

NEW TECHNOLOGIES IN

SPAIN

# BIOTECHNOLOGY

With new companies, new products, and new research centers, Spain is a world-class contender in the biotech industry.

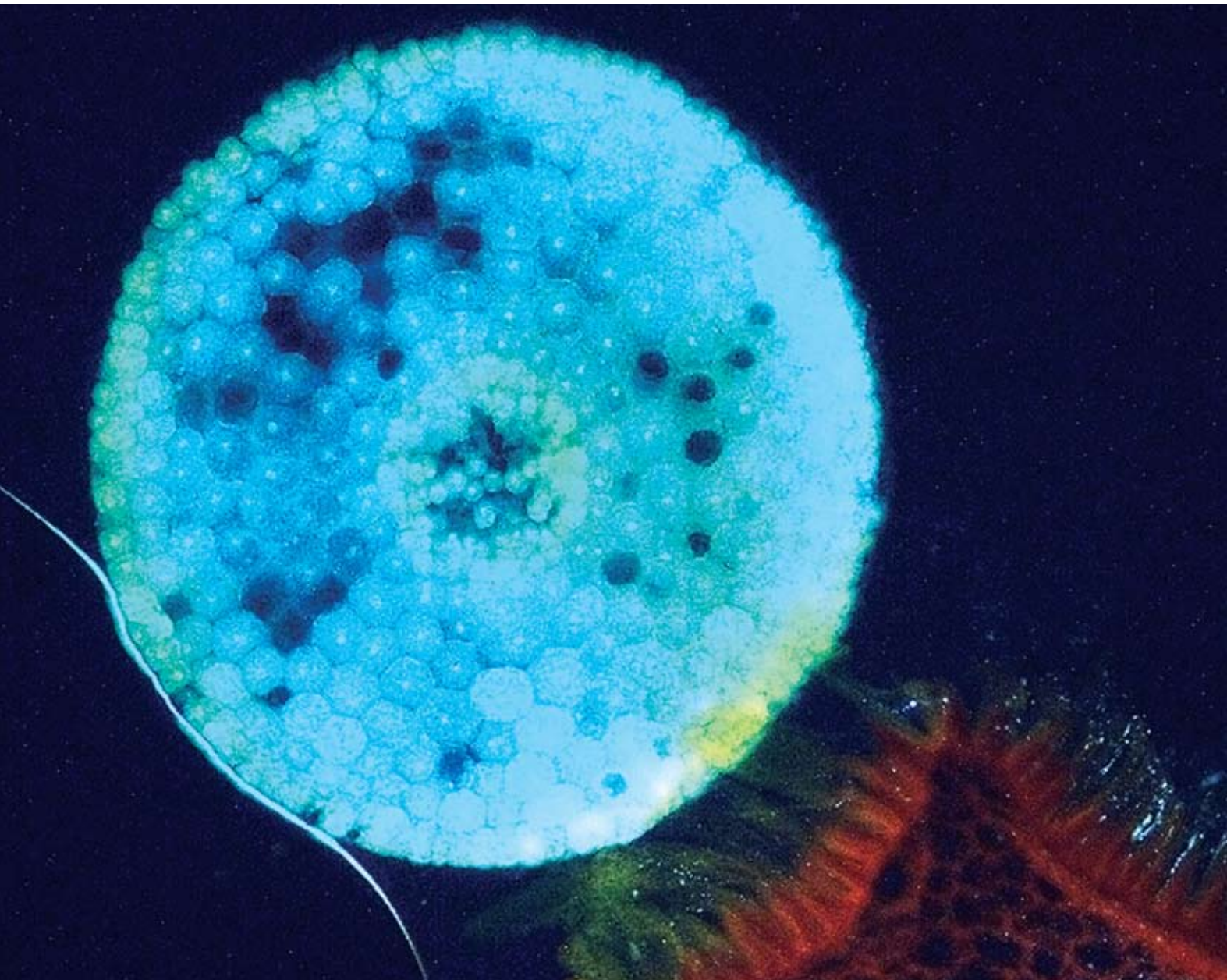


## Innovation in Motion

Spain represents more than 2.1% of the world's total GDP and has enjoyed a remarkable 14-year streak of economic growth above the 3% mark. The country is a modern knowledge-based economy that is supported by a young, highly qualified workforce. Spain is fast becoming a leader in innovation, generating advanced solutions in the industries of aerospace, renewable energy, water treatment, rail, biotechnology, industrial machinery, and civil engineering. Spanish firms are innovators in the field of public-works finance and management, where six of the world's top ten companies are from Spain. Where innovation thrives, so will the successful global enterprises of the 21st century.

