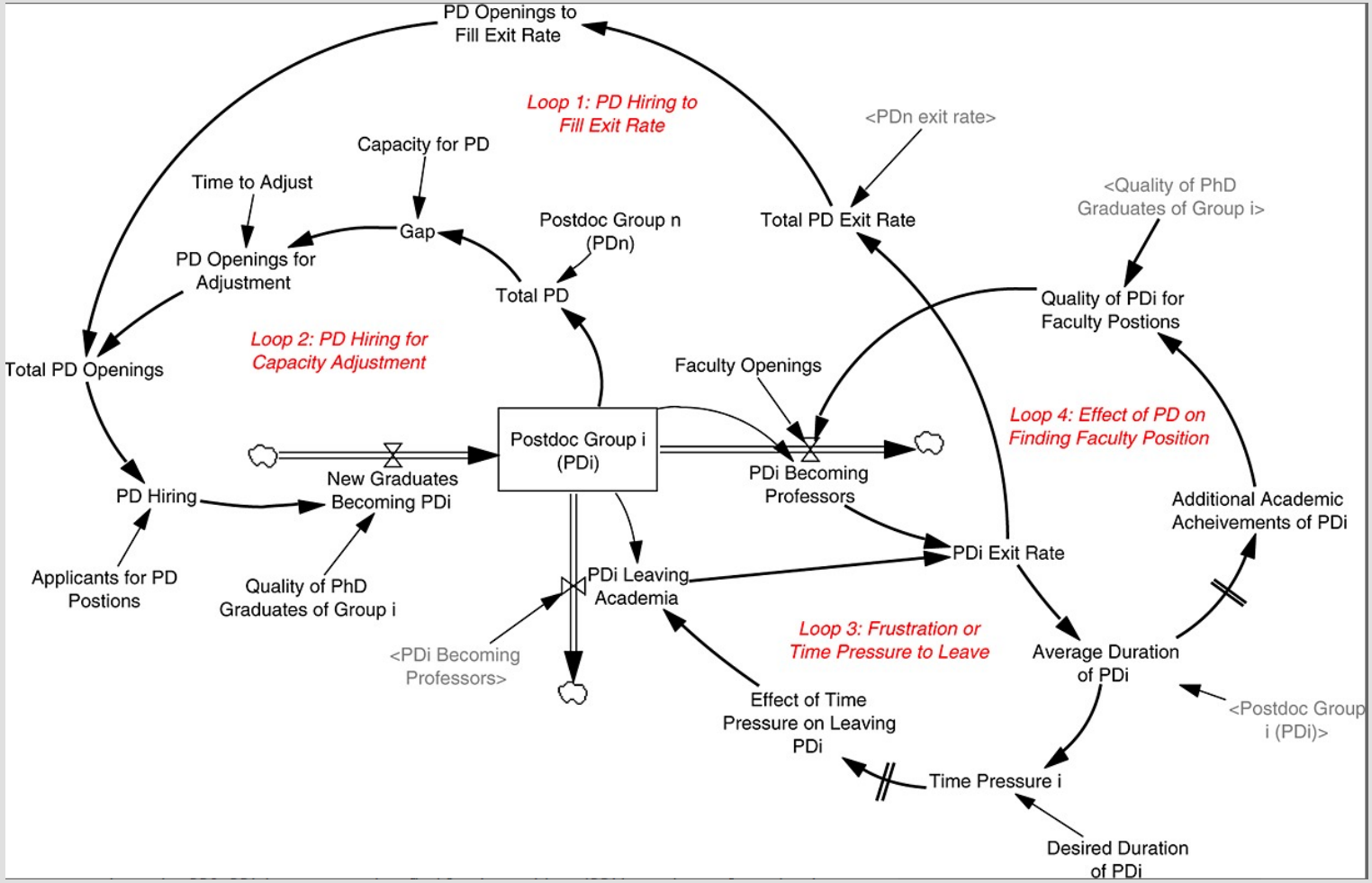
Faculty talking about careers. . . . Not always pretty.



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Essay

Improving Graduate Education to Support a Branching Career Pipeline: Recommendations Based on a Survey of Doctoral Students in the Basic Biomedical Sciences

C. N. Fuhrmann, D. G. Halme,* P. S. O'Sullivan, and B. Lindstaedt

University of California, San Francisco, San Francisco, CA 94143-0523

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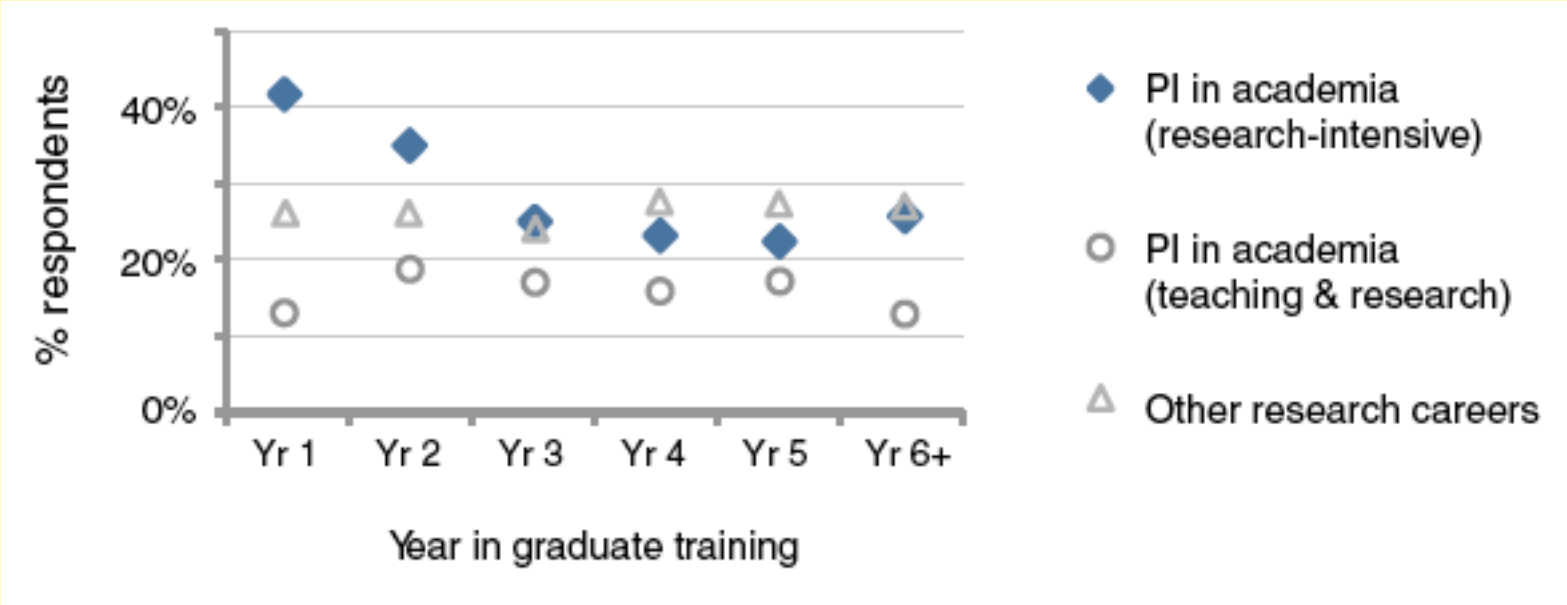
Monitoring Editor: Vivian Siegel

