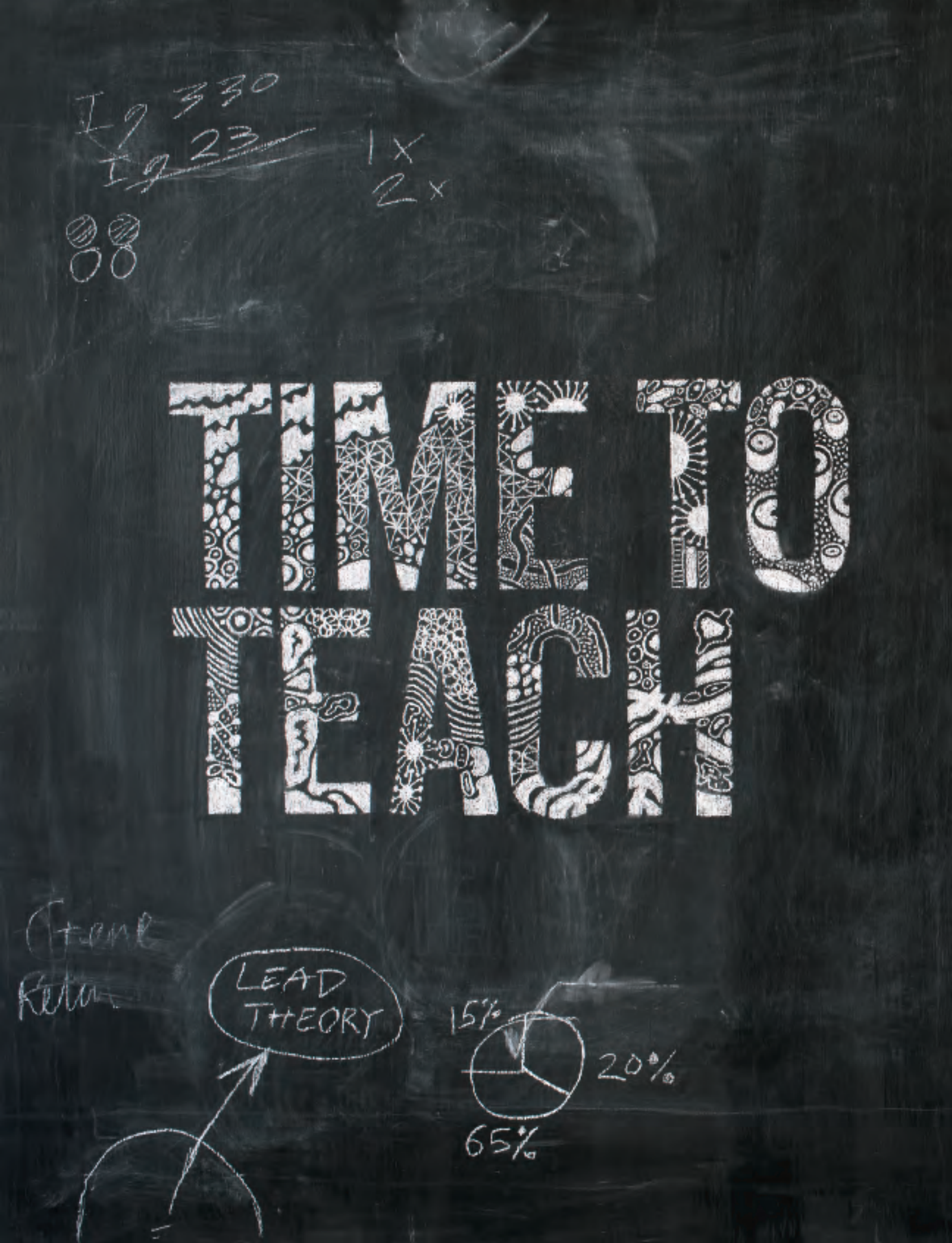
TIME TO
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