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# BIOTECHNOLOGY IN SPAIN

The biotechnology sector in Spain has grown dramatically, with nearly 700 companies contributing significantly to the Spanish economy.

In a technology park in Tres Cantos, on the outskirts of Madrid, researchers clad head to toe in light blue protective gear perform experiments with adult stem cells. They're hard at work developing compounds to fight diseases at Genetrix, home to the country's only commercial adult stem-cell facility.

In a nearby lab at PharmaMar's research facilities, a faint tang of salt in the air recalls the sea, as the company investigates applications for its first approved cancer-fighting compound, which is derived from marine organisms.

This region is just one of the many around the country in which biotechnology is thriving. According to the Spanish Association of Biotechnology (ASEBIO in Spanish), the sector has flourished in the last five years. By 2007, the latest year for which data is available, the association counted nearly 700 companies engaged in biotechnology, with almost 50 percent growth in funds devoted to research.



Companies in Spain are taking advantage of the country's strength in the life sciences and turning research into useful services and products.

## BIOLOGICALLY ACTIVE

Spain has a long tradition of scientific excellence, particularly in the life sciences. In the past decade the country has focused on transforming its research into consumer-focused companies and products. This advance has come about in large part because of a national and local government focus on increasing the country's prominence in biotechnology.

Madrid is home to 75 hospitals, seven of which have more than 1,000 beds, and “the tissue of Madrid health care provides the grounds for clinical trials,” according to Jesus Sainz, chair of PromoMadrid. This opportunity for research partnerships, along more than a dozen universities, top-quality health care, and government focus on biotechnology, has led the region to become a magnet for both local and international companies. Almost half of all new Spanish biotechnology startups locate their head offices in the Madrid region, while pharmaceutical companies, including GlaxoSmithKline, Pfizer, and Bristol-Meyers Squibb, to name a few, have set up research facilities. The success of the region, says Sainz, is based on the “connection between the universities and research centers and the biotech and pharmaceutical companies.”

Two of the most prominent examples of the country's success are PharmaMar and Genetrix, both located on the outskirts of the city.

Genetrix, today a family of nine biotechnology companies, was spun off from the National Center for Biotechnology in 2001

by researcher Cristina Garmendia. While Garmendia no longer heads the company, she is a powerful example of the cultural changes in Spain: she is now the minister of the newly-created Ministry of Science and Innovation.

Cellerix, the most prominent Genetrix company, investigates the properties of adult stem cells derived from adipose (fat) tissue. The patient's own fat is removed through liposuction, and its stem cells are isolated and cultivated, then used for the patient's therapeutic needs.

The company is in the final stages of clinical trials of use of these adipose-derived stem cells to treat complex perianal fistulas (abnormal tunnels connecting the rectum with the perianal skin). Today, this inflammatory bowel syndrome is only treated with surgery, which is often unsuccessful and can leave the patient incontinent. In contrast, the stem cell treatment controls inflammation and allows the body to heal and close the fistula. In 2007, Cellerix entered an agreement with Axcan Pharma, a pharmaceutical company dedicated to gastroenterology, for the North American rights to license the product.

Cellerix has a second product in clinical trials, designed to treat individuals who suffer from a rare skin disease called epidermolysis bullosa in which minor trauma causes the loss of skin. The company prepares an artificial skin to be used as an implant and help prevent skin deterioration.