Table 1. Survey demographics and response rate

Students		Enrolled at UCSF	Responded to survey	% Responded
Year	1	138	84	60.9
	2	121	80	66.1
	3	142	88	62.0
	4	105	69	65.7
	5	114	58	50.9
	6	78	49	62.8
	7 or higher	55	21	38.2
	Unreported		20	
Graduate program	Bioengineering[a]	176[a]	67	38.1[a]
	Biomedical Sciences	135	88	65.2
	Biophysics	63	39	61.9
	Biological and Medical Informatics	32	21	65.6
	Chemistry and Chemical Biology	45	28	62.2
	Neuroscience	91	64	70.3
	Pharmaceutical Sciences and Pharmacogenomics	51	33	64.7
	Tetrad	160	122	76.3
	Cell Biology	—	39	—
	Developmental Biology	—	7	—
	Genetics	—	16	—
	Biochemistry & Molecular Biology	—	50	—
	Tetrad—focus not yet determined	—	10	—
	Unreported		7	
Gender	Female	368	249	67.7
	Male	385	205	53.2
	Unreported		15	

attrition?

Figure 2. Early in graduate school, some students lose interest in becoming a PI at a research-intensive academic institution.



The two primary concerns cited by respondents:

“Stress.”

“Lack of work-life balance.”

Recommendations:

“1. Shift academic culture to embrace the “branching” science career pipeline.”

“2. Integrate career development into the graduate curriculum.”

Doctoral Program Assessment, University of Illinois at Urbana-Champaign
May, 2011

MCB respondents who indicated that their department is "not at all or slightly" supportive of:

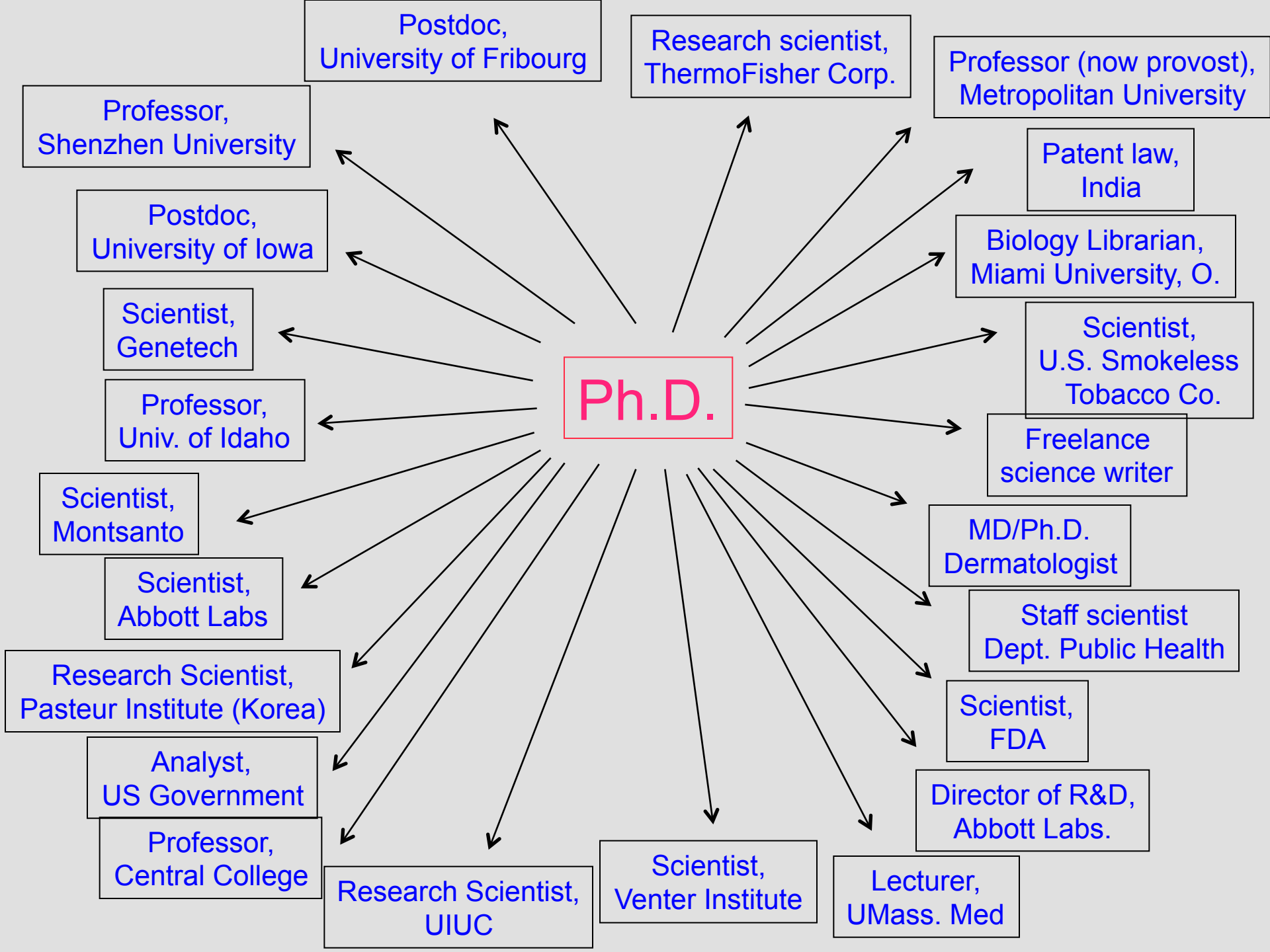
Interacting with people in industry and government agencies? 74%
Developing a career plan? 72%
Consideration of careers outside academia? 68%

(Note: 86% felt they receive a "moderate amount to a great deal" of career/professional advice from their mentors.)

What percentage of biology Ph.D. recipients move on to tenure-track positions?

14%.

Stephan, P. (in press).


Ph.D.
Postdoc, University of Fribourg
Research scientist, ThermoFisher Corp.
Professor (now provost), Metropolitan University
Professor, Shenzhen University
Patent law, India
Postdoc, University of Iowa
Biology Librarian, Miami University, O.
Scientist, Genetech
Scientist, U.S. Smokeless Tobacco Co.
Professor, Univ. of Idaho
Freelance science writer
Scientist, Montsanto
MD/Ph.D. Dermatologist
Scientist, Abbott Labs
Staff scientist Dept. Public Health
Research Scientist, Pasteur Institute (Korea)
Scientist, FDA
Analyst, US Government
Director of R&D, Abbott Labs.
Professor, Central College
Research Scientist, UIUC
Scientist, Venter Institute
Lecturer, UMass. Med

Ph.D. Biology Careers:

PI in academia (research-intensive)

PI in academia (teaching & research)

Other research in academia

Research in biotech/pharma

Bench science in government

Teaching-intensive in academia (post-secondary)

Science education for the public

Science education for schools

Healthcare

Science writing or publishing

Science or education policy

Law-related

Business of science

Drug approval and production

Other (science-related)

Other (not using science knowledge)

MCB & GSA host career speakers.

