

Douglas R. Kellogg

It was one of those long-running, half-silly and half-serious bench arguments. Was the best way to unravel the secrets of the cell through biochemistry or genetics? The place was Bruce Alberts' lab at the University of California, San Francisco (UCSF). The time was the early 1990s. Doug Kellogg was still a grad student under Alberts but enjoyed defending the honor of biochemistry against the genetic gibes of postdoc William T. (Bill) Sullivan. It was Sullivan who escalated to print, writing a tongue-in-cheek, scientific fairy tale called "The Salvation of Doug."¹ Kellogg quickly responded with his own fable, "The Demise of Bill."² Twenty years later, both essays are still in wide circulation, especially in undergraduate classes.

The fabled setting is the shared retirement home of Doug, the biochemist, and Bill, the geneticist, high on a hill overlooking a remarkably laid-back automobile factory. The retired scientists are unfamiliar with cars and set out to understand the workings of the factory. As Sullivan tells it, the "lazy" geneticist investigates by going down the hill at the start of a shift, tying the hands of random workers, and then watching for mutant phenotypes. Car mutants that lack a round object inside are unable to turn and thus the geneticist discovers that the random worker he tied up embodied the steering wheel gene. Meantime, Doug the biochemist is taking cars apart and causing explosions as he investigates the liquid in the gas tank. In the Kellogg version, it's the biochemist who gets right under the hood, analyzing the spark plugs, discovering that gasoline is the energy source, and tracing the flow of vaporized fuel to the cylinders for ignition. When the geneticist's van breaks down, it is the biochemist who gets it running. On the research front, the hapless geneticist ends up stumped by lethal mutants that result in a null phenotype—the factory produces nothing.

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Whatever their limits as literature, the dueling essays make clear for undergraduates the differing experimental tactics of mutational genetics and analytic biochemistry. But Sullivan laments, "I've worked on a research paper for five years and barely anybody noticed. This essay, I worked on it for 15 minutes and it's still going strong."

And so is Kellogg, Sullivan concedes. In fact, the Sullivan lab is next door to the Kellogg lab in the Department of Molecular, Cell, and Developmental Biology at the University of California, Santa Cruz (UCSC). There the one-time friendly rivals are longtime friendly colleagues. Sullivan confesses that he still enjoys giving Kellogg a hard time about biochemistry but, in truth, the single-track approaches common 20 years ago have long since overlapped. "Next door I've noticed that there's a lot more genetics going on in his lab," Sullivan reports. "And (in my lab) we do a little bit of biochemistry along with genetics and a lot of cell biology. Actually right now, we have a big biochemistry project going on."

If his techniques have changed, Doug Kellogg's appetite for tough scientific problems hasn't, says Sullivan. "Some people jump about from problem to problem. I suffer from this myself. But the thing about Doug is that he's relentless and tenacious with these hard, hard problems in the cell cycle. Other people have taken the cream off the cell cycle and then gone on to other things but Doug is still at it, working on the key problem of controlling cell size that up to now has been intractable. Laser focus, that's Doug."

A Wee Problem

The Kellogg focus has been on the cell cycle since his postdoc with Andrew Murray, also at UCSF, where not incidentally, Kellogg learned yeast genetics. Budding yeast became the foundation for Kellogg's ongoing pursuit of the



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cyclin-dependent kinases, particularly *Cdk1* and its intricate relationship with *Wee1* as a regulator of cell size. *Wee1* is a very famous gene in cell cycle research, having been discovered by Paul Nurse in 1975 at the University of Edinburgh (hence the Scottish “wee” for the undersized cells that result after it is knocked out). It was Nurse’s first step toward the 2001 “cell cycle” Nobel Prize. And yet all these years after its discovery, Kellogg explains that the exact role of the *Wee1* kinase in cell size control has remained elusive. “It’s been difficult to nail down,” he adds in a monumental understatement.

“The complication is that growth is thought to be continuous during the cell cycle. Therefore, if something affects timing, it will affect cell size,” says Kellogg. “A lot of people have argued that *Wee1* is just controlling timing and that causes indirect impacts on cell size.” But Kellogg believes that the *Wee1* kinase is not just a timer for the entry into mitosis but is itself an active player in cell size control. “It’s difficult to prove,” he admits. “The key is to understand the signals that act upstream from *Wee1*. That’s what we’ve been working on using a combination of biochemistry, genetics, and computational techniques to unravel the signaling network that acts upstream of *Wee1*.” Kellogg now has a paper in press in *Molecular Biology of the Cell (MBoC)* on a major study of the systems-level mechanisms that control *Wee1*. The study was spearheaded by postdoc Stacy Harvey and collaborators Jeremy Gunawardena and Steve Gygi at Harvard Medical School.

But how does Kellogg stay motivated on such long-term projects? “It’s really just curiosity,” Kellogg says. “I’ve always wanted to know how things work.” Kellogg also says that he’s been lucky to find students and postdocs who share his long-lasting brand of curiosity.

That’s what attracted Derek McCusker, a Scot with a new doctorate from Cambridge University in 2001, who was looking for a postdoc in the U.S. McCusker admits that at first he was equally enthralled by Santa Cruz’s wild beauty and Kellogg’s enthusiasm for the science, and not just by the project. His stay in the Kellogg lab stretched out as McCusker

pursued a separate role for *Cdk1* in controlling cell surface growth, but it was time well spent, he says. “I had a very happy postdoc. I did stay much longer than I’d imagined but the project went from strength to strength as we developed a really full story.” It culminated in a 2007 *Nature Cell Biology* paper, says McCusker,

but only after they battled through some very difficult biochemistry and a lot of cell biology. “But Doug was always so encouraging that there was never any question of things taking too long,” he recalls. “Doug is the type of guy who doesn’t have any preconceptions on the way things are supposed to work. I just found that fantastic,” says McCusker, who has been on the faculty of the University of Bordeaux in France since 2009.

