Spain, [jsamitier@ub.edu](mailto:jsamitier@ub.edu)

This paper analyses the state of the art for nanobiotechnology commercialization, focusing on the scientific and economic challenges arising from nanomedicine.

Nanotechnology is an endless source of innovation and creativity at the intersection of medicine, biotechnology, engineering, physical sciences and information technology, and it is opening up new directions in R+D, knowledge management and technology transfer. Nanotechnology has already penetrated the market and, consequently, the competitive advantages of the more developed economies are threatened.

Nanotechnology is expected to make a rapid impact on society [1]: creation of future economic scenarios, stimulation of productivity and competitiveness, converging technologies, and new education and human development. Evidence for the rapid impact of nanotechnology can be gleaned from figures for government investment in nanotechnology R+D activities, facilities and workforce training. The 2008 USA National Nanotechnology Initiative budget request for nanotechnology R+D across the Federal Government was over US\$1.44 billion [2]. In Europe, the VIIth Framework Programme (FP) will contribute about €600 million per year to nanotechnology research until 2013, with an additional, similar amount being provided by individual countries. This gives Europe a larger yearly spend on nanotechnology than the United States or Japan [3].

Scientific papers and patents in the nanotechnology sector have grown exponentially over the last two decades. Products based on nanotechnology are already in use and analysts expect markets to grow by hundreds of billions of euros during the present decade. After a long R+D incubation period, several industrial segments are already emerging as early adopters of nanotech-enabled products [4]; in this context, surprisingly rapid market growth is expected and high mass market opportunities are envisaged for targeted research sub-segments (Figure 1). Findings suggest that the Bio&Health market is among the most challenging ones during the next years.

By the end of April 2009, the NanoSpain Network was up to 273 research groups and companies accounting over 1500 researchers. In 2007, there were 211 Spanish projects in the nano field (including 567 subprojects), involving 294 industries as partners or end users, as well as 5,000 researchers (2,400 doctors) [5]. Over 100 companies, research centres, technology centres and hospitals are currently members of the Spanish Nanomedicine Platform. Since 2004 the Spanish NanoTechnology Think Tank has sought to link public research institutions and private companies by exploiting innovative market opportunities from nanotechnologies. Over fifty applications in biomedicine and pharmacology, energy, electronics, ICT, aeronautics, chemistry and advanced materials have been launched onto the market in the search for development agreements [6]

Nanobiotechnology is a rapidly advancing area of scientific and technological opportunity that provides advances into the food industry, energy, environment and medicine. In the nanomedicine case, there is a wide range of technologies that can be applied to medical devices, materials, procedures, and treatment modalities. A closer look at nanomedicine introduces emerging nanomedical techniques such as nanosurgery, tissue engineering,

nanoparticle-enabled diagnostics, and targeted drug delivery. According to an expert group of the European Medicines Evaluation Agency (EMA), the majority of current commercial applications of nanotechnology to medicine are devoted to drug delivery. On the other hand, novel applications of nanotechnology include tissue replacement, transport across biological barriers, remote control of nanoprobes, integrated implantable sensory nanoelectronic systems and multifunctional chemical structures for targeting of disease.

In summary, a survey about nanobiotechnology commercialization is given laying emphasis on nanomedicine and its Spanish context, where research and medical applications are heavily funded by governments and private sector. Thus, Spain could strengthen its networks of science and technology parks, institutes and research centres, hospitals, technology platforms and incubators to meet the new scientific and market challenges provide by nanotech-related life sciences .

### References:

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### Figures:

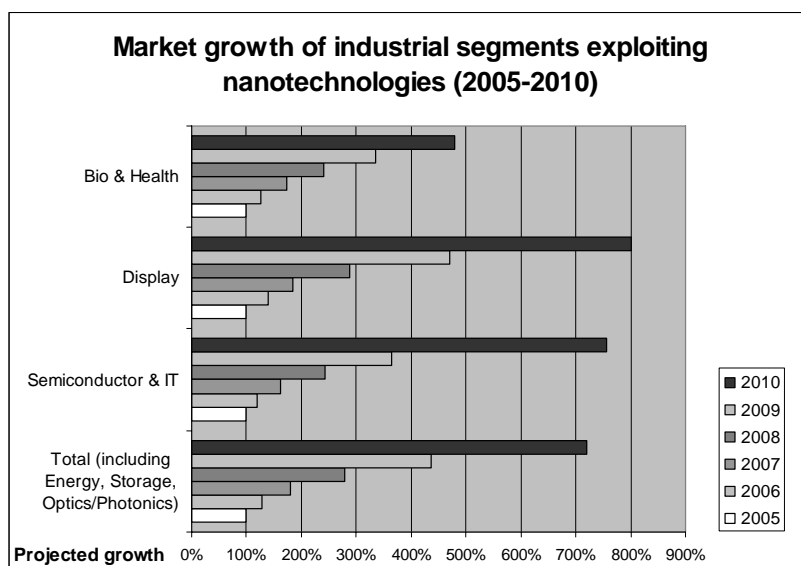


Figure 1: Chart based on Fuji-Keizai USA market research