Amy Cheng Vollmer - Swarthmore College, Swarthmore, PA (11/11/16)

Scott Brun - AbbVie Ventures, Chicago, IL (5/4/17)

Tom Hannan - Fimbrion Therapeutics (Biotech Start-up), St. Louis, MO (12/18/17)

Josh Gajsiewicz - LEK Consulting in Boston, MA (4/27/18)

Abby Stayart - U Chicago, MyChoice Program (5/7/18)

Ran Chao - LifeFoundry (Research Park, UIUC) (5/11/18)

Pathways to a Ph.D. job: How long?

4 years undergraduate study in science

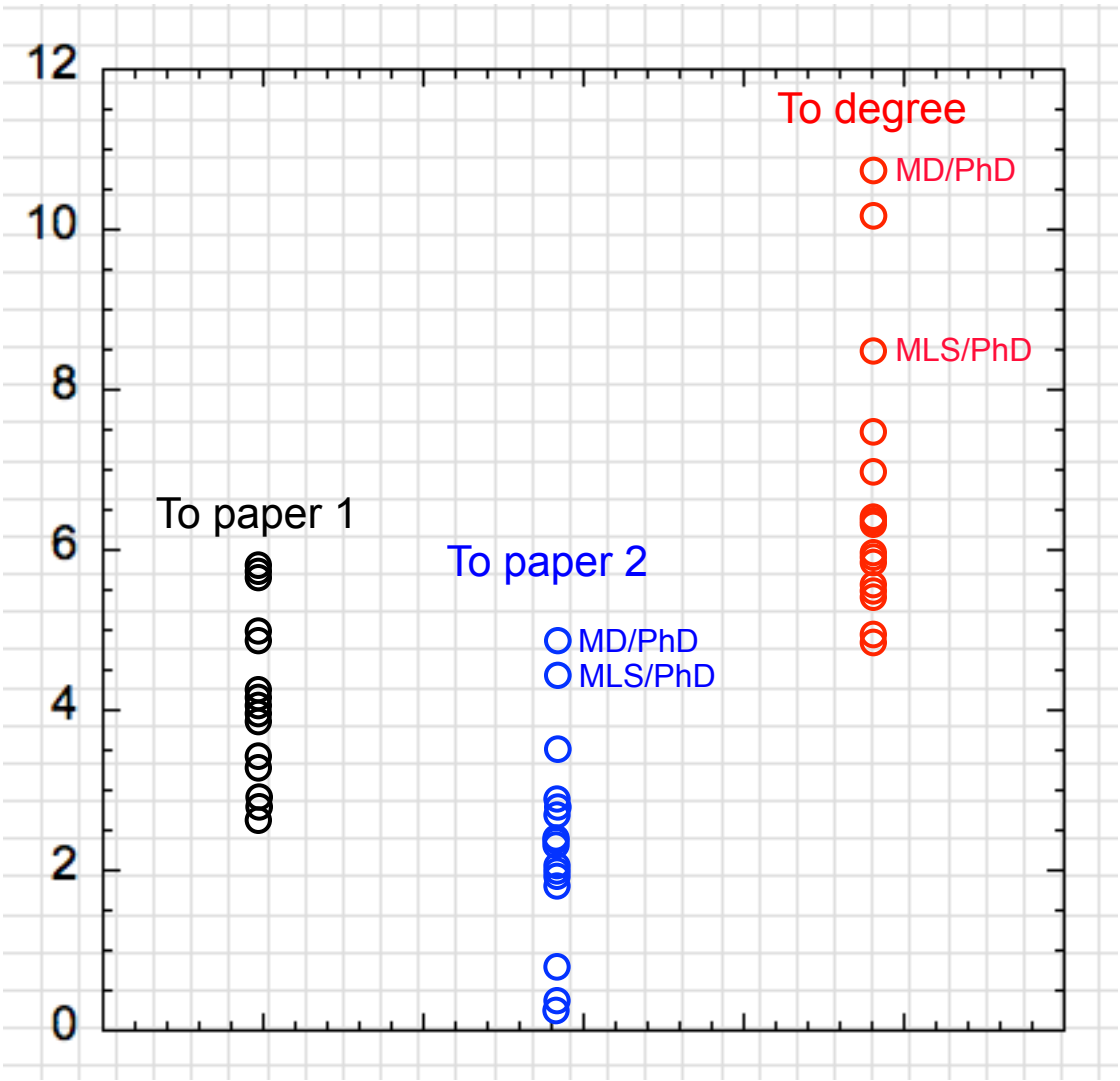
5-6 years Ph.D. work: original research

