



# CURIOSITY— IT'S IN HIS DNA

KSU alum finds career  
at biotech company

By Joëlle Walls

illumina

**G**rowing up in Kennesaw, Georgia, Lewis Kraft could usually be found on the baseball field or with his neighborhood friends. Now he is leading a research group at Illumina, a biotechnology company based in San Diego, developing flowcell consumables for DNA sequencing.

Having met his future wife in high school, Kraft decided to stay local for his undergraduate education, attending Kennesaw State University from 2004–2009. He credits his undergraduate research experience at KSU as the catalyst for changing the trajectory of his future career toward biotechnology.

"I was always a curious kid, always asking questions about how things worked, but I was never a great student," said Kraft. "My parents encouraged me to do a pre-med major and to consider a career in medicine—something I was never really passionate about. But that got me into the biochemistry major."

During his sophomore year, Kraft discovered his appreciation and excitement for research after taking a course with biochemistry professor Jonathan McMurry. That summer, he worked full time in McMurry's lab, studying how bacterial proteins interact with each other and self-assemble into a bacterial flagellum, a tail-like structure that allows bacteria to swim. He was tasked with purifying proteins and measuring their binding kinetics, or the rates of the chemical reactions, when they bind together in the flagellum.

"This was a systems biology project, that is, the quantitative analysis and modeling of a biological system. The research was something that I found I was really passionate about, and it was exciting because it was the first time anyone had ever looked at that particular aspect of nature," he said. "And it turned out I was actually pretty good at research. That summer was when I realized that this was something that I wanted to do as a career. With McMurry's support, I kept going with it."



Photo by James Blake, Illumina

With his curiosity never waning, Kraft also invented a device that allowed him to measure the binding kinetics faster and easier than in the original laborious process. He entered his device into the Concept-2-Reality® competition sponsored by KSU's Coles College of Business, an opportunity for participants to pitch their new product and service ideas to entrepreneurs and venture capitalists. He quickly wrote up an elevator pitch and a business plan.

"It was probably impressive for an undergraduate to do something like that. I saw the business competition advertised and figured I might be able to win some money for building more devices," he recalled. "They selected me as a finalist to present in front of a panel of entrepreneurs. Little did I know I was competing against graduate students in the business school."

By the time he graduated from KSU in 2009, Kraft was a published researcher and had presented at local, national and international conferences such as the American Chemical Society and the American Society of Biochemistry and Molecular Biology. After interviewing at a number of institutions for graduate school, he chose to pursue his Ph.D. in chemical and physical biology at Vanderbilt University.

During his time in Anne Kenworthy's biophysics lab at Vanderbilt, Kraft, together with a group of mathematicians, developed methods of measuring reaction-diffusion (how fast molecules move around and react) in living human cells. Reaction-diffusion is a fundamental behavior of molecular systems and it underlies how biologically relevant processes, such as embryo development or pattern formation on an animal's fur, occur.

Kraft published several papers in that area. He chose to focus his method development efforts on the central proteins in an important biological pathway called autophagy, Greek for "self-eating," a process for breaking down and recycling cellular parts. The discovery of autophagy was recently recognized with the 2016 Nobel Prize in Medicine or Physiology awarded to Yoshinori Ohsumi.

After graduation in 2014, Kraft expanded his research experiences as a post-doctoral fellow in the research group of George Whitesides at Harvard University, the most highly cited living chemist at that time. His two-year fellowship gave him exposure to a variety of

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projects including the chemical origins of life—how does a molecular soup on a hot planet turn into a living cell?

Kraft honed his skills in physical chemistry and picked up additional ones in microfabrication. Kraft eventually published a paper in *Nature* before taking the next steps to a position in industry.

"The research topics that I was involved with were very challenging, but it was a fun time in my scientific career because I was involved with so many different things and there were so many brilliant people there," he said. "Despite being a university professor, George is a serial entrepreneur and a huge champion of utilitarian science. He taught us to always think about the market — what do people really want?"

Today at Illumina, Kraft spends his time leading teams on multidisciplinary research projects tied to the company's products and serving as a functional manager for the research associates and scientists in his group.

One of his first projects involved developing the surface chemistry for the iSeq100 flowcell consumable that was introduced to the market in early 2018. This compact benchtop genome sequencing device was designed to be used for routine genomics testing and exploratory research.

"My hope was that Illumina would provide opportunities for me to develop new technologies that improve human health and have a positive impact on society," said Kraft. "The technology we develop is fascinatingly complex and interdisciplinary. It feels good to deliver products that touch lives in a positive way such as hearing David Cameron [former prime minister of the United Kingdom] talk about how sequencing helped put his family's mind at ease as his son had a rare neurological disease that baffled doctors."

"Developing the next generation of scientists is critical for sustaining the technological pace at Illumina and companies like it," Kraft said, adding, "A quality undergraduate research experience is a great place to start."