Coretherapix, also within the Genetrix family, is developing products that are based on stem cell therapy for myocardial regen-



**Above:** PharmaMar has built up the world's largest private library of marine samples to investigate for novel cancer-fighting drugs.

eration after infarctions (heart attacks). Although stem cell therapy to treat heart attack patients has thus far proved elusive, Coretherapix focuses on adult stem cell populations that reside in the heart itself. The company is also developing a growth-factor treatment to stimulate cardiac stem cells to heal the trauma from an attack. Genetrix scientific director Gabriel Márquez sees Coretherapix as the next company to duplicate Cellerix's success.

Genetrix's experience has inspired many others interested in biotechnology, and this has "generated more and more interest in Spanish society," says Márquez. "The number of companies has grown considerably, and the sector has seen a notable increase in support and interest from the government."

PharmaMar, which investigates the anti-tumor properties of marine life, was created in 1986 by José María Fernández-Sousa. Since then, the company has amassed the largest private library of marine life samples in the world, more than 70,000 to date. Its scientists regularly go on dives in biologically rich areas in cooperation with local governments and research institutions, and they bring back samples of a wealth of underwater life.

These samples are evaluated for cancer-fighting properties. The most successful so far has been Yondelis, PharmaMar's first product to go on the market and the first marine anti-tumor drug in the world.

"We isolated it from an invertebrate called *Ecteinascidia turbinata*, which was quite difficult," says Luis Mora, general director of PharmaMar. Clinical trials began in 1996, and Yondelis was licensed to Johnson and Johnson in 2001, with shared rights for codevelopment and commercialization. Yondelis has been approved for soft tissue sarcoma and is awaiting authorization for use against ovarian cancer as well.

Yondelis works by attaching to the tumor's DNA and preventing it from reproducing, halting the tumor's growth. "This mechanism of action is different from other products on the market," says Mora, "and it will work well in combination with other products." With ovarian cancer, he explains that there's a synergistic benefit to the patient when Yondelis is combined with current treatments.

"We think this is only the tip of the iceberg for Yondelis," says Mora.

A second product, isolated from a sea creature called a marine tunicate, is now in clinical trials for use on deep cell lymphomas and multiple myelomas, both cancers for which today there is no effective treatment. Two other products are also in the pipeline, with more on the way.

Noscira, part of the Zeltia Group, in the same family of companies as PharmaMar, takes advantage of the PharmaMar marine library to search for compounds that could treat central nervous system diseases. The company began in 2000 with two patents licensed from the Spanish Research Council for a family of compounds to treat Alzheimer's and a transgenic mouse that reproduces major features of neurodegenerative diseases. The company has two compounds in clinical trials.

"In the brain of any Alzheimer's patient, you will find tangles and plaques, the two major lesions that constitute hallmarks of the disease," says Belén Sopesén, director of Noscira. "The drugs currently on the market don't work at the level of the lesions, they only treat the symptoms. They don't delay the disease." Noscira's compounds are designed to interfere with the development of the lesions, and thus slow the disease's progression.

In a lab not far from the PharmaMar marine library, Noscira researchers isolate samples of marine compounds in their screening platforms. If one is found to have promise, it's isolated, developed, and tested against disease models. Already they have found a number of marine compounds that have similar mechanisms to combat Alzheimer's, and are preparing them for clinical trials.

Genomica, also a member of the Zeltia group, focuses on microarrays—DNA chips—for sensitive and specific diagnostics. Their most popular product today, sold around the world, tests for the human papilloma virus (HPV). Unlike standard tests, where doctors must interpret the results, their product includes software that gives the doctors the exact results immediately. It can also detect small amounts of variations of the virus to assist early diagnosis.

After the success of the HPV diagnostic, “We then began considering other diseases caused by viruses or bacteria that could be included” to be addressed by the company’s technology, says Rosario Cospedal, CEO, focusing on highly transmissible respiratory and sexually transmitted diseases. Genomica also provides DNA identification services for the Spanish police for crime scenes and paternity tests.

## SEARCHING FOR DATA

Many researchers who have spent part of their careers in biotechnology with either Genetrix or PharmaMar have moved on to form companies of their own. Juan Carlos del Castillo, formerly with Genetrix, now heads a family of companies called the Bionostra Group. The group’s subsidiaries are involved in a variety of aspects of biotechnology; Chimera Pharma, for instance, focuses on virus-like particles that can be used to develop a variety of vaccines and also serve as the basis for therapeutics.