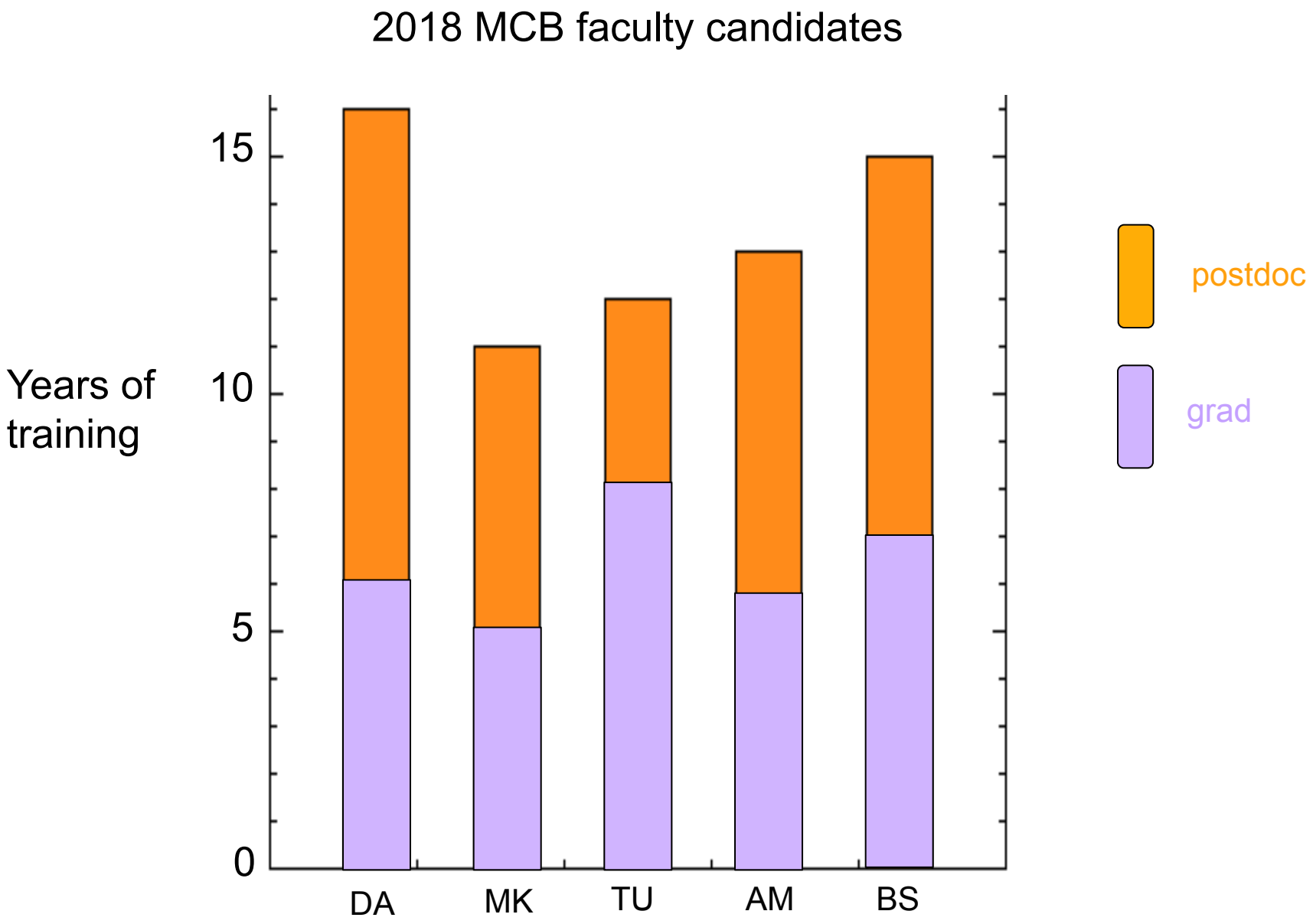
~ 80%

2-5 years postdoctoral research
(or other professional training)

Job!

Time to degree varies.




2018 MCB faculty candidates
Years of training
15
10
5
0
DA
MK
TU
AM
BS
postdoc
grad

The impact of postdoctoral training on early careers in biomedicine

Shulamit Kahn & Donna K Ginther

While postdocs are necessary for entry into tenure-track jobs, they do not enhance salaries in other job sectors over time.

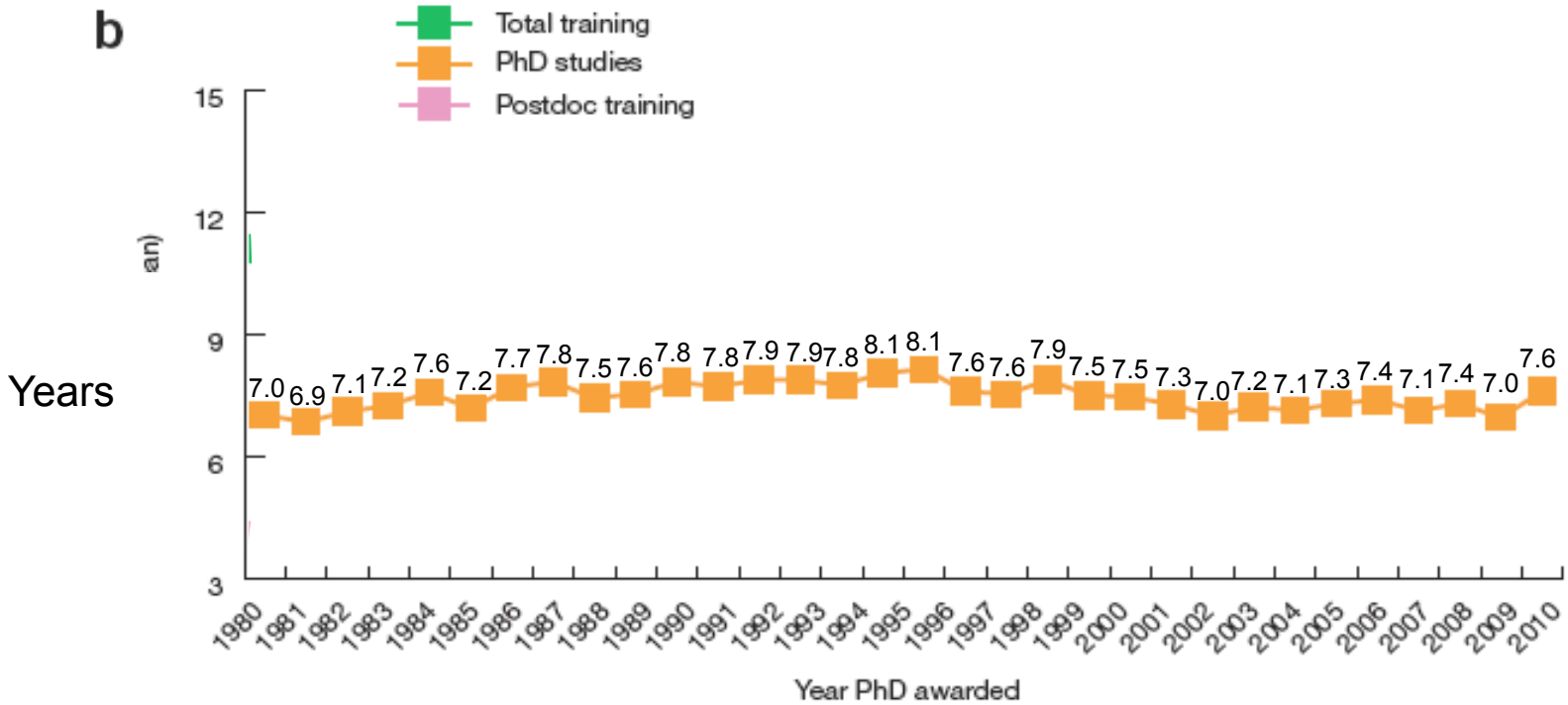
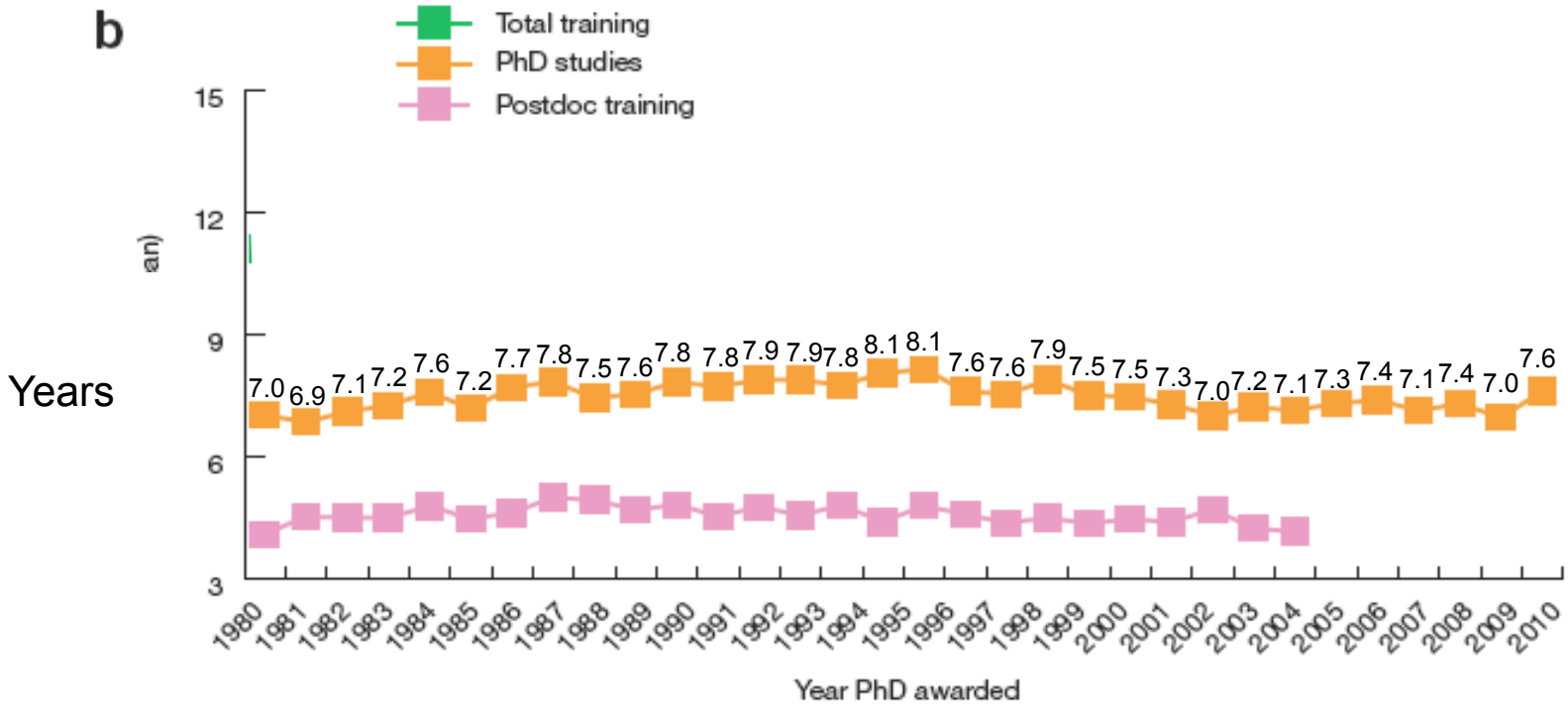