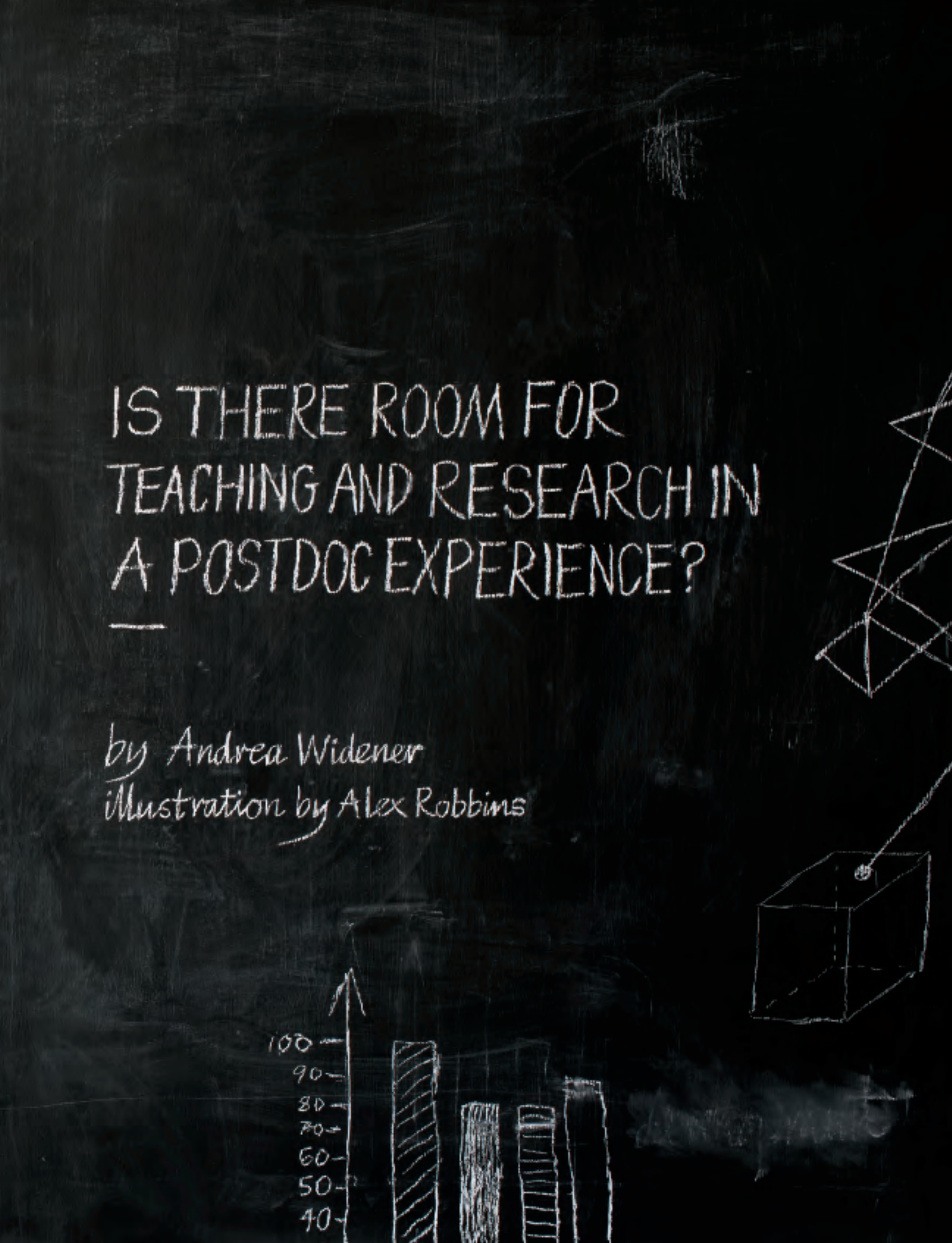
IS THERE ROOM FOR TEACHING AND RESEARCH IN A POSTDOC EXPERIENCE?

