

MOLECULAR BIOLOGY

On Ends and Means

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Elizabeth H. Blackburn, telomere, and telomerase are not yet household names, but odds are we'll see Blackburn in Stockholm before we see federally funded research on embryonic stem cells. Blackburn's groundbreaking work in telomere biology is a remarkable story worth telling. Beyond this, Catherine Brady's *Elizabeth Blackburn and the Story of Telomeres* offers a commanding account of an inspiring effort to overcome gender bias along with advice about doing science, conquering academic politics, and taking responsible positions on science policy.

"For her," says Brady, "a feeling of awe for the mystery of life, symbolically embedded in the 'secret code' of the genes, was wedded to curiosity and a methodical effort to dismantle that mystery." Fred Sanger invited Blackburn to pursue graduate study in his laboratory at the Medical Research Council's Laboratory of Molecular Biology in Cambridge. There she rubbed shoulders with the likes of Sydney Brenner, James Watson, and Francis Crick; got into DNA sequencing at ground zero; and met her future husband, John Sedat. You get the impression that she was intelligent and, although mostly silent, able to hold her own without difficulty in a British tradition that invited the students to tea and lunch with the eminent scientists of the day. She no doubt benefited from picking up information even if she wasn't always a lively participant.

As a postdoc in Joe Gall's lab at Yale, Blackburn applied her knowledge to determining the nucleotide sequence of telomeres in *Tetrahymena*. She went on to dominate the field, sequencing telomeres in several other organisms and, with her graduate student Carol Greider, identifying the telomerase enzyme.

Brady pays close, but not unwarranted, attention to the dynamics of a woman navigating a male-dominated science. She paints a picture of Blackburn steering clear of the most competitive aspects of molecular biology,



Elizabeth Blackburn and the Story of Telomeres
Deciphering the Ends of DNA

by Catherine Brady

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carving out a niche of her own, and then becoming a titan in that field. Brady is fervent in interpreting every event in Blackburn's life as a conquest of her disadvantages as a woman rather than as a natural evolution of her excellence as a scientist: "That Blackburn, so eminent in her field, still could not see herself as powerful speaks volumes about the difficulties that continue to beset women as they enter the higher ranks of academia. She couldn't imagine a negotiating strategy other than threatening to leave...." Sometimes, no matter who you are, there is no other strategy.

Although Brady (a professor in the writing program at the University of San Francisco) has done an admirable job of educating herself in the science, readers desiring a good understanding of telomeres and telomerase will need some background—say, a couple of semesters of college biology. Yet all should come away comprehending the main scientific points, recognizing the potential clinical applications, and appreciating how science is done and just how painstaking work at the laboratory bench is.

What most researchers will value most from the book is its compilation of a master's wisdom about doing science. Hints and quotable lines abound, from how to think about data to how to navigate a career. Brady explains that Blackburn "tends to 'roam' the data," "exploring a single experimental question from every angle and ... synthesizing a wide range of potentially relevant information." Blackburn captures a key difference between the biological and physical sciences when she notes "You can't operate from first principles, as physicists can, but have to test

logic against precedent and the data itself. Proof in the purest sense is something that comes in a messy way."

Blackburn faults the granting and publishing establishments in which she has been quite successful. She notes that the National Institutes of Health are risk-averse, but "countering this tendency ... is the fact that the grant itself is not a contract." Reviewers sometimes abuse the process. "Who knows what knives are out there, under the cloak of anonymity?" With disdain Blackburn remarks, "I don't even really know what the impact factor is.... It's the bottom-feeders who talk about the impact factor."

A staid member of the President's Council on Bioethics, Blackburn holds that "[i]t is important for scientists to participate in policy debates because they can evaluate the data." Her insistence on accuracy put her at odds with council chair Leon Kass, whose "yuck factor" replaced reason when presidential policy on embryonic stem cell research conflicted with science. The result was her dismissal from the Council and another embarrassment for the president.

Brady never shows us the dark side of Blackburn, but the encounters I've had with Blackburn's former fellows, students, and colleagues suggest that there isn't one. She always supported her students and fellows whether they chose to follow her career path or not. She thinks that it is important to have competent scientists in every walk of life. Leading a new field and training the people who will take it into the future is a tremendous contribution. But Blackburn's academic legacy is notable because it has begun to spread far beyond academe. I'm waiting for a sequel.

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