Figure 1 Trends in PhDs and postdoc training. (**a**) Trends over time in the number of biomedical PhDs awarded, number of biomedical PhDs in postdocs, and the percentage of biomedical PhDs starting their careers in postdocs. (**b**) Average number of years spent in graduate school, in postdocs, and in total training.



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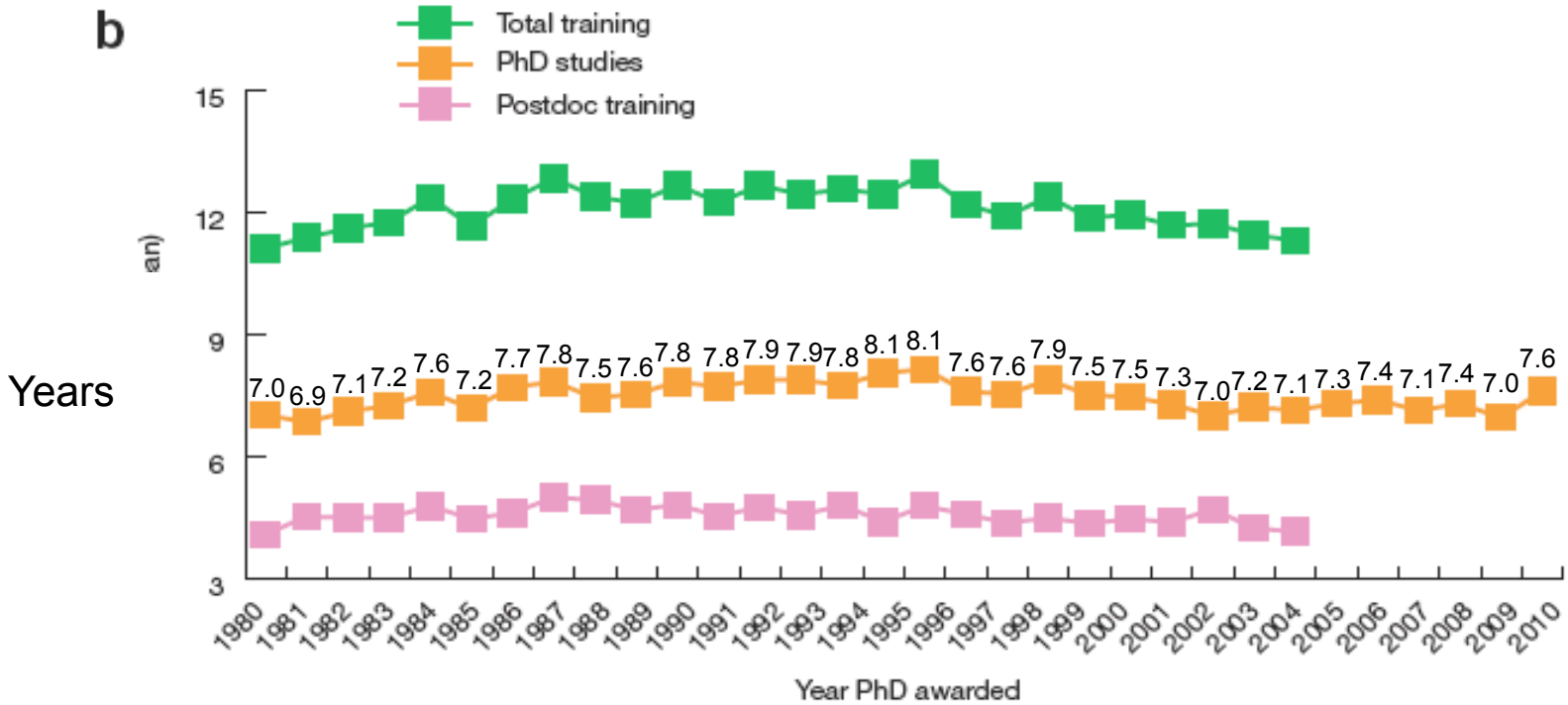

