Biotechnology, pharmaceutical and life sciences

Personalised medicine

Personalised medicine is a set of scientific fields comprising epigenetics (the study of how environmental factors cause diseases like cancer or Alzheimer's) **and pharmacogenomics** (the study of the effect of an individual's genetic variability in their response to certain drugs).
Personalised medicine is the (genetically) individualised diagnosis and treatment of diseases. Potential applications include cancer treatments where a treatment based on **the genetic condition and molecular characteristics of the tumour** is designed, maximising the immune response against the pathology and minimising the need to take medication and therefore side effects.

ORIGIN OF THE INVESTMENT OPPORTUNITY

ECONOMIC/BUSINESS | **DEMAND** | **REGULATIONS** | **TECHNOLOGY**

The application of pharmacogenomics in the health system could help **reduce total costs in the medium term**, mainly by reducing the costs associated with the administration of drugs, especially in oncological diseases.

The diseases with the larger business opportunity for development of early diagnosis and treatments in medicine are **haematology** (e.g. transplant immunology and malignancies of lymphoid tissues) and **oncology** (the most common among the population: breast, colon and lung).

Research in personalised medicine is the "priority" area of H2020 European funding programme "Health, demographic change and well-being" with a budget of **543.5 million euros earmarked for personalised and stratified medicine** during 2015.

The technology is currently in the **development phase** of the national biotech sector. This gives rise to the **SUMMA project** which **coordinates public procurement projects of innovative technology** in the areas of oncology and haematology.

LOCATION OF THE INVESTMENT OPPORTUNITY IN THE SECTOR VALUE CHAIN

Research → Scale → Production → Commercialisation

While there are certain drugs considered to be precision, the field of oncology technology is currently more a **stratified**, meaning that different types of cancer are classified based on **critical targets** for developing effective drugs in place of a personalised one. Therefore the opportunity of personalised medicine is placed in the **research phase**.

DIFFERENTIATING FACTORS OF THE INVESTMENT OPPORTUNITY

CONSUMER/USER

- Innovation
- Price
- Quality

- The more highly **patient-specific treatment** can be done faster and is less traumatic for patients recovery, which is expected to reduce the **average hospital stay** significantly.
- Personalised medicine involves management and drugs savings, ensuring the provision of a more efficient service for patients and more sustainable from the economic point of view.

COMPANY/INNOVATION

- Operations
- Supplies
- New business lines

- New personalised drugs are accompanied in most cases by **biomarkers** (predictive and diagnostic tests) to identify patients for whom treatment is most appropriate and to monitor progress.
- In addition to the biomarker throughout all stages of development, the research of new drugs drives: research, clinical trials, manufacturing and commercialisation.

SOCIETY

- Environment
- Well-being
- Safety

- The search for effective drugs and without side effects (pharmacogenetics) is essential to **increase the effectiveness** of treatment and **reduce negative side effects**, which in some cases can even be fatal.
- Clinical experience shows the low efficiency of some treatments in various diseases such as **Alzheimer's** (between 30% and 60%); **schizophrenia** (between 25 and 75%) or **hypertension** (between 10 and 70%).

INVESTMENT OPPORTUNITY LIFE CYCLE

DEVELOPMENT | INTRODUCTION | GROWTH | MATURITY

Cellular regulation (epigenetic) was first described **50 years** ago and technologies are currently under in the **development phase** with the national biotech sector. However, there is already pharmacogenetic information regarding 25% of the medicines used and pharmacogenetics is already a reality in most of the **major Spanish hospitals** (7 welfare, 7 research and 3 are very interested in starting this type of tests) [(1)], although there are still major barriers to implementation and final extension into **hospital pharmacy** services, such as training of staff and low budgets having impeded their spread.

Sources: (1) Survey conducted by the Group of Pharmacogenetics and Clinical Pharmacokinetics of the Spanish Society of Hospital Pharmacy from 32 hospitals (2013). Fundación genoma España (2014). OPTI (2015). BioCoreLabs (2014). ASEBIO (2015).

