

## Fueling Athletic Performance

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**Tuesday September 2, 2014**

Thanks to a partnership between pharmaceuticals executive and entrepreneur Frederick Sexton '81 and Clarkson researcher Sitaraman Krishnan, today's athletes will benefit from an innovative drug delivery system that works with the body to improve the absorption of carbohydrates for maximum benefit and peak performance.

The product, XRCEL™, hits the market this fall.

Bioactives are substances that have an effect upon a living organism, tissue, or cells. They are derived from plants or other living systems and are added to pharmaceutical products or foods for their associated health or nutritional benefits. Aspirin (acetylsalicylic acid) is one example. Probiotics which are added to yogurt to promote digestion, is another. As are vitamins and carbohydrates like starch and sugar.

For bioactive ingredients to provide their maximum health returns however, they must be absorbed into the body. For that to happen, they need to be delivered to the right place and for the right amount of time to maximize the therapeutic effect.

That's where Sitaraman Krishnan, associate professor of chemical and biomolecular engineering, comes in. Krishnan and his team have been working with Sexton, founder and president of New World Pharmaceuticals, to develop a patented pH- and temperature-responsive, micro-gel delivery system for the sustained delivery of bioactives.



Sexton, a 30-year veteran of the pharmaceuticals industry and successful entrepreneur, founded New World Pharmaceuticals in 2007. The Charleston, South Carolina-based company focuses on the development of innovative controlled-release technologies.

ZSource Ltd. President and Clarkson Trustee Robert Ziek '78, who has led consumer product research and development for large corporations as well as start-ups, serves as supply chain and product development advisor for the company. The two met at an on-campus alumni leadership event a few years ago and Sexton invited Ziek to join the advisory board.

When it came time to find research partners to develop these technologies, Sexton turned to his alma mater.

"Clarkson has always had strong chemical engineering and chemistry research programs and a great deal of expertise in this area," says Sexton. "It seemed like a natural fit."

## **“Smart” Microparticles Improve Drug Release and Absorption**

The drug delivery technology developed in Krishnan's laboratory at Clarkson is capable of incorporating hydrophilic (water soluble) and hydrophobic (non-water soluble) compounds in an aqueous suspension. This significantly improves the overall solubility and availability of the drug compounds, which aids absorption.

“Most importantly, the micro-sized polymer particles we developed are pH and temperature sensitive,” says Krishnan. “This means the particles can be ‘tuned’ to maximize the release and absorption of bioactive substances, like carbohydrates or drugs, at specific points along the GI tract.”

This is important because compounds are better dissolved and absorbed at different locations along the GI tract, based on their physical and chemical characteristics. Because Krishnan and his research team's “smart” particles are responsive to the pH differences between the stomach (which is highly acidic) and the intestines, they prevent the release of the supplement or drug in the stomach and allow instead for a gradual release in the small intestine where it is better absorbed. The particles are also designed to be temperature-responsive so that the degree and rate of release of bio-active material is designed to work in concert with the temperature of the human body giving them the ability to release at different controlled rates when the body temperature elevates yet maintain shelf-life under normal storage conditions.

One of the company's first applications for this patented technology is the sustained delivery of glucose and other sugars and nutrients for use by athletes to increase their performance potential.

This fall, New World Pharmaceuticals and its affiliate, New World Consumer Products, will release XRCEL™, a sports performance carbohydrate supplement.

“We are extremely excited about XRCEL™,” says Sexton. “Being able to apply our innovative delivery technology to carbohydrates to improve athlete performance potential is awesome. There hasn't been any real breakthrough in athlete nutrition technology. Most products are really derivative blends of the same basic ingredients. Our technology platform is positioned to change that.”

### **Broader Therapeutic Applications**

Of course this technology has broader applications beyond carbohydrate formulations for high-performing athletes.

The same platform technology can be applied to specialty pharmaceutical markets. In particular, it can be used to improve the delivery and efficacy of “difficult to absorb” drug compounds, a significant problem in the pharmaceutical industry today.

For Clarkson, the project and timing couldn't be better. Last fall, N.Y. state announced it will invest \$35 million to support a new partnership between the University and the nearby Trudeau Institute, a world leader in immunology research. The institutions will work closely to develop novel technologies for preventing and treating infectious diseases and immune-related disorders.

The goal is to establish the region as a premier center of biotechnology research and development.

“It's an exciting coincidence that we have been able to work with Fred and his company to help develop this product just as we are embarking on this partnership with The Trudeau Institute,” says Clarkson President Tony Collins. “We are excited to have our name associated with New World Pharmaceuticals and the products they are developing.”

Clarkson University launches leaders into the global economy. One in five alumni already leads as a CEO, VP or equivalent senior executive of a company. Located just outside the Adirondack Park in Potsdam, N.Y., Clarkson is a nationally recognized research university for undergraduates with select graduate programs in signature areas of academic excellence directed toward the world's pressing issues. Through 50 rigorous programs of study in

engineering, business, arts, sciences and the health professions, the entire learning-living community spans boundaries across disciplines, nations and cultures to build powers of observation, challenge the status quo, and connect discovery and engineering innovation with enterprise.

**Photo caption: In the lab, Prof. Sitaraman Krishnan makes rheological measurements to evaluate the pH and temperature responsiveness of the microparticles.**

[A photograph for media use is available at <http://www.clarkson.edu/news/photos/skrishnan-lab.jpg>.]

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