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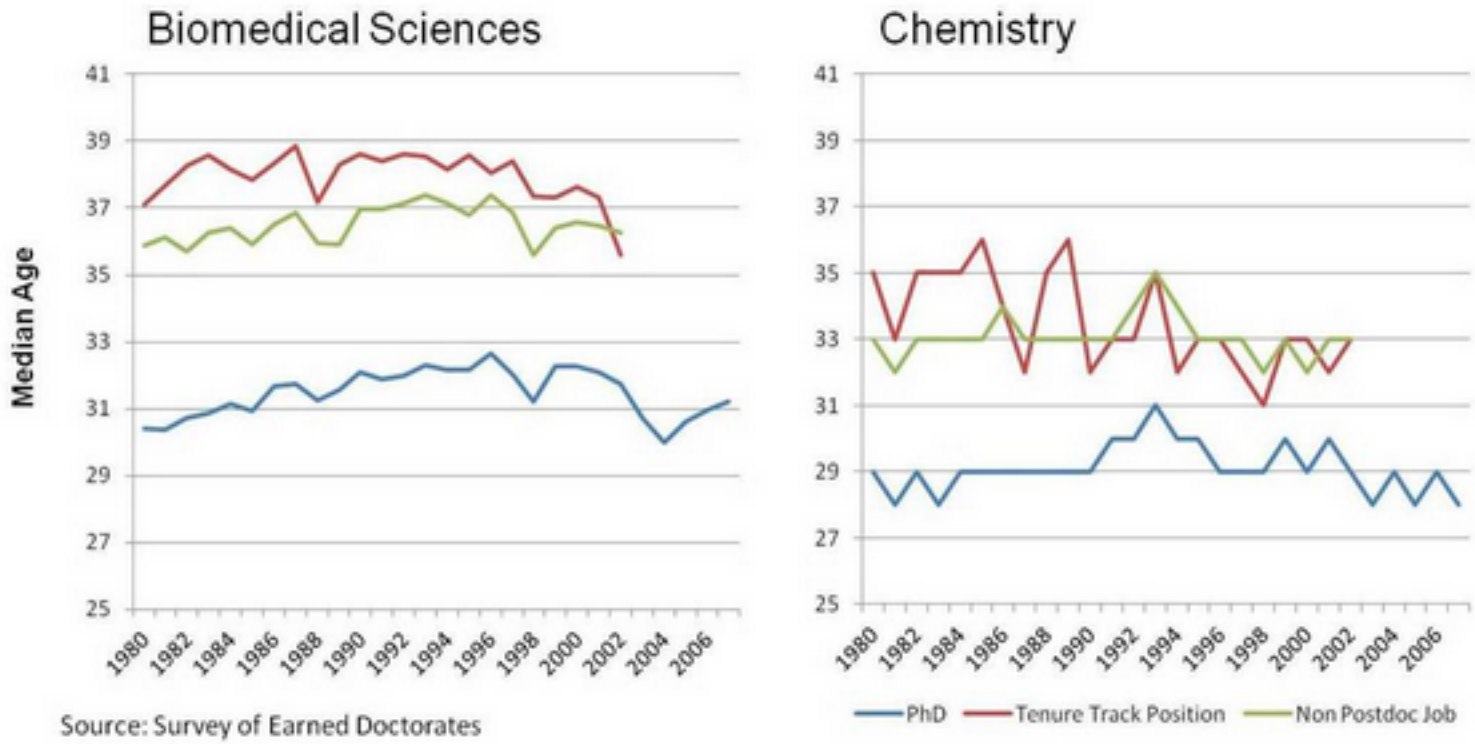
Age at First PhD, First Non Postdoctoral Job, First Tenure Track Job, for US trained Doctorates



From NIH Extramural Nexus, posted in June 2012.

See: https://nexus.od.nih.gov/all/wp-content/uploads/2012/06/postdoc_age1.jpg

Postdoc or not?

Postdoc or not?

Postdoc, University of Fribourg

Research scientist, ThermoFisher Corp.

Professor (now provost), Metropolitan University

Ph.D. student, Cal Tech

Patent law, India

Professor, Shenzhen University

Biology Librarian, Miami University, O.

Postdoc, University of Iowa

Scientist, U.S. Smokeless Tobacco Co.

Scientist, Genetech

Freelance science writer

Professor, Univ. of Idaho

MD/Ph.D. Dermatologist

Scientist, Montsanto

Staff scientist Dept. Public Health

Scientist, Abbott Labs

Research Scientist, Pasteur Institute (Korea)

Scientist, FDA

Analyst, US Government

Director of R&D, Abbott Labs.

Professor, Central College

Research Scientist, UIUC

Scientist, Venter Institute

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Scientist, Abbott Labs — No

Scientist, Montsanto — No

Professor, Univ. of Idaho — Yes

Scientist, Genetech — ~No

Postdoc, University of Iowa — Yes

Professor, Shenzhen University — No

Ph.D. student, Cal Tech

Postdoc experience is not always rewarded with $

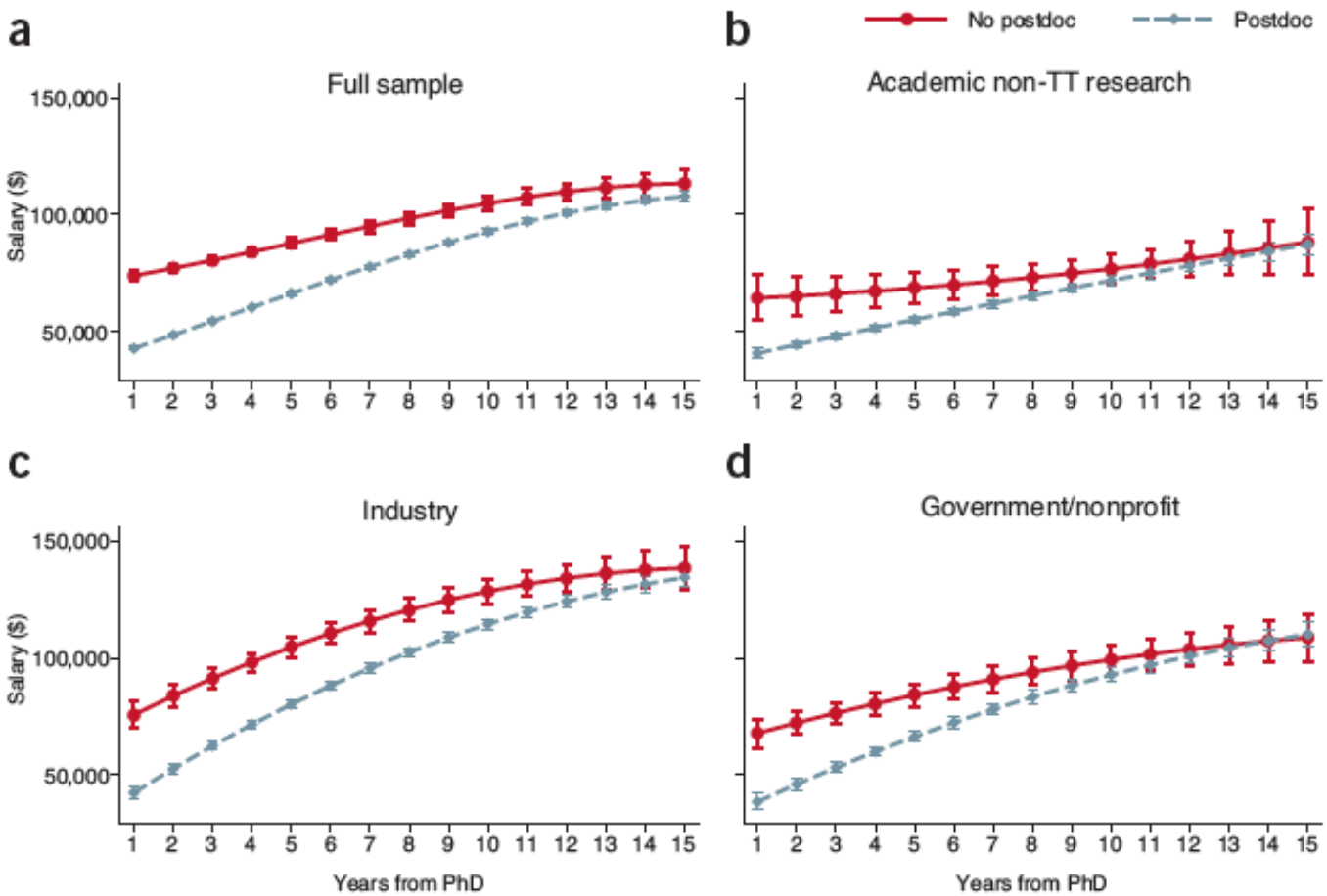


Figure 5 Predicted inflation-adjusted salary (2013 dollars) 1–15 years after PhD completion. (**a**–**d**) Salaries shown for those with and without postdoc experience by 10-year sector (**a**), academic non-TT research (**b**), industry (**c**), and government/nonprofit (**d**). Shown with 95% confidence intervals.

