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Andrew Carter: Dynein Trailblazer

By Hannah Waters Andrew Carter: Dynein Trailblazer Nick Morrish Group Leader, Laboratory of Molecular Biology, Medical Research Council. Age: 36 The typical biologist's desk is strewn with reprints and lab notebooks, maybe a coffee cup, perhaps a small model of a DNA molecule. Structural biologist Andrew Carter's workspace has all these things, but a cluster of framed dog photographs stands out amid the clutter: his collection of corgi pictures

By Hannah Waters | May 1, 2011

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Andrew Carter: Dynein Trailblazer



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The typical biologist's desk is strewn with reprints and lab notebooks, maybe a coffee cup, perhaps a small model of a DNA molecule. Structural biologist Andrew Carter's workspace has all these things, but a cluster of framed dog photographs stands out amid the clutter: his collection of corgi pictures. "Good science, good beer, and corgis are three of Andrew's passions," says his postdoctoral advisor, University of California, San Francisco (UCSF), biologist Ron Vale. He teasingly parodies his advisee: "When times get tough, all I have to do is to look at these pictures of corgis for release and genuflection..."

Carter's "good science," structural biology, is a discipline that didn't necessarily come easily to the young researcher. "When you're taught structural biology as an undergrad, it seems impossible," Carter says. "It was so mathematical I thought I would never be able to do it." A friend's successful experience convinced him that it was, in fact, possible, and he chose to pursue a career in the field for the thrill of solving the structure of a molecule that no one had ever seen before, he says. "I compare it to the early people that explored continents—like Lewis and Clark." So in 1999, Carter set off to graduate school at the Medical Research Council's Laboratory of Molecular Biology (MRC-LMB) in Cambridge, UK, to study protein structure, an intrepid explorer with his trusty corgi, Abigail, at his heel.

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[1 Ramakrishnan shared the 2009 Nobel Prize in Chemistry for the work.](#)

RESULTS: After a "fateful beer" with Vale in 2003, Carter headed to his UCSF lab to study the motor protein dynein, which comprises around a whopping 13,500 amino acids in yeast and had yet to be crystallized. Dynein transports a wide variety of molecules along microtubules within the cell, is involved

in mitosis, and seems to function differently than the well-studied molecular motor proteins kinesin and myosin. "Dynein is a lovely motor," says Carter. But to study this massive protein, he had to develop a way to systematically cleave off nonessential parts, leaving a smaller molecule to manipulate, and a new way to crystallize large quantities of the protein, growing 75 liters of dynein-producing yeast at a time. "Being able to produce pure amounts of a protein that long was slightly nontrivial," Carter says. Since developing the new methods, he's solved the structures of two domains of dynein: the microtubule binding domain,² which determines the molecule's directionality, and the motor domain,³ which converts ATP into mechanical energy for directional movement.

DISCUSSION: "It was the best collaboration I've had so far in my scientific career," says Samara Reck-Peterson, who was a postdoc with Carter at UCSF and now runs a structural biology lab at Harvard. "Andrew is one of these individuals who, when part of the project, really changes things because of how deeply and creatively he thinks about things."

Carter has now returned to MRC-LMB, where he leads his own lab's work on dynein. Vale is confident that Carter will emerge victorious from his tussles with the ungainly protein: "He always will think of a new angle of a problem that I haven't thought of. He's someone I have learned a lot from."

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