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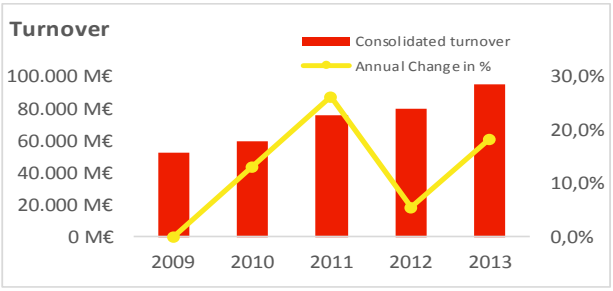
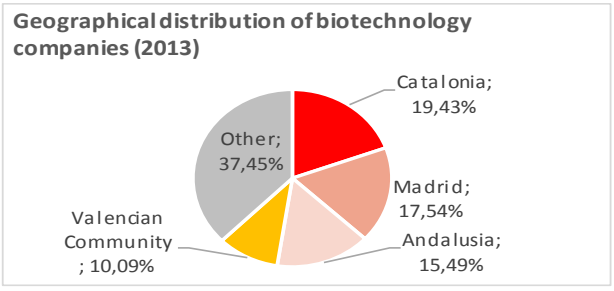
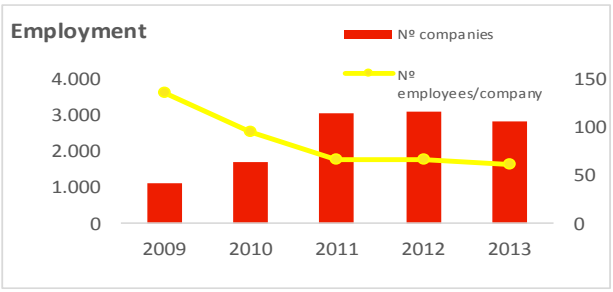
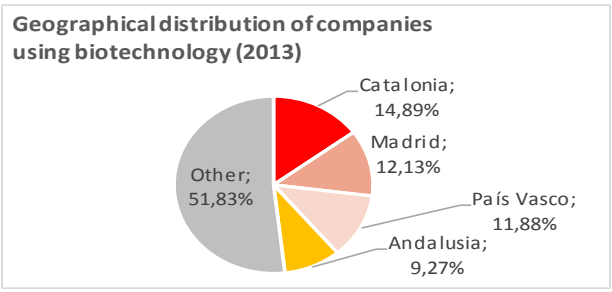
CHARACTERISTICS OF THE SECTOR (2)









SUPPLY

TOP 5 COMPETITORS IN SPAIN

#	Company	Net sales	Last available data
1	Roche farma SA	635.4	2014
2	Sistemas genómicos	€3.49 M	2013
3	Pangaea biotech	€3.09 M	2013
4	Progenika biopharma	€2.82 M	2013
5	Vivia biotech	€0.072 M	2013

DEMAND

GROWTH

- It is expected that the global market of personalised medicine will reach a volume of 2.453 billion by 2020.
- By activity, the fastest growing segments will be the **proteomics** (the study of proteins in epigenetic) and **genomics**, which emerged as a result of intense research of the prior segment.
- Between 2011 and 2014, the number of **personalised** medicine therapies grew **57%** from 72 to 113 products (diagnostic tests and targeted therapies). In 2006 there were only 13 treatments globally.

SUCCESS STORIES

Progenika Biopharma
GRIFOLS

In 2012, Progenika Biopharma presented Proscan, a genetic test for predicting the **risk of relapse** (recurrence of an illness shortly after the end of convalescence) in prostate cancer. Proscan will help urologists in choosing personalised treatments from a sample of blood or saliva from the patient, the test detects five genetic variants associated with the risk of the disease recurring following convalescence after surgery.
Among other successfully developed and marketed products is the **IBDchip**, the first DNA chip that can predict the clinical course of inflammatory bowel disease which includes ulcerative colitis and Crohn's disease.

PangaeaBiotech S.L.

Pangaea Biotech has a laboratory of 380 m2 with the latest technology dedicated to applied research studies in the area of personalized medicine. It was the first pharmacogenetic laboratory to be certified by ENAC (National Accreditation) in Spain and audited by FDA (United States Food and Drug Administration), with more than 10,000 genetic tests a year, demonstrating a high operational capacity. Among the successes of the company are the patent (European Union) of its own method for determining the degree of EGFR mutations in blood.
In 2013, Pangaea Biotech signed an alliance with the **Institut Químic de Sarrià** (IQS) to jointly investigate lung cancer and other solid tumours over a period of three years.

Roche

Roche has a presence in Spain and are leaders in the healthcare industry on the world stage. In recent years, Roche has developed the area of personalised medicine, combining expertise in the areas of diagnostics and pharmaceuticals. There is some progress in oncology, such as the **K-RAS mutation** test in cases of colon-rectal cancer, which identifies tumour-specific mutations to anticipate the prognosis of the disease before symptoms. The test helps doctors identify patients who could benefit from a specific cancer therapy, depending on the absence or presence of the mutation.

Sources: (2) ASEBIO, "Report - status and trends of biotechnology in Spain 2014" (2014). PANGEA BIOTECH (2014). PROGENIKA (2012). ASEBIO (2015). CNIO (2015). PMC (2014).

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POSITIVE FACTORS FOR INVESTING IN SPAIN

Favourable factors in Spain for the development of the opportunity

High level of research activity

Spain has a large number of both public and private centres. In the private sector, it the pharmaceutical company Ferrer stands out, with an investment of 30 million euros over the last eight years in the field of personalised medicine. At the public level, the **National Cancer Research Centre** stands out, which receives 7 million euros of European funds for cancer research

Push in the development of new technologies

Spain stands out in **diagnosis, search for biomarkers, developing microarrays, gene silencing, and development of personalised therapies**. Specifically, they include the **National Bioinformatics Institute** and the **Carlos III Institute of Health**, which spent over 26 million euros on the training of researchers.