How do Ph.D. biology jobs differ?

Primary tasks

Research vs. non-research

Work independently or in a group

Working hours

Job security

Necessary training

Postdoc or not

Regional vs. national job search

Salary

In their own words:

Professor at a research university

Professor at a teaching college

Scientist at a large research company

Scientist at a small start-up company

Patent lawyer

A science writer

Non-bench scientist at a government agency

Professors at research institutions

The primary task is to publish original research. A secondary task is to teach classes.

Faculty also serve on committees that run the place. This can take a good amount of time.
Most faculty are at work 50+ hours each week, and they take work home, too.

Professors at research institutions

The negatives: Projects can fail through no fault of the researchers. This is stressful if you are coming up for tenure or if you are trying to get funding from federal agencies.

Competition for jobs can be fierce, with 50-100 applicants for each advertised position.

Good things: (1) Researchers choose their projects. (2) Both research and teaching benefit society.

Salaries are solid—though perhaps not as much as in industry. And tenure provides great job stability.

Amy Gort
Professor of Biology
Dean of LAS
Concordia University, MN

Ph.D. Illinois, 1998. Postdoc, Washington U., 1998-2000.

(Courses: Introductory biology, Microbiology, Genetics, Biochemistry)

"At my institution, faculty teach 6 courses a year and participate in some research. . . .
I spend 3 hours in class and the rest of my day preparing for class, grading, and in meetings.
I think you can be very successful giving 40-50 hours a week if you are focused and creative."

"Being a faculty member at a small institution is distinct from other Ph.D.-level jobs in a few ways:
(1) There is a great deal of autonomy. You have a lot of freedom to be creative in your courses.
(2) The majority of research is done while teaching undergraduates how to do research. The publications are not the main focus--the students' learning is."

Amy Gort
Professor of Biology
Dean of LAS
Concordia University, MN

"At many colleges, including mine, you need a Master's degree to be an instructor. However, you cannot be a tenure-track faculty member unless you have a Ph.D. Tenure-track faculty have much better job security. . . . In each of our job searches over the past few years, there were a large number of applicants with Ph.D. degrees, so those with Master's degrees were not among those we interviewed."

"My Ph.D. work was essential for me to learn how to teach students how to do research. My experience as a teaching assistant in grad school proved very helpful."

"Being a professor at a small college is a great and challenging job. It can be incredibly rewarding and very frustrating all in the same day. You have to love teaching and you have to love working with students."

Lauren Seaver
Senior Research Scientist
Abbott Diagnostics

Ph.D., Microbiology, 2004, Illinois

“I develop immunodiagnostic assays of clinical significance. I spend 70% of my day in the laboratory. My job may be distinct from other Ph.D.-level jobs in that I can see the direct effect of my work in improving medical diagnosis.”

“My position did require a Ph.D. My previous job [also at Abbott] was to troubleshoot on-market diagnostic assays. This let me learn the ins and outs of the development and manufacturing process. I applied for a research scientist position within the internal job posting site. Once you have a job within Abbott, you have the opportunity to move around within the company.”

Lauren Seaver
Senior Research Scientist
Abbott Diagnostics

Ph.D., Microbiology, 2004, Illinois

"The salary is not too shabby. The bad things? I don't get to choose projects. Whatever I have assigned to me I am stuck with for the year. There is always the concern that your job will be eliminated--big business seems to always be 'restructuring.'"

"Graduate school teaches you a specific skill set. More importantly, it teaches you to be a laboratory investigator of any subject. Your job function will likely change several times within a large company. You succeed by showing that you can take on any scientific challenge."

Chris Privalle
Director of Research & Development
Apex Bioscience, Inc.

Ph.D., Biochemistry, 1983, Wisconsin-Madison.
Postdoctoral fellow, 1983-1985; 1985-1993, Duke University.

"I am responsible for the science surrounding the rationale for the use of [our lead compound, a modified hemoglobin that will be used to treat shock]. I am responsible for the biochemical properties, safety, clinical trial design, and regulatory issues associated with clinical development."

"There are rarely ever two consecutive days alike. This is not a highly tiered organization replete with layers of people specializing in one specific area. Some days are spent writing/reviewing clinical protocols, filling out case report forms for patient data collection, or submitting regulatory documents with the FDA. Others days are more of a 'scientific' nature, such as trouble-shooting a manufacturing run of our compound."

Chris Privalle
Director of Research & Development
Apex Bioscience, Inc.

Ph.D., Biochemistry, 1983, Wisconsin-Madison.
Postdoctoral fellow, 1983-1985; 1985-1993, Duke University.

"A good background in biochemistry/microbiology/pharmacology or other hard sciences is essential. New courses are now being offered in biotechnology, manufacturing, and process development, which would strengthen one's training for an industrial position."

"When I was choosing between this job and one with Glaxo, my eventual boss asked me whether I wanted to be a drop of water in the ocean or be someplace where if I screwed up, the company could fail. Who could turn that down?"

Mark Roberts

Patent lawyer, Archer-Daniels-Midland Corp.

Ph.D.

"A patent lawyer is half lawyer and half scientist. My job is to be an intermediary between the scientific world of innovation and the legal world of patents. Most of the work is patent prosecution--writing patent applications and arguing for patent protection before the US patent and trademark office. I am also a lawyer and do contracts and provide legal advice on technological issues."

"One does not need Ph.D. training to be a patent lawyer. However, it is almost a necessity for practice in the more complicated areas of biotechnology, such as immunology, biochemistry, molecular biology, cancer therapy, etc. My Ph.D. training has been very useful."

"Start work as a practicing scientist for at least one year, and then go to law school and start work in a law firm. You can move from the law firm later."

Mark Roberts

Patent lawyer, Archer-Daniels-Midland Corp.

Ph.D.

“The bad things? Every patent is something new. Intense writing and reading is demanding. There is high pressure to deliver high-quality product in a short period of time. Also, there is an entrepreneurial side that some scientific types would not like.”

“Life as a patent lawyer is very rewarding for the curious mind and more lucrative on the average than being a scientist.”

Karen Hopkin

Freelance Science Writer

Ph.D., Biochemistry, 1992, Albert Einstein College of Medicine.

"I've written stuff for magazines like New Scientist and The Scientist and Science. . . anything with 'science' in any form in the title. I've written for a kid's magazine ('Muse') and I'm an author on the Alberts book, 'Essential Cell Biology.' Recently I've started doing podcasts for Scientific American. I also did a beefcake calendar ['Studmuffins of Science']."