by Andrea Widener
illustration by Alex Robbins



As she faced the end of grad school, Karmella Haynes wasn't sure what direction to take. "I couldn't think of a research project that got me really excited," says the graduate of Washington University in St. Louis.

Haynes thought she might want to teach. But, like many modern grad students and postdocs, she didn't have enough experience teaching to know if she liked it—or if she could get a job doing it.

Science educators say teaching experience is vital for postdocs, many of whom are going to be teaching as part of their faculty duties someday. But a lot of schools are struggling with how to prepare graduate students and postdocs to teach, and there is no consensus on the best approach.

"For someone truly interested in becoming an academic scientist, traditional training usually won't offer lessons in pedagogy or how to teach," says David J. Asai, director of HHMI's precollege and undergraduate education programs. "I think teaching experiences for postdocs are a great idea if someone can be patient, get their research solid, and do a postdoc where they can learn to teach and mentor undergraduates in their own research lab."

Few postdocs are getting teaching experience now. Greater than 60 percent have 21 or fewer hours of teaching experience, and almost a third have no experience at all, according to an ongoing longitudinal study of science graduate students from Arizona State University, the University of Washington, and the University of Wisconsin–Madison.

Postdocs who want some teacher training will find a handful of training opportunities, and the numbers are increasing. They range from formal teaching postdocs to programs that expose postdocs to teaching while they work in a traditional research position.

To land a job when the training is over, however, a student must strike a fine balance between research and teaching, and few positions offer that balance. Teaching experience isn't always seen as a plus by hiring institutions, especially research universities. Many faculty discourage graduate students or postdocs from going after teaching experiences because they fear that time away from the lab will mean fewer publications—and more difficulty getting a job.

Haynes's mentor was Sarah Elgin, an HHMI professor who created the Genomics Education Partnership and is intensely involved in developing better ways to teach genomics. Haynes recalls Elgin strongly encouraging her to take a traditional research postdoc at first. But Haynes was persistent, so Elgin pointed her toward a teaching postdoc position at Davidson College in North Carolina.

Haynes thought it might be a chance to find out about life at a liberal arts college while exploring whether she liked teaching. She chose Davidson's postdoc over other teaching opportunities because it provided a mix of education and research—just in case she changed her mind.

"I was very aware of the fact that I was taking an alternative path," Haynes says. "A bad move would have been to jump into the first teaching position I saw. I was really careful to make sure the course of the fellowship left me with my options open."

TEACHING AND RESEARCH MIX

A focus on research appears to be the hallmark of many of the successful teaching postdocs at liberal arts colleges and research universities. Many also include formal education mentoring by current faculty members or seminars on how to best teach so students learn. The duration of teaching postdocs is traditionally shorter than a typical biology research postdoc (two or three years, rather than five or more).

At Davidson, Haynes spent the first year of her two-year postdoc doing research in a new field, synthetic biology, with mentor Malcolm Campbell. Working at a college research lab was completely different from her grad school experience. "It was very small, in a wash-your-own-glassware, stuff-your-own-pipette-box way," she says.

Campbell taught her how to design projects that were easy for undergrads to jump into. "His approach was setting up student-accessible science, rather than bringing the students up to the science," Haynes explains. The lab focused on bacteria, which are easy for students to work with themselves, instead of using animals or complicated equipment. "They were pretty big impact projects but there wasn't this big hurdle of technical difficulty."

"I WAS VERY AWARE OF THE FACT THAT I WAS TAKING AN ALTERNATIVE PATH." —KARMELLA HAYNES

The group published a research paper in the *Journal of Biological Engineering* describing how they engineered the bacterium *Escherichia coli* to solve a mathematical problem. The publication landed Haynes on National Public Radio's *Science Friday*. "It was just really cool how this paper with undergraduates—not coming from a big, powerful research university—got us a lot of attention," she says. The research also allowed Haynes to attend an international synthetic biology conference—her first professional trip overseas—and meet some prominent scientists in the field.

