The Speed King

Professor Greg Weiss and collaborators have developed a method of detecting cancer molecules within minutes, a breakthrough that could save lives
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“At the end of the day, I want to be faster than the next guy,” says Greg Weiss.

Picture Credit:
Steve Zylius / UCI

Weiss, who sits on the scientific advisory board of ULB, from which he plans to launch future companies, is heading to his office, clear on the other side of campus, in the Natural Sciences I building.

This is no leisurely stroll. The 49-year-old, who’s also a professor of molecular biology & biochemistry as well as pharmaceutical sciences, maintains a brisk pace, easily passing scores of students rushing to get to their next class.

Weiss is focused on speed. “At the end of the day,” he says, “I want to be faster than the next guy.” It’s a mindset that nearly got him killed as a road cyclist (more on that later). It’s also a mindset that perfectly suits his research specialty: streamlining cancer diagnosis by finding malignant cells as early as possible.

Weiss, in collaboration with UCI professor Reg Penner, an electrochemist, and Dr. Jaime Landman, chair of the Department of Urology at UCI Medical Center, has come

up with a way to detect cancer molecules in urine within 60 seconds – far quicker than conventional tests.

Because cancer is a disease caused by molecules running amok in the body, doing what they shouldn't be doing – hijacking cells that eventually form a tumor – Weiss' research is a breakthrough that could save lives. And it's a breakthrough thats's playing out at the molecular level.

Scientists at PhageTech, a biotech startup Weiss co-founded in 2015 at UCI Beall Applied Innovation, have developed a method using bacteriophages – viruses that infect bacteria – that drags them onto an electronic circuit for measurement.

"We have this new thing – we call it the Virus BioResistor, or VBR – that gives us this amazing way of detecting cancer molecules in urine really fast," Weiss says.

"Bacteriophages are a special kind of harmless virus," he explains. "They're long and skinny, so we line them up like a kelp forest. And these phages are able to reach into urine and grab onto cancer molecules more rapidly, which speeds up the whole process of identifying them."

Weiss and Penner began publishing papers on their VBR breakthrough in 2017. "We're really excited about it," Weiss says.

Bringing It to Market

PhageTech is in the process of commercializing the technology.

"The company is working on stuff like 'How do we manufacture this? How do I make a ton of these things? How do I make it so it works in all patients and not just some of them?'" Weiss says. "For example, if a patient is on a lot of medications, those also show up in their urine and could interfere with the process. Things get complicated really fast."

He continues: "What we have achieved in the lab is amazing, but commercializing it is another fascinating challenge, and it's something I'm really passionate about."

A Personal Motivation

Weiss' love for all things scientific began at age 7 when his mother, Marjorie, a teacher, gave him a periodic table. Weiss, who grew up in Palos Verdes, also took

inspiration from his father, Arthur, a former U.S. Navy doctor who became a tumor surgeon.

It was his father's death at 59 from lung cancer that fueled Weiss' desire to find a way to detect cancer in its early stages.

He was nearing the end of his postdoctoral work at UCI when his father, who never smoked (25 percent of lung cancer patients report having never smoked), called him with the terrible news: "I have stage 4 lung cancer."

"I was devastated," Weiss says. His father died two years later, in 2001.

A couple of years after that, Penner – Weiss' longtime research collaborator at UCI – lost his mother to cancer.

"We looked at each other, and it was like 'We need to do something about this,'" Weiss recalls.

The Egg Breakthrough

Early on in his career as a professor, Weiss set a goal.