But the product that elicits the most enthusiasm from del Castillo is a recent release from the bioinformatics company Bioalma: he calls it a Google for

printed biological data. The engineers at Bioalma created a system of information retrieval that can search texts and understand the biological meaning of the written word.

“It took seven years of research, and now we have a product that’s out in the world and working very, very well,” del Castillo says proudly.

Thousands of papers are published every day, and it’s nearly impossible for researchers to keep up with the volume. Company engineers needed to develop algorithms for a computer to recognize all the ways of referring to genes, proteins, diseases, symptoms, and other related biological terms, and then create a searchable database of them.

Designing the system proved quite difficult. Says del Castillo, “The challenge for us was to design a computer system capable of reading those papers, understanding what is written, and offering the information to scientists in a structured, comprehensive format.” The end result was software called Alma Knowledge Server (AKS). In addition to purchases of AKS by companies such as Roche and Novartis, the National Institutes of

Health in the U.S. purchased Bioalma’s software to organize its library and facilitate searches for NIH researchers.

But Bioalma engineers realized the importance of allowing all scientists everywhere, around the world, access to an easily searchable database of scientific papers. So they simplified the program from the one that had been purchased by companies and research institutions. In February 2009 they released novoseek.com as a free online tool available to everyone.

Bioalma alerted the research community around the world, and within only the first month, searches from computers around the world, particularly in the U.S., skyrocketed. Scientists can search for “flu” or “influenza,” and the system understands both terms and searches through all the papers published. Responses may be filtered by symptoms, by treatments, or by all the genes and proteins that could have a relationship to the flu. In addition to published papers, in March they added U.S. grants, and by the end of 2009, the system will include patents.

“We think by the end of the year we’ll be the world leader for a biomedicine

## RETURN TO SPAIN

Joan Ballesteros had built up a successful biotechnology company called Novasite Pharmaceuticals in San Diego. The company took a known, validated technology—flow cytometry—which evaluates blood samples, and fully automated the system. Suddenly, a machine that could evaluate perhaps some dozens of hand-fed samples a day was transformed into one that could handle thousands, automatically.

Ballesteros saw a wealth of possibilities with the new technology. He imagined how this could aid in the personalization of medicine for leukemia patients: a doctor could put a patient’s blood into the machine and check it against thousands of options for fighting leukemia, drugs alone or in combination, in a variety of strengths. And that, to him, was just the beginning.

To make the most out of his ideas, he knew he had to do something that might surprise his research colleagues in the San Diego area, considered one of the world centers of biotechnology. He had to move back home to Spain.

“I turned to my investors and said, ‘We should be screening

known drugs on patient samples ... They told me, ‘You will lose our money,’” says Ballesteros. “If I’m wrong, and it doesn’t work, they’ll lose money. If I’m right, and we’re successful, then we’ll have so many lawsuits that we’ll lose money.”

The problem resides with the legal system in the U.S., says Ballesteros, with a culture of easily bringing suits to trial. If a private company were to sign agreements with hospital patients to use their samples for research to help treat diseases, and if that company makes money, the patients could sue for a percentage of the profits.

Because of this, biotechnology companies in the U.S. do not work with fresh patient samples; that falls to public institutions such as the National Institutes of Health or public hospitals and universities. “But there have even been cases where the NIH has been sued,” says Ballesteros.

In Europe, he explains, if patients have been fully informed and signed a consent form in accordance with all legal and ethical principles (which are essentially the same as in the U.S.), the legal

search system,” says del Castillo. They hope to be able to monetize the system through advertisements, as they will regularly reach a broad spectrum of the international scientific community.

## COMPUTATIONS FOR THE FUTURE

Search optimization also inspired Ignasi Belda when he and his partners created Intelligent Pharma in Barcelona, “a kind of a Google for compounds,” says Belda.

They’ve developed a computerized system called Helios to search for molecules that might match the functions of ones that researchers plug into the database.

“They connect to our website, they put in the compound that they want to mimic, and then they click ‘search,’” says Belda. “Our supercomputer does the calculations to obtain a list of the compounds that have the same biological activity as the compound that the user introduced.”