In her second year at Davidson, Haynes focused on teaching. She redesigned a bioinformatics course to overcome its intimidating reputation among students. They were no longer left on their own to navigate databases and new software; instead, she walked students through the complex material in class—a method she affectionately calls "synchronized swimming exercises"—before making them go solo. She also taught an introductory biology course that had even nonmajors doing polymerase chain reaction and biochemistry.

But the very experience she thought would cement her desire to teach instead drew her back to research. She decided to follow her two-year postdoc with a traditional research postdoc in synthetic biology at Harvard University.

"When I immersed myself in teaching there were some things I missed, like being able to mentor grad students and postdocs," Haynes says. "So I wanted to make sure I was competitive for a small liberal arts college job or a research university job."

THE COLLEGE MYTH

Haynes made a wise choice. Schools at all levels—liberal arts colleges, regional public universities, and major research institutions—look first at research, says Jo Handelsman, an HHMI professor and national education leader who runs a science education training program for graduate students and postdocs at Yale University.

"If people want to go into academic positions, a pure teaching postdoc can be fatal," Handelsman explains. "There is a myth out there that you don't need a research postdoc if you are going to a predominantly undergraduate institution, but many of them expect a strong research program."

Chris Himes learned that lesson the hard way.

As a graduate student at the University of Washington, Himes sought out teaching opportunities and eventually won his university's teaching award for co-developing a course that teaches study skills to students from groups traditionally underrepresented in the sciences. When it came time to graduate, Himes had an offer for a traditional research postdoc, but he decided to take a two-year teaching postdoc position at Williams College in rural western Massachusetts instead. "I wanted to see how

Haynes: Jared Leeds Himes: Jen Judge

KARMELLA HAYNES AND CHRIS HIMES ENJOYED FORMAL TEACHING POSTDOCS. BOTH, HOWEVER, WENT ON TO A SECOND POSTDOC TO GET THE RESEARCH EXPERIENCE THEY THEY'D NEED TO GET A GOOD FACULTY POSITION.

research is done at a college, see how teaching is done, and learn what a liberal arts college is like."

The two-year postdoc was set up to include both research and hands-on teaching experience, but because of his interests—and the shock of being in such a different environment, with so few colleagues at his level with similar scientific interests—he did more teaching than research. He taught in a whole range of settings: labs, seminars, and large lecture courses.

Himes had a great experience at Williams and learned a lot about teaching. He may even want to work at a liberal arts college someday. But when he looked for a job after the first year of his postdoc, he didn't get a single offer. Williams had an open position in his area; he applied but didn't even get an interview. "That was an eye opener for me," Himes says. "Here I am doing the work at a liberal arts college that I would be expected to do later, but I wasn't considered for the job."

Wendy Raymond, who oversaw the postdoc program at Williams, says the school doesn't emphasize teaching experience when hiring faculty. Any postdoc with only two years of experience would be in the same boat as Himes, she says. "We wouldn't hire a teaching postdoc for a faculty position without a strong research record," she says.

Himes doesn't regret going to Williams, but he does wish he had had different priorities. "My advice: even if you are going to do a teaching postdoc, focus on research and take the teaching experience as a plus," says Himes, who is now in a second teaching postdoc with a stronger emphasis on research. "At the end of the day, it is the publication record that will get you the interview, then the job."

Many in the academic community have a negative view of teaching postdocs and other teaching positions for newly minted Ph.D.s. Rather than helping postdocs become better teachers or get better jobs, they think schools just use them to fill teaching slots. "All too often teaching postdocs are primarily … to teach a class or two to relieve a faculty member from his or her teaching duties," says Chris Craney, an Occidental College chemistry professor. "We didn't want to do that."

Occidental has had a teaching postdoc in the sciences for almost 20 years. When the college redesigned the program in 2004, the focus was on a postdoc's future. "We thought, what would this postdoc have to demonstrate to make them a top candidate at a place like Oxy?" explains Craney, who led the program through the changes.

