

THE AUTHOR FILE

Richard D. Cummings

A bleaching method for glycobiology and some impromptu fund-raising at the piano.

Many famous scientists tried to deter him from studying carbohydrates, but “I was convinced there was a great world to be discovered in the glycoworld,” says



Harvard Medical School

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Richard Cummings, a biochemist, biologist and professor of surgery at Harvard Medical School who also directs the National Center for Functional Glycomics. “I was looking for that landscape in science where other people haven’t been.” His journey to the unexplored territory now

known as glycomics has taken courage, a willingness to fail, and, he says, his loopy enthusiasm helped, too.

Sugars fascinated Cummings as an undergraduate: they could straight-chain or form a ring, they had optical activity and chiral centers. Many organic chemists find these beautiful molecules repetitive, boring and limited, but, he says, “I was hooked for life.” He sees an unlimited number of possibilities in CH_2O , which is the minimal formula for carbohydrates.

Cummings’s latest work—his 330th paper—describes oxidative release of natural glycans, or ORNG, an approach nicknamed Orange. Orange will let many labs study glycans more easily and at a much larger scale, he says. Besides their role in metabolism, glycans are involved in many disorders, including lysosomal storage diseases, which are fatal. In the cells of afflicted children, cellular lysosomes are filled with undigested proteins. “It’s sort of like a storage bin that keeps filling up and no one ever removes the trash,” he says.

Studying glycans up until now has been tedious and hampered by the need to extract, then purify these macromolecules and use mass spectrometry. With Orange, household bleach releases the glycans from cells and tissue. The chemistry is now straightforward, says Cummings, and a glycome can be prepared using an ingredient from a local drugstore.

The lab was speechless when they did the decisive experiment, says Cummings. He turned to Xuezheng Song, a former postdoctoral fellow who is now a researcher at Emory and first author on the paper, and said, “We’re going to go after the human glycome, we are going to go after all glycomes.”

Given the paucity of enzymes with which to harvest glycans, the team had been exploring chemical

approaches. They wanted to selectively destroy the protein to which the sugar is attached. Instead of the typical reduction reaction used in carbohydrate analysis, they explored oxidation. The idea was that sugars are already oxidized, so their glycosidic bonds might resist further oxidation, whereas the amino acids’ peptide bonds would be susceptible to oxidation. It worked. “I always look at everything from one direction and then look at it from the opposite direction,” says Cummings.

Cummings, an Alabama native, received his PhD in biochemistry from Johns Hopkins University and did his postdoctoral fellowship in hematology and oncology with Stuart Kornfeld at Washington University School of Medicine. Cummings was chairman of the biochemistry department at Emory University School of Medicine and moved to Harvard Medical School last September. He is also cofounder of Selexys Pharmaceuticals, a drug discovery company focused on using glycan recognition to block inflammation. As he expands his work in glycomics, he stays in close contact with Emory.

“He is one of the kindest, most intelligent individuals I have ever met,” says Sean Stowell, an assistant professor of pathology and laboratory medicine at Emory. Cummings was Stowell’s PhD advisor, and Stowell says that beyond being a consummate scientist, Cummings is a “quintessential renaissance man” whose lab was a remarkable, multidisciplinary place to train in.

“His relentless optimism, vision and insatiable curiosity were unbelievably contagious and as a result, I absolutely fell in love with biomedical research,” says Stowell, who switched his career plans from clinician to physician-scientist. Cummings cares deeply about people and, says Stowell, his helping and mentoring leave an indelible impression on those around him.

When he is not in the lab, Cummings goes for walks, plays chess, and is a pianist, composer and singer. He plays and listens to all music types, from classical to jazz to rock, with rock music being his favorite to play.

Growing up in rural Alabama, Cummings was drawn to the piano at the ripe age of five. “If you wanted any other noise other than bees humming and birds singing, you had to make it yourself,” he says. With a colleague at the University of Georgia, Cummings started a band called The Glycobiology Blues Brothers, and they have played at scientific conferences. At one meeting, Cummings noticed that the pianist had left the hotel bar, so he sat down and began to play. The tip jar, a big brandy glass, started to fill up. Cummings kept playing.

Vivien Marx

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