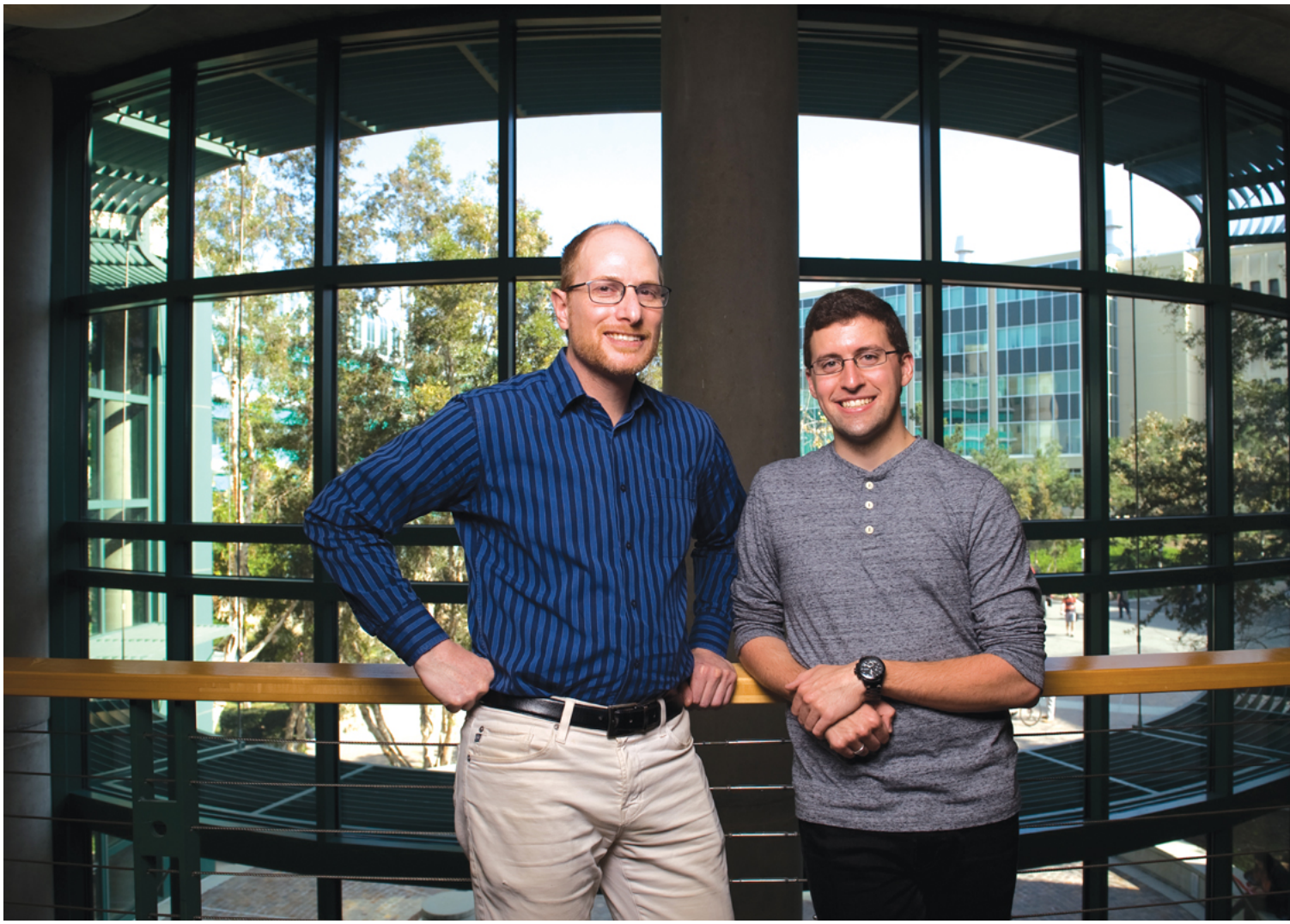
"I wanted to become nationally recognized," he says. "I wanted to compete at the national level. I'm just hyper-competitive. That's who I am. I'm not sure why. My parents were completely normal about their expectations for me."

Early in 2015, Weiss made global headlines when, working with Australian chemists, he figured out a way to unboil egg whites. They came up with a method of pulling apart tangled proteins and allowing them to refold.

"We showed that you could uncook the egg and then cook it again," Weiss says. "We used mechanical energy to drive the proteins into the correct shape. I became really interested in how you transform things. How do you change chemicals and do it on a massive scale?"

For the egg breakthrough, Weiss and his collaborators were awarded the annual Ig Nobel Prize in chemistry, presented at Harvard University. "The award is given for science research that makes you laugh and then makes you think," Weiss says.

The technique his team employed to unboil egg whites – which involves re-creating a clear protein known as lysozyme and a process at the molecular level that breaks up protein masses – can be applied to a lot of other foods as well as cancer proteins, he says.



Greg Weiss, shown here with his former student Stephan Kudlacek ’15, discovered how to unboil an egg se years ago, and now he and his colleagues have developed a way to detect cancer cells in urine within 60 seconds. Photo: Steve Zylius / UCI

Weiss and his collaborators built on the unboiling-an-egg results to show that they could use similar processes for accelerating enzymes in their catalysis of chemical reactions.

“In other words,” Weiss explains, “we can make pharmaceuticals, beverages and other high-value chemicals faster, cheaper and with less waste, water and energy.”

Research in this area is being conducted at another startup Weiss formed in the last year, Debut Biotech, based in La Jolla. Weiss co-founded the company, which has a wet lab (a lab in which a wide range of experiments are performed that sometimes involve dealing with hazardous substances), with Joshua Britton, a visiting student from Flinders University in Adelaide, Australia.

Keeping Up the Pace

Unboiling egg whites is one thing; reversing critical and traumatic injuries is another.

Weiss' need for speed nearly got him killed in 2015, when the then-avid road cyclist crashed three times. In the most serious accident, his bicycle slammed into a car illegally parked in a bike lane and was catapulted through the rear window. He suffered numerous lacerations on his arm but narrowly avoided cutting a major artery – by millimeters.

Much to the relief of his wife of 21 years, Kim, a history scholar who helps build museum exhibits in UCI's School of Physical Sciences, Weiss has since given up road cycling but still rides a stationary bike in his garage in UCI's University Hills residential community. His other non-research passions are photography, fly-fishing and his five cats.

Weiss also loves teaching organic chemistry. He had 450 students in the fall 2019 quarter.

"We showed that you could uncook the egg and then cook it again. We used mechanical energy to drive the proteins into the correct shape. I became really interested in how you transform things. How do you change chemicals and do it on a massive scale?"

True to form, he gets to class speedily.

"I run to work every day because I love teaching so much," says Weiss of the mile-plus route.

"But there's another reason I do it," he adds. "About 50 percent of my students are first-generation college students. These kids are, like, the hopes of entire families.

They have something to prove, and they want to get out there and make it happen.”

“I find that inspiring,” Weiss says. “And I want to keep up with them.”

Running to class helps keep him fit. And keeping cancer patients healthy drives his desire to stay in the race to detect cancer as early as possible.

“If we can diagnose cancer early,” Weiss says, “we’ll be so much better at treating patients. Physicians will be more successful, it will cost us less money, and patients will go through less pain. I’m all about early detection.”

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