The school settled on a two-year postdoc for a single Ph.D. graduate that focuses primarily on developing the capacity to combine teaching and research. Both a teaching mentor and a research mentor, or one person filling both roles, commit to guiding the postdoc in everything from balancing teaching and research to college politics.

The trainee spends the first year working in the lab, choosing a research project and learning how to create a research program that can work for undergraduates. In a twist from other teaching postdocs, no classes are directly assigned to Oxy's postdocs. Instead, they coteach courses with their teaching mentor during the second year, while continuing to do research.

Craney and Eileen Spain, who runs the program now, say this model of teaching and research works, and the proof is in the jobs that have come later. Their postdocs, eight in all, have landed the jobs they wanted, including tenure track positions at places like the College of Charleston, Mount Holyoke College, Loyola Marymount University, even Occidental itself.

For those seeking a job at a liberal arts college, "the game has changed from 20 years ago," Spain says. "The bar is higher, the expectations are higher. They need to come to the table with a robust plan for how they can do their research with undergraduates and a clear understanding of what it is like to be at a liberal arts college."

Like Occidental, schools that offer teaching postdocs need to keep those larger goals in mind. "It is a big responsibility," Asai says. "It's not, let's hire a teaching postdoc so that my workload goes down. In fact, when done right it will likely increase your workload because you have the added responsibility of mentoring the teaching postdoc."

POSTDOCS NEED TO FOCUS ON RESEARCH FIRST, TEACHING SECOND, SAYS JO HANDELSMAN (LEFT). BUT THEY DO NEED TO LEARN HOW TO TEACH, SAYS DIANE EBERT-MAY, AND THE EARLIER THE BETTER.

Handelsman: James Kegley Ebert-May: Peter Baker

TEACHING ON THE SIDE

While not going as far as a formal teaching postdoc, some programs help traditional research postdocs at major colleges and universities get teaching experience.

The largest is the federally funded Institutional Research and Academic Career Development Awards (IRACDA), which

> **"THE MIXED TEACHING AND RESEARCH POSTDOC IS THE IDEAL FOR THE GREATEST DEPTH OF ACADEMIC JOBS... THEY ARE GETTING SUPERVISORY EXPERIENCE, THEY ARE GETTING MULTI-TASKING EXPERIENCE."** —JO HANDELSMAN

support traditional postdocs at research-intensive universities who also teach at nearby predominantly minority institutions. The awards currently fund around 180 three-year postdocs at 17 research universities across the country. In addition to their research positions, the postdocs teach classes with help from mentors and get formal instruction in the science of teaching and learning.

Clifton Poodry, director of the division of minority opportunities in research at the National Institute of General Medical Sciences, designed the program in 1997 when he saw a golden opportunity: postdocs told him they wanted teaching experience and minority-serving institutions expressed the need for more research-active faculty to help update their courses. The trainees spend 75 percent of their time on research and 25 percent on career development, including teaching, Poodry explains.

"Initially there was real concern that this would be a burden on postdocs. How could they be competitive if they are teaching a quarter of the time?" Poodry remembers. Assessment of the program showed that the postdocs (500 to date) do as well or better than their peers and publish as much as or more than their peers. They have gotten jobs at research universities, liberal arts colleges, minority-serving institutions, and industry, says Shiva Singh, who currently directs IRACDA. "For people who believe data, the idea that teaching experiences are hurting these postdocs should be dispelled," Poodry says.

When Himes finished his postdoc at Williams and didn't get a job, he started an IRACDA postdoc at the University of New Mexico in Albuquerque. He says the structured split of research and teaching has been a good fit. He also values the formal teacher training seminars—his mentorship at Williams was more freeform—and his interactions with other postdocs who face the same challenges and concerns.

Even in his first year, "the goal of the program is clear," Himes says. "They want us to get this teacher training but they also recognize that the primary goal of this postdoc is research."