"A Ph.D. is not necessary to do what I do. In radio a Ph.D. can be a hindrance because you run the risk of 'knowing too much'--you fail to push your guests to present things clearly. For the textbook, I'd say the Ph.D. helps. It's possible that Bruce Alberts wouldn't have considered me for the gig if I didn't have some sort of proof that I could handle the material."

"How do I get my jobs? Networking, mostly. A big part of the whole writing biz is making connections and milking them. Even though I work at home in my bathrobe, writing I think is not a job for a recluse."

Karen Hopkin

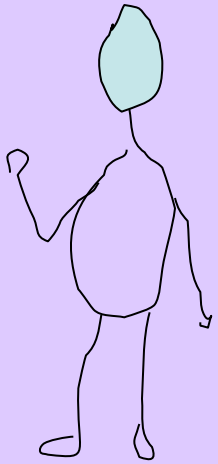
Freelance Science Writer

Ph.D., Biochemistry, 1992, Albert Einstein College of Medicine.

"[To become a science writer] I'd advise trying to write. If there's some sort of student-run publication at your university, get involved in editing, or offer to write a piece. See how you like it. [In grad school] slip away from lab one afternoon a week and intern at a publication or at a public radio station."

"Another way to ease into science writing is to apply for one of the formal science-writing programs. Some of these provide you with a Master's degree in writing. The programs often help you find internships."

"I think the best part of the job is that I continue to learn stuff. I got into science because I enjoyed seeing how biology works. Now I get to do that all the time, every day."



Jeff Kramer

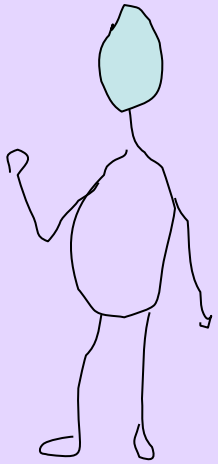
Senior Scientist, Environmental Protection Agency, Washington.

Ph.D., Biochemistry, 1987, Berkeley; Postdoc, USDA.

"Our job is to protect the public and the environment from harmful exposure to synthetic chemicals. In order to evaluate the risk from pesticides, EPA reviews data on the hazard of potential exposures. My job is to evaluate data on the levels of pesticides in food and to perform a risk assessment in order to characterize the risks. Others in the Agency will use this assessment to decide whether to approve use of the pesticide."

"Most of my day is spent at the computer evaluating data & writing reports. This job is ideal for a scientist who really likes interpreting data but doesn't like the bench as much."

"A Ph.D. is not required. Many new hires come directly from undergrad. However, having a Ph.D. is a big plus for moving up into senior non-managerial positions."



Jeff Kramer

Senior Scientist, Environmental Protection Agency, Washington.

Ph.D., Biochemistry, 1987, Berkeley; Postdoc, USDA.

“[To prepare for this job] have a strong background in analytical chemistry and bio- and/or organic chemistry. Have strong scientific writing skills, and have good grades. In terms of getting hired, the best way is through a job fair. Try applying to several different agencies (EPA, FDA, USDA, Patent and Trade). Most of the regulatory jobs are in the DC area, but there are also opportunities in regional offices around the country.“

“The best thing is the people--we have a great work environment. The nature of the work allows me to have a regular schedule, work independently, and telecommute part of the week. The government is a good place to work because of job security. (Downsizing? Ha, ha!)”

A take-home message. . . .

When people start grad school, most do not foresee their ultimate career.

Questions? Want to contact these people? jimlay@illinois.edu.

Amy Cheng Vollmer - Swarthmore College, Swarthmore, PA (11/11/16)

Scott Brun - AbbVie Ventures, Chicago, IL (5/4/17)

Tom Hannan - Fimbrion Therapeutics (Biotech Start-up), St. Louis, MO (12/18/17)

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Abby Stayart - U Chicago, MyChoice Program (5/7/18)

Ran Chao - LifeFoundry (Research Park, UIUC) (5/11/18)

Industry 7
Research university faculty. . 2
Small-college faculty. 2
Non-tenure track university. . 3
Public agency. 4
Patent law 1
Science librarian 1
Science writer. 1
MD. 1

Kevin Messner
Academic science librarian
Miami University, Ohio

Ph.D., Microbiology, 2003, Illinois
Master's, LIS, 2002, Illinois.

"It's a jack-of-all-trades profession--I help students and researchers find and manage the literature they need; manage journals and software; teach workshops on using literature databases, software, and web design; and do some research [in information technology]. The job is a little sociology, a little computer science, a little bioinformatics, a little bibliometrics. Many of our librarians are as much IT workers as 'bookworms'."

"Science librarians with doctorates are the exception, not the rule. The job posting for my current position required a Master's in biology, as well as one in library/information science. . . . It's not rare, though. The doctorate is certainly useful--for example, I have good command of all the molecular databases. I speak the language chemists and biologists use, so they don't have to dumb down questions. Frankly, I also command a higher salary than most librarians."

Kevin Messner
Academic science librarian
Miami University, Ohio

Ph.D., Microbiology, 2003, Illinois
Master's, LIS, 2002, Illinois.

"Contrary to most people's perceptions of librarians, the work is not the same old thing every day. You never know what else is going to come up in a day while your juggling the six things you expected to be working on. My job is a nice mix of science, educator, and management skills."

"When I started library school I actually expected I'd work as an information specialist for a pharmaceutical company or law firm. Going the academic route was pretty much just because they were the jobs that came along first."

"[If you might be interested,] volunteer or work in a library while in school, e.g., get involved in a special project where you'll work with librarians/information specialists to get a feel for the work. Take all the computer science you can. That is increasingly the direction of the field and where all the real innovation is happening."

Beth Fatland-Bloom

Research scientist, Archer-Daniels-Midland Corp.

Ph.D., Plant Physiology and Molecular Biology.

"We engineer [microbes] to produce more product more efficiently. My responsibilities include designing strategy for strain improvement, testing those strategies in the lab, coordinating sub-projects with two technicians, and managing intellectual property."

"This position is distinct from academic jobs in that we start at point A and need to reach point Q as quickly as possible. We do not take the time to pursue more 'academic' queries of interest unless they directly relate to our goals."

"My position requires Ph.D. training. In order to develop, manage, and drive a project forward, critical thinking, creativity, organization, and the ability to manage time are essential skills. Ph.D. candidates drive their own dissertation projects which allow the development of these skills above and beyond the levels of a Master's degree."

Beth Fatland-Bloom

Research scientist, Archer-Daniels-Midland Corp.

Ph.D., Plant Physiology and Molecular Biology.

“Use your elective credits to take a wide breadth of classes in varied fields. You never know what you will be working on.”

“The bad things? We rarely pursue peer-reviewed publication of our work. Occasionally, we scientists are unable to convince the business units to fund projects we deem worthwhile.”

“Keep in mind that at a company, business goals and thus research pursuits can change abruptly, no matter how good progress has been. Flexibility in a business environment is a necessity.”