To do this, they’ve created algorithms that calculate the physical and chemical properties of the molecule, in three-dimensional space. “It’s a kind of virtual atom that we move around the compound,”

says Belda. By testing the virtual interactions between the compound and their virtual atom, they generate 22 different fields, such as charge, hydrophobicity, and ability to accept hydrogen bonds. The system runs through millions of compounds in a database to determine which ones might have the same fields, and thus perhaps the same functionality.

“This might be helpful if you have a natural product that’s difficult to synthesize and you need another compound more chemically available,” says Belda.

The company’s current research focus, adds Belda, is to create software based on artificial intelligence that will aid in the creation of new compounds for drug discovery.

The founders of NorayBio, based in Bilbao, saw a need for advanced computations and data analysis in the field of biotechnology. The founders, with experience in biotechnology, chemistry, and research, worked in collaboration with companies and clients to develop software to suit their needs.

Small companies and research groups “were just using an Excel set,” says Julio Font, CEO. “Now that’s changed, they know they need specialized software for

managing data.” NorayBio designs software for managing sample banks (such as DNA or tissue samples) that can be tailored to meet a customer’s needs.

The company is now developing a visualization system for biomarkers, so researchers can actually see the data in relationship to different biological pathways. The first one in development is software to visualize biomarkers in liver disease. “It’s been exciting to see the market evolution,” says Font. “Two or three years ago potential customers said they can manage their data with a simple spreadsheet, and now they call and say, ‘I need your software.’”

Integromics, a spinoff from the National Center for Biotechnology begun in 2003, has developed a number of solutions to help companies manage and analyze their experimental gene-expression data. The software takes all the information created by a research instrument such as a PCR machine and performs the data analysis for the scientist. The company’s founders have focused their sights internationally, and they count companies like Pfizer and Novartis among their clients.

“Usually it takes time for a small company to build up a base,” says Marco

system won’t allow such a case to be brought to court. “A key differentiating factor between the U.S. and Europe, particularly Spain, is the access to fresh human samples,” he says.

Ballesteros left his first company in San Diego and brought some of his team to Spain, where in 2007 he founded a new company, Vivia Biotech, with his brother Andres.

Vivia Biotech is partnering with hospitals that have samples of blood and bone marrow samples, and signed consent forms, from leukemia patients. He says his system can test thousands of combinations of the less than dozen approved leukemia drugs. “We’re already seeing tremendous differences” in how different patients’ cancers respond to different drug combinations, he says. In theory, a doctor in the future would be able to send his patient’s blood in to be tested, and he could get an answer back in 24 hours about the patient’s best course of treatment.

“This is what doctors have been doing for years, one drug at a time,” says Ballesteros. “We’re only altering the scale.” Ballesteros hopes that this method will be validated within a year.

Ballesteros doesn’t stop there. He’s particularly excited about the prospect of using this machine to discover new cancer-fighting drugs from existing, approved drugs that treat unrelated diseases.

Most researchers are investigating what genes or proteins differ in cancer and trying to create molecules to kill cancer that don’t kill healthy cells, says Ballesteros, “but we do exactly the opposite. We say, let’s get all the drugs that don’t kill you. And of those, let’s see if some of them kill cancer.” He ticks off antibiotics, drugs for the flu, for headaches, for Parkinson’s. So far, he says, “the data is amazing, much better than what we had expected.”

“We’ve found ten very safe drugs that have the same efficacy in killing cancer as the harmful chemotherapy drugs,” he says; but it will take at least three to five years to go through the necessary trials before any will be validated for cancer treatment.

Rodríguez, vice president. “We’re lucky in the sense that the software sells itself. Once a client in the lab tries it out, we don’t need to explain how much time this can save.”

## WORKING TOGETHER

The Barcelona Science Park, housed at the University of Barcelona, bustles with constant construction. As soon as companies and research groups fill existing space, more is in demand. The facility is one of the many new research centers in the city that, in partnership with hospitals and local companies, continue to propel Barcelona into the biotechnology future.