Several other programs that offer teaching as a supplement to research postdocs have the same approach. The University of Wisconsin and Emory, Stony Brook, and Yale Universities have programs that provide postdocs and grad students interested in teaching with formal courses, mentored teaching opportunities, or both. "Some of the students say getting a break 10 hours a week actually makes them more excited to go back to their research," says Pat Marsteller, who runs a program at Emory. "And they learn how to get the work done for both things—research and teaching—which they will have to do as faculty."

Diane Ebert-May from Michigan State University runs a program recently funded by the National Science Foundation called FIRST IV that is available to postdocs in biology from any university. The idea for the program grew out of Faculty Institutes for Reforming Science Teaching (FIRST), which showed that the longer faculty teach, the less likely they are to adopt student-centered teaching techniques. This prompted her to target future faculty for the FIRST IV program to help them learn how to teach from the get-go.

The two-year program began in the summer of 2009 when the first 100 postdocs were selected for intensive training. The postdocs then went back to their home institutions to use what they learned to teach or coteach a course. The following summer, they came back together to share what they learned in the classroom, review videos of their teaching, and revise their courses. "We confirmed that learning how to teach is better at the outset of a career," says Ebert-May, whose second cohort of FIRST IV postdocs began training this summer.

Around 25 percent of the first cohort have finished their postdoc and moved into jobs, and Ebert-May thinks their participation in FIRST IV gave them a competitive edge. For the most part, they have been able to land the types of jobs they want at the types of institutions they are interested in. Those who have faculty jobs now "are becoming change agents in their departments and are influencing their peers' approaches to teaching."

The biggest challenge for someone who wants to apply to FIRST IV and many other university teaching programs is getting their lab head's permission, which is required.

But she is optimistic that scientists' attitudes toward teaching and learning are changing. Most applicants don't have a problem getting their lab heads to sign off, and she thinks that it is important for faculty mentors to support postdocs who want to develop not only as researchers but also as teachers.

ADVICE FOR THE FUTURE

Emory's Marsteller hopes that awareness will lead to expanded teaching opportunities for postdocs. "I think it is unconscionable for universities to not prepare people for the jobs that they want to do," Marstellar says. "We are way past the time where we should be thinking that we can just throw people into a classroom if they can give a good lecture."

More fellowships that allow teaching or other professional development as part of a postdoc would better train these students to balance the mix of demands they will face as faculty members, says Handelsman at Yale. "We as a scientific community need to be thinking about what the goals for postdocs are and what the opportunities should be, " she says. "The mixed teaching

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Down the line, it's likely that the field will be choosing from a range of vectors and using both in vivo and ex vivo approaches, depending on the disease, according to Kay. "There's not going to be one vector that's going to be perfect for all applications. They all have their niche." (See Web Extra sidebar, "Taking Down Bad Genes.")

The AAV procedure, for example, transformed Corey's life. His father, Ethan Haas, knew the surgery was the right decision four days after Corey left the hospital, when the family took a trip to the zoo and Corey said that the sun was hurting his eyes. "That had never happened before. It was a pretty big deal," Ethan recalls. But best of all, he says, was the day Corey tried out the maze. "To see him navigating this obstacle course without difficulty—it was the most dramatic thing."

In the two years since, Haas says he's been pressing the researchers to repeat the procedure in Corey's other eye. He's slated for surgery this fall. ■

WEB EXTRA: For more about the work described here and to see a timeline of events in the field of gene therapy over the last 30 years, visit www.hhmi.org/bulletin/aug2011.

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(TIME TO TEACH)

and research postdoc is the ideal for the greatest depth of academic jobs.... They are getting supervisory experience, they are getting multitasking experience."

That's how it turned out for Haynes.

After three years as a research postdoc at Harvard University, she starts a tenure-track faculty position at Arizona State University in the fall. She interviewed at several institutions and believes her teaching experience was a key factor in her appeal.

Her advice? "Find a place that has top notch research facilities but cares enough about teaching that it will not count against you," Haynes says. "Those universities do exist." ■

WEB EXTRA: Postdocs can learn to be science education researchers too. Visit www.hhmi.org/bulletin/aug2011.