Industry And Academic Research In Regenerative Medicine Leads To Biological Treatment For Damaged Joints

Cambridge Enterprise Limited
University of Cambridge

Professional athletes are well-aware of the damage their sport may wreak on their bodies. So too are many of the millions of weekend warriors, overweight and others whose age, activities and medical conditions may one day lead to pain brought on by degradation of the cartilage in the linings of their joints.

Many with the onset of degenerative joint disease and osteoarthritis will find respite in a range of symptom-relieving products, from physical therapy and orthotics to anti-inflammatory and analgesic over-the counter medications. Seniors, who are in a more advanced stage of this condition, may require surgery to replace the damaged or diseased joint with a prosthesis.

Then there are the individuals with big cartilage lesions who no longer find pain relief from traditional treatments but are too young for total joint replacement. For this group of patients who are in the prime of their life, there are few

available options today. It is in this space, between symptom relieving products and surgical treatment, where industry and academia are conducting regenerative medicine research to develop a biological solution that might stem the projected six-fold increase for total knee replacements by 2030 cited in Health, United States, 2009, by the Centers for Disease Control and Prevention.

One possible biological solution is Chondromimetic, a collagen scaffold developed by the British medical technology company Orthomimetics. As a porous, bioresorbable tissue regeneration scaffold, it stimulates bone and cartilage growth when implanted into the knees and other joints, which could offer a more effective, economical, easier and less painful means of treatment than current methods. A research group is conducting clinical trials in Europe to gather data on its ability to help regenerate articular cartilage and provide durable solutions for degenerative joint disease and osteoarthritis.

Groundbreaking Transatlantic Collaboration

Orthomimetics, part of the Belgian biotech company TiGenix since December 2009, is a relatively young academic spinout with a list of accomplishments:

- Chondromimetic received CE Mark approval ahead of schedule, which allows the company to market its line of bioresorbable implants for bone or soft tissue repair in the European Union.
- Orthomimetics was featured in the "Killer 50" list of the most "disruptive technology" businesses in Eastern England for 2009. Unveiled by Business Weekly in association with Mathys & Squire Intellectual Property, the Killer 50 companies are chosen on raw technology that has either achieved commercial success or promises to do so.
- Andrew K. Lynn, Ph.D., Orthomimetics' founder and chief executive officer, who successfully made the transition from academic to entrepreneur, received the top European Award for University Entrepreneurs in Chemistry and Materials in the inaugural Academic Enterprise Awards 2008.

Orthomimetics' products are based on a proprietary technology platform, with patent-protected technology that was developed during a groundbreaking collaboration between the University of Cambridge in Cambridge, United Kingdom, and the Massachusetts Institute of Technology (MIT), in Cambridge, Mass., under the Cambridge-MIT Institute (CMI) alliance. CMI was an experimental transatlantic collaborative program between two of the world's leading research universities. It was launched in 2000, funded by the British government, in recognition of MIT's commitment to share its successful approach to connecting public research with innovation and economic growth.

"Orthomimetics brings a new dimension to the treatment of joints thanks to its heritage in this trans-Atlantic collaboration between our two world-leading academic institutions and its researchers who have contributed more than 30 years of experience to the repair of bone and soft tissues, respectively," says Margaret Wilkinson, technology manager at Cambridge Enterprise Ltd, the commercialization arm of the University of Cambridge that helped Lynn spin out the company, and, on behalf of CMI, negotiated the license.

A Marriage of Two Technologies

While working on the CMI project as a doctoral student at University of Cambridge, and collaborating with a team at MIT, Lynn played a leading role in developing the technology platform on which Orthomimetics' products are based.

He co-founded Orthomimetics with a core group of CMI-funded researchers who are pioneers in the fields of artificial bone and artificial skin:

• Artificial-bone pioneer William Bonfield, Ph.D., professor of medical materials in the Department of Materials Science and Metallurgy, University of Cambridge

• Lorna Gibson, Ph.D., Matoula S. Salapatas professor of materials science and engineering, MIT

• Ioannis Yannas, Ph.D., professor of mechanical engineering, biological engineering, and health sciences and technology, MIT, who developed a scaffold for the regeneration of skin that is now in clinical use

• Brendan Harley, Sc.D., a graduate of MIT and now an assistant professor in the Department of Chemical and Bimolecular Engineering at the University of Illinois at Urbana-Champaign

"This really ended up as a marriage of two technologies: at MIT we had an expertise in the fields of tissue engineering and artificial skin, while Professor Bonfield at Cambridge and his team of international researchers had an expertise in bone replacement and biomaterial innovation," says Gibson, who knew of Bonfield and his work and had firsthand knowledge of the University of Cambridge system as she did her doctoral degree there.