Oryzon Genomics, spun off from the Spanish National Research Council and the University of Barcelona, opened its doors in 2001. The company focuses on gene discovery and has developed a high-throughput screening technique to focus on genes of interest, their expression, and their pathways of action.

“The idea in 2000 was that we wanted to develop new applications for discovering key genes in fundamental processes,” says Carlos Buesa, Oryzon director and one of the company’s founders.

This technique has allowed Oryzon Genomics to compare tissues, for instance comparing cancerous tumors to healthy tissue, or diseased brains to healthy ones, to discover the genes or proteins that differ from one to the other. The next step for the company has been to discover these biomarkers in more easily accessible samples, such as urine or blood.

They have several products for early detection of cancer and of neurodegenerative diseases based on this technology; in many cases, advanced early detection can lead to significantly improved chances of successful treatment. The products in the most advanced stages of development are to detect endometrial, colorectal, ovarian, and lung cancers.

This gene screening technique has also led Oryzon Genomics to develop its own therapeutic antibodies, based on their protein discovery. Two are headed for preclinical proof-of-concept trials later this year.

Buesa says its origins in the Barcelona Science Park helped the company on its successful path. “The location was providential,” says Buesa. “It was one of the best ideas here in Catalonia [to create a science park] where young companies could be embedded into institutes and share facilities and instruments and equipment, and the creative atmosphere. In the early days we had very little money to invest in instruments and sophisticated facilities.”

The Barcelona Science Park is the largest local incubator thus far, home to 50 companies; but an even larger one is under development. “There are 17 science parks in Catalonia, and 9 have activities in life sciences,” says Montserrat Daban, head of external affairs for BioCat. The city will also be home to Spain’s new genome sequencing center.

Another company housed at the science park is Advancell, founded in 2001 by a group of professors and researchers in Barcelona and Valencia. In 2004 the company launched their

nanomedicine unit, the first main product of which is an in-vitro cell reagent to ascertain the oral absorption of chemicals and drugs. The product, called CacoReady, is now entering the North American market.

Advancell has also moved into therapeutics and is developing nano-based medicines for a variety of diseases. They’ve created nanocapsules for molecules to treat skin diseases such as psoriasis, which greatly improve the delivery and efficacy of existing treatments.

One of the recent products that Advancell has patented began as a solution for an in-house problem. They wanted to send cells to companies, but living cells do not survive freezing and transport well. “We’ve invented a transport medium, a gel. Instead of being frozen, the cells survive transport alive and well,” says Davide Sirtoli, CEO.

Researchers at Biotools transformed a similar challenge into a business opportunity. Their first forays into biotechnology were to produce enzymes for molecular biology applications. But the enzymes and reagents for the process usually needed to be mailed individually at below freezing temperatures. In response, Biotools created and patented a process in which all the compounds for a complex reaction can be mailed together, semidried, stabilized, and suspended in a gel at just above freezing; the addition of water catalyzes the process. Biotools has honed the process for HIV and hepatitis C and is currently working with the government of Brazil to apply the technology around the country for diagnostic testing.

“This was mainly to solve an internal problem,” says Sonia Rodríguez, licensing and partnering manager. “We had problems with shipping goods at - 20° Celsius. But then we realized this had a greater value.”

Diagnostics are the basis for Ingenasa as well. More than twenty years ago, Ingenasa founders focused on the African swine fever virus, a disease that now plagues pig farms across Europe. The company’s sensitive diagnostic became a success, leading to diagnostics for close to 80 different products. Ingenasa sells its products to major livestock centers in countries such as China and India. Included in the diagnostics are the robotic system and rapid throughput testing to analyze tens of thousands of samples in only a few hours.

Today, the company is expanding from their expertise in animal husbandry and moving into human health products. “We made this decision,” says Carmen Vela, Ingenasa’s managing director, “because the veterinary field is an interesting and important one, but it’s not really the field for making a difference with technological breakthroughs.”

Ingenasa has built on its expertise in designing vaccines for livestock viruses. The company has developed a technology that produces a capsid covered in proteins; identical to the virus it is attacking but not biologically active. “We were able to demonstrate that these capsids can induce very specific T-cell response—and this could lead to the treatment of some kinds of tumors,” says Vela.