Partnerships with the National Health System

The **SUMMA project** aims to identify early demand for technologies in the field of Personalised Medicine (advanced markers). To do this, it will assess the needs of hospitals in the field of biomarkers and technology to **coordinate public procurement projects of innovative technology**, mainly in the areas of oncology and haematology .

Social factors and habits

The forecasts of the Spanish population by age reveals a progressive and continued **ageing of the population**. According to the INE (Spanish Statistical Office), the percentage of population over 65 years old currently stands at 18.2% and will become 24.9% in 2029 and 38.7% in 2064. This projection places the Spanish population as a market with great potential in terms of healthcare. (3)

Favourable factors for the sector in Spain

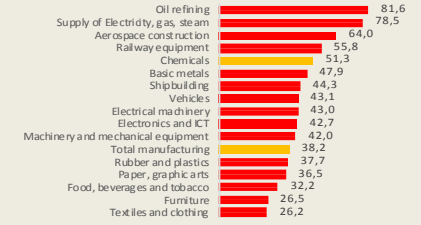
Macroeconomic situation

For weight of the sector in GDP (sales of companies using biotechnology respect to national GDP), the ratio continues to grow another year and reached **9.07% of GDP** at constant prices (compared with 7.61% in 2012 and the low 2.91% in 2008). **88%** of companies carried out some international activity, mainly in Europe and North America. (4)

Labour market

The **average productivity per employee** in the chemicals sector is **91, 400 euros per year**. Their **average individual remuneration** is **51,300 euros per year**. The **Unit Labour Cost** accounts for **56.1%** of the ratio between the remuneration per employee and the individual productivity (productivity defined as value added per employee). (5)

Remuneration per employee (thousands of €)



Graph created using data from the Sectoral Presentation: chemicals sector. April 2015. Ministry of Industry, Energy and Tourism

Incentives

The Centre for the Development of Industrial Technology (CDTI) finances R+D projects in four categories: Individual R+D projects, National Cooperation R+D projects, International Technological Cooperation Projects and specific announced R+D projects. Furthermore, there are other cross-sectional programmes such as the línea Directa de Innovación, the línea de Innovación Global, Innvierte and FEDER (ERDF) Innterconecta. Also, the ICEX-IIS Technology Fund funded by the ERDF and ICEX offers companies with **foreign capital** aid of up to 75% of the project to carry out new R +D+i in Spain.

I+D+i

The Spanish biotechnology companies involved in R+D+i are small: 84% of companies have fewer than 100 employees, 68% no more than 25 employees and 38% have less than 10 employees (micro), mostly spin-offs. (6)

Suppliers, Supplies, Raw materials

Personalised medicine is based on the use of new discoveries and **molecular diagnostic** trials. The Spanish government backs the **Programa Oncológica**, focused on the development of biomarkers to improve the prognosis and diagnosis of cancer to detect cancers and predict its development.
The project consists of seven biopharmaceutical and biotechnology companies led by **PharmaMar**.

Geographic location

Spain is **within reach of three main regions**: the **European** region, the **Mediterranean** region and the **Atlantic** region. Spain is considered to be the gateway between North Africa and Europe, and a key link to Latin America,
not only because of its geographical location but also because of its strong historical and cultural ties with the region. In Spain the **Canary Islands** play a key role with regards to **maritime traffic** with **West Africa**.

Technological and research infrastructure

The Healthcare Reputation Monitor (MRS) establishes the best public and private hospitals based on **indicators** such as human and material resources, number of beds, availability of basic and high-tech equipment, total admissions and average time of stay, and satisfaction with the service.
The top five public hospitals are La Paz, Hospital Clínic i Provincial de Barcelona, the Gregorio Maranon, Vall d'Hebron Hospital and 12 de Octobre. The five best private centres are the Navarra University Hospital , the HM Montepríncipe, the HM Sanchinarro, the Quirón de Madrid and the Hospital Ruber Internacional. (7)

Location of the top 10 public and private hospitals in Spain in 2014.

Graph created using the results of the Health Reputation Monitor 2014. (2014). (5) MINETUR, "Sectoral Presentation: Chemicals industry" (2015) (6) MINETUR "Report - profile of Spanish biotechnology companies involved in R+D+i" (2014). (7) Merco, "Healthcare provision indicators" (2014). 8) Brand Spain, "Foreign investment in Spain and its socio-economic contribution" (2014)

Transport infrastructure and logistics networks

There are **250 airlines** operating in Spain in its 47 airports; its high-speed rail network is the 2nd best in the world and the best in Europe; it is ranked **1st in the EU for its motorway network**; and it has excellent sea connections to its **46 ports** distributed along the Atlantic and Mediterranean coasts. (8)

Sources: (3) INE, "Projection of the population of Spain 2014-2064" (2014). (4) ASEBIO, "Report - status and trends of biotechnology in Spain" (2014). (5) MINETUR, "Sectoral Presentation: Chemicals industry" (2015) (6) MINETUR "Report - profile of Spanish biotechnology companies involved in R+D+i" (2014). (7) Merco, "Healthcare provision indicators" (2014). 8) Brand Spain, "Foreign investment in Spain and its socio-economic contribution" (2014)