> *The CMI-enabled collaboration began when the team of academic researchers and students decided to build a biological scaffold based on an existing method to produce a skin scaffold that could provide support for tissue regeneration in the areas of orthopedics and regenerative medicine.*

The result was a technique to mineralize the collagen scaffold by adding calcium and phosphate to mimic the structure of bone, which then led to the development of a two-layer scaffold to regenerate both bone and cartilage.

Orthomimetics' products are based on this leading collagen biomaterials platform they developed for the production of scaffolds for cartilage, meniscus, ligament and tendon repair. Orthomimetics' technological advantage lies in the patent-protected ability to combine three natural biomaterials — collagen, glycosaminoglycans and calcium phosphate — into bioresorbable tissue regeneration scaffolds.

As the first product to come out of this collagen biomaterials platform, Chondromimetic is designed to stimulate regenerative repair in millions of young and aging patients who suffer from damaged joint surfaces and bony defects caused by degenerative diseases such as osteoarthritis, trauma or surgery. It was shown in a head-to-head preclinical trial to outperform leading synthetic products, and a simple and accurate delivery system has been designed and tested by surgeons. TiGenix expects Chondromimetic to join a growing number of market-ready products in the field of regenerative medicine, which the U.S. Department of Health and Human Services in 2006 cited as a technology that is "desperately needed to combat rising health care costs."

The Art of Reaching Consensus

As the first spinout from CMI, Orthomimetics licensed the exclusive rights to four patents covering the revolutionary technology that had resulted from the team's research and was funded by the University of Cambridge and MIT.

The negotiation on the licensing agreement with CMI was a delicate process, due to opinions about the terms for an exclusive license, especially on future revenue streams. Traditionally, Cambridge had taken equity stakes in its startups, while MIT had rights not only to equity but also to milestone fees, royalties and license fees. Lynn and his co-founders wanted to make sure the right balance was struck between early milestone payments and equity or other compensation linked to progress when the company was more mature.

Eventually, the parties succeeded in finding licensing terms that worked for everyone. And, despite the delicate process of the license negotiations, all involved credit CMI and the collaboration it fostered as the reason they "gathered in the same room, put all the technologies together" and launched a spinout company.

“I think our success is due in large part to CMI, which enabled an international team of academics with a prior track record of producing commercially successful innovations to come together and develop our new technology platform," says Lynn.

Technology Transfer Offices Give an Assist

Lynn gives Cambridge Enterprise and the Technology Licensing Office at MIT a lot of credit for helping the startup ain a solid financial footing.

“They did a good job of pointing us in the right direction," Lynn says. "Our story was good, and we had a great business case. But first and foremost, we had to learn how to talk to investors, which the technology transfer offices facilitated."

Building on this support, they established links with venture capitalists, business angels and potential company directors in both Cambridge communities, successfully raising an initial funding round of $8.5 million (£5.65 million) in 2007 from the United Kingdom equity firms Schroders Investment Management Ltd, Oxford Capital Partners Sloane Robinson Private Equity and a group of private investors of Eden Financial. In 2008, the company received funding from United Kingdom funding bodies; $1.5 million (£747,000) from the Technology Strategy Board for the commercial development of the company’s second commercial product, LigaMimetic; and a $953,440 (£600,000) Technology Strategy Board grant to support a research and development project for improving joint tissue regeneration.

Today, the onetime CMI spinout is part of TiGenix. The Belgian developer of regenerative medical products that treat damaged and diseased joints now has two complementary products to market in the European Union — its own Chondrocelect, a cell-based product that helps to regrow cartilage in the knee, and Orthomimetics' Chondromimetic, a scaffold for the repair of damaged joint surfaces and underlying bone defects.

"This is a really sensible and exciting way forward," says Lynn, who is now the chief business officer at TiGenix. “I’m delighted with this development because it is the culmination of the Orthomimetics story.”

Orthomimetics is a successful technology transfer story that is taking the next step in delivering innovative commercial products in the field of regenerative medicine.

This story was originally published in 2010.

To see available technologies from research institutions, click here to visit the AUTM Innovation Marketplace.