# EVOLUTION OF A COMPANY

Progenika, based at a science park on the outskirts of Bilbao, began when its founders wanted to start a biotechnology company, any biotechnology company.

So they launched one. “At the beginning we started doing everything,” laughs Antonio Martínez, one of the founders. “Food, health, everything.”

Martínez had been working for PharmaMar, one of Spain’s most established biotechnology companies. His old friend from student days Laureano Simón, had spent time in Wisconsin and then come back to the National Center for Biotechnology in Madrid. At the time—in the 1990s—there were few opportunities in the Spanish biotechnology sector.

Together with Corina Junquera, Martínez and Simón settled on Bilbao as a home for their new company, because the Basque region had launched an initiative to grow its information-based sector.

“The ultimate goal has been to diversify our industrial tissue and our economy,” says Maria Aguirre of BioBasque, the government agency that focuses on the life sciences. The local government’s support for biotechnology is intended, she adds, “not just for the creation of new companies, but the creation of jobs to help stay competitive, in areas that have not been traditional for the region.”

Progenika set up the new company in Bilbao. Intrigued by the emerging technology of DNA chips, Progenika offered to become a service provider for Affymetrix, a California-based DNA microarray company that provided genetic testing services.

“Providing services is a good way to start, but it’s not the way to make Progenika a big company,” says Martínez, so the team

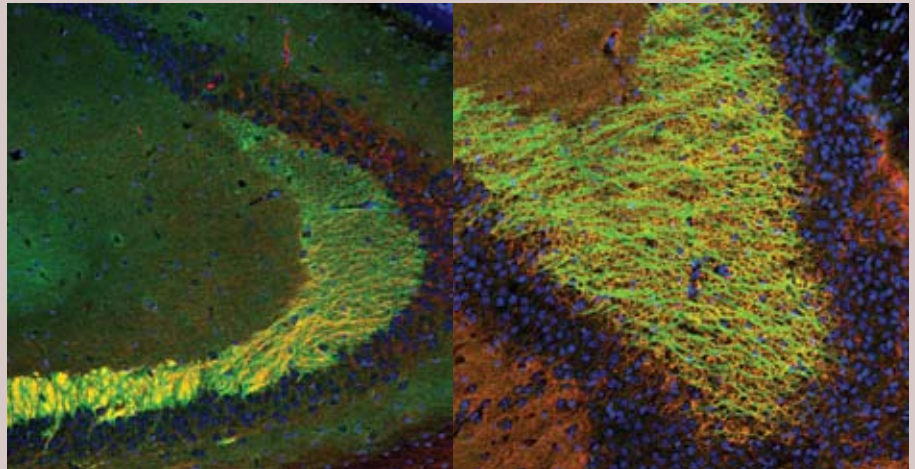
began to develop its own products.

The Spanish government was interested in identifying people who suffer from familiar hypercholesterolemia (FH), a genetic disease with no visible symptoms that can lead to heart attacks at the age of 40 or 50. The government turned to Progenika for assistance.

The company needed to develop a system to accurately recognize 120 genetic mutations that lead to the disease. After

patients, who produce antibodies against improperly matched blood.

“The genetic basis of blood groups was not well-known,” says Martínez. Two years later, the company came out with a DNA chip to test for genetic markers for a variety of blood groupings. They have set up platforms in some of the major blood banks in Spain, the UK and Holland and are beginning to expand into Europe and the Middle East.



**Above:** Progenika uses mouse neurons in their research into treatment for psychiatric diseases such as schizophrenia. (Source: Dr. Fabien Pichon, Progenika Biopharma 2009)

three years of research, in 2004 Progenika received European approval for a diagnostic DNA chip. Newsweek proclaimed it the first genetic diagnostic for FH.

After this success, the European Union approached Progenika to develop a chip to identify blood groups. The two most familiar blood groupings, A/B/O and RH positive/negative, don’t represent a variety of other blood groupings more common among populations, for instance, from Africa. Differences can lead to rejection of blood transfusions in

Progenika continues to research and expand its product lines. It is developing a system to monitor the urine of bladder cancer patients, which can detect proteins from tumors to determine if the tumor is regenerating, as well as diagnostics for Crohn’s disease and ulcerative colitis.