In the lab next door at Santa Cruz, Sullivan has his own half-serious explanation for Kellogg’s genius for long-haul science. “I think it comes from all those Minnesota hard, harsh winters,” says Sullivan. “I come from Southern California—the San Fernando Valley—where

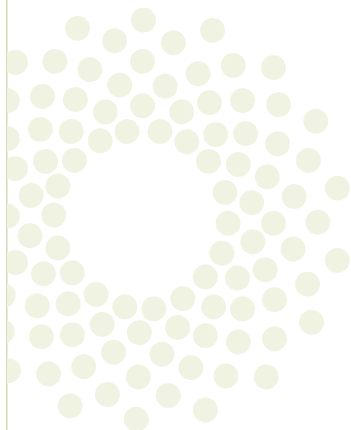
we did a lot of skateboarding, but Doug, he’s from Minnesota.”

Snow Falling on Black Velvet

St. Paul to be exact, where Kellogg was born and raised, the second of four children and the only one to pursue a scientific career. One of his earliest memories is a black velvet-covered table being carried outside during a snowfall by his nursery school teacher, who handed out magnifying glasses. Kellogg says he was always wild about science, particularly biology.

He plowed straight through public school and into the University of Wisconsin–Madison (where Minnesota students could still get in-state tuition) to study biochemistry. Graduate school was a question of where, not if, and UCSF was the answer. In 1983, the Alberts lab was on the ninth floor of the legendary Parnassus Avenue science high-rise where Kellogg found himself waiting for the overtaxed elevators and collaborating with a rising generation of cell biologists including Sullivan, Tim Mitchison, Karen Oegema, Christine Field, and Jordan Raff. For his postdoc, Kellogg moved down two floors into Murray’s cell cycle domain.

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Whatever his Midwestern roots, Kellogg had become a thoroughly acclimated Californian by 1995 when UCSC offered him an ideal setting for his science and his daily 4:00 pm run. “I can leave my campus building and be running in the redwoods in a matter of 20 seconds,” Kellogg reports with mild astonishment.

Now a full professor, Kellogg just concluded a three-year term as department chair, an experience that left him with a new appreciation for scientific leadership. It’s chairs, directors, and deans who hold things together, and also national leaders such as Alberts, Harold Varmus, and Tom Cech, Kellogg contends. “There’s a lot of focus on individual scientists but it’s rare that any one scientist makes contributions that are indispensable. It’s the overall scientific community that really matters, and having leaders who can make the community work effectively is unbelievably important and valuable,” Kellogg believes.

Kellogg has also grown to appreciate UCSC’s large undergraduate population. “There are always interesting undergraduates looking for a lab to work in, and their fresh curiosity and eagerness to learn can be a tonic to everyone in the lab. The key is to get talented and motivated undergrads and pair them up with a grad student or a postdoc who can get them really involved in a project.”

First Great Science

One of the first undergrads in the Kellogg lab was Topher Carroll. “It was the first great scientific experience of my life and in some ways it still remains the best,” Carroll declares. He went from an undergrad in the Kellogg lab to grad school at UCSF and a postdoc at Stanford. In the fall, Carroll will join the faculty at Yale.

“In Doug’s lab, there was just a real sense of excitement and adventure,” Carroll recalls. Doing his independent senior thesis, Carroll proved to be exceptionally talented at the bench, cloning and analyzing the gene behind a tricky *Saccharomyces cerevisiae* mutant. “So I had this good experience that went well and then Doug came to me and said, ‘We should write a paper.’ But he didn’t just want me to contribute to a figure. He wanted me to be first author. It was a

real eye opener. I just knew that this was the life I wanted.”

Today Kellogg lives in Santa Cruz with his wife Needhi Bhalla and their one-year-old son, Elias. Bhalla, who is in the same department at UCSC, studies chromosome segregation defects in *Caenorhabditis elegans*, a mechanism with implications in polyploidy human disorders such as Down syndrome. Kellogg has been an avid outdoors type since childhood when the whole family took extended paddling trips in the remote lakes and forests of Canada. His parents went on canoe trips well into their 70s, Kellogg says, and he hopes his own growing family will carry on the tradition, by water and by trail.

A Passion for *MBoC*

Besides his family, his lab, and his runs through the redwoods, Kellogg is passionate about the ASCB’s journal, *MBoC*. Last year, *MBoC* Editor-in-Chief David Drubin convinced Kellogg to take on the role of Features Editor. They co-edited an acclaimed special issue in celebration of the ASCB’s 50th anniversary. Kellogg says, “*MBoC* is a place where people can publish their best work without being subjected to a prolonged review process, requests for large numbers of supplementary experiments, and seemingly arbitrary decisions as editors are forced to meet space constraints. I think David Drubin has done an excellent job of defining expectations for *MBoC* reviewers and editors that encourage a transparent, fair, and constructive review process.”

Kellogg and Drubin have a vision for *MBoC* as a scientific home journal for cell biologists, as well as a forum for members of the community to communicate interesting and unique perspectives as Features articles. In other words, it’s time for the scientists on the hill to come down and take control of their own journal, says Doug the cell biologist. ■

—John Fleischman

References

¹bio.research.ucsc.edu/people/sullivan/savedoug.html.

²bio.research.ucsc.edu/people/kellogg/contents/Demise%20of%20Bill.html.

**Kellogg says,
“*MBoC* is a place
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