Progenika now has 130 people and a vast research space. Says Martínez of the company’s rapid growth, “We have a lot of energy. That’s important—at the beginning you need a lot of energy.”

## SUPPORTING RESEARCH

Companies such as Advancell and Oryzon Genomics attribute some of their success to government support and to the network of science parks around the country that provide shared facilities for young, smaller companies starting out.

“Science parks have been shown to be one of the best instruments for the creation of technology-based companies in a variety of sectors, including biotechnology,” says Felipe Romera, president of the Spanish Association of Science Parks.

The science parks are a key feature of what are known as bioclusters, where regional governments such as those in Catalonia, Madrid, Valencia, Andalusia, and the Basque country have invested in coordinating an area’s public and private biology research and promoting the creation of knowledge-based companies. They link scientific parks, hospitals, universities, and private companies to develop a robust biotechnology sector.

“We need to be able to attract talent, and we’re seeing a big change in that area,” says Montserrat Daban of Catalonia’s BioCat. “Many researchers and professionals from the private sector are willing to come here to work, because they see this is a promising sector.”

One unusual model of a research institution-company partnership is Digna Biotech, the company created to commercialize research conducted at the University of Navarra’s Center for the Study of Applied Medical Research (CIMA in Spanish). Both began operations in 2004.

CIMA, a Pamplona-based research center, studies the areas of gene therapy and liver-related diseases, central nervous system disease, cardiovascular health, and oncology. “Digna’s mission is to take the patents from CIMA and move them to the market,” says Pablo Ortiz, CEO.

Within only four years, one product has already reached phase-2 clinical trials: a cream for scleroderma, a skin disease with no known treatment. They have also developed a treatment that aids in the regeneration of liver tissue after liver sur-

gery and transplant. The treatment goes into clinical trials next year; if successful, this would be the only drug of its kind.

The technology transfer office of the Spanish Council for Scientific Research (CSIC in Spanish) aids in the transfer of patents from more than 6,000 researchers to private companies. CSIC is the largest Spanish research organization, comprising 126 research centers and 145 additional research units associated with local institutions. Under the auspices of the national government, CSIC performs multidisciplinary scientific and technological research to contribute to the advancement of both science and the economy.

The culture in Spain has changed, says CSIC’s Beatriz Lara, IP and knowledge transfer manager: “Researchers are increasingly patenting their discoveries and working with companies to develop their research.” Her organization helps shepherd researchers through the patent and licensing process.

“It’s important to establish a relationship between scientists and companies,” says José Pablo Zamorano, deputy director of licensing for life sciences. “Researchers can learn the needs of the private companies, and companies realize there are researchers out there who can help them.”

Some challenges remain in the Spanish biotechnology sector. Researchers speak of the need for increased access to venture capital funds. They stress the importance of continuing to develop the culture of patenting innovations and transforming those discoveries into companies. They point out the need to facilitate the creation of companies by university professors, who today are hampered by regulations about how much of a company a professor may own. The Spanish government has a number of initiatives underway to deal with these challenges and encourage the growing industry.

“I think Spain has good competitive advantages in biotechnology,” says Joan Ballesteros, chief scientific officer of Vivia Biotech. “There’s a lot of great science going on here.”

## Resources

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## New Technologies in Spain Series

Spain is a technologically and industrially advanced country committed to innovation, research, and development, both through its government and through its private sector. The country is determined to deepen and intensify its productive specialization in industries that depend on technology and innovation. The Ministry of Industry, Tourism, and Commerce has launched an ambitious plan combining its available human and financial resources and setting out specific lines of action with the goal of strengthening the international outlook of the most technologically advanced companies in Spain.

As part of this initiative, Technology Review's custom-publishing division has produced the New Technologies in Spain Series, which appears as a special supplement in MIT's Technology Review magazine and a multimedia special section online. This powerful multi-part series showcases the technological development and excellence of Spanish companies in several important industries, such as wind energy, water desalination, high-speed rail, aerospace, industrial machinery, biotechnology, and solar energy.

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