Journal Pre-proof

From bench to board-side: Academic teaching careers

Edward A. Freeman, Nicole A. Theodosiou, William J. Anderson

PII: S0012-1606(19)30590-1

DOI: https://doi.org/10.1016/j.ydbio.2019.10.032

Reference: YDBIO 8151

To appear in: *Developmental Biology*

Received Date: 10 October 2019

Revised Date: 29 October 2019

Accepted Date: 29 October 2019

Please cite this article as: Freeman, E.A., Theodosiou, N.A., Anderson, W.J., From bench to board-side: Academic teaching careers, *Developmental Biology* (2019), doi: https://doi.org/10.1016/j.ydbio.2019.10.032.

From Bench to Board-side: Academic Teaching Careers

Edward A. Freeman[a,*], Nicole A. Theodosiou[b,*,†], William J. Anderson[c]

[a*]St. John Fisher College, 3690 East Avenue, Rochester, NY 14618 USA efreeman@sjfc.edu
[b*†]Union College, 807 Union Street, Schenectady, NY 12308 USA theodosn@union.edu
[c]Harvard University, 7 Divinity Avenue, Cambridge, MA 02138 USA
william_anderson@harvard.edu

[*]These authors contributed equally to this work

[†]Corresponding Author
theodosn@union.edu
Phone: 1-518-388-8791

Keywords

teaching, career, PUI, R1, academia, DBER, liberal arts

Abstract

Teaching positions provide a rewarding career pathway for Ph.D.s wishing to stay in academia outside of the research-focused position. The balance of teaching and research expectations on faculty can vary greatly depending on the type of institution. Faculty at primarily undergraduate institutions may be required to be research active and mentor undergraduates in the laboratory, while teaching faculty at a research-centered university may not have a research lab. In addition, faculty are expected to actively contribute to the shared governance of the institution, in the name of service. The career in teaching has become highly competitive and offers unexpected rewards and benefits. Considered here are the differences found among teaching positions to serve as a guide when considering teaching as a career option. We include our personal career narratives to illustrate the driving forces that led each of us to this challenging yet fulfilling academic path.

Introduction

The trajectory from trainee to academic may take many paths, and the path that serves to educate the next generation of scientists has an array of opportunities. In 2016, there were a total of 4,583 Title IV degree-granting institutions: 3,004 4-year institutions including liberal arts colleges and public or private universities, and 1,579 2-year or community colleges (Department of Education, 2019). Among the 4-year institutions, 770 are exclusively undergraduate 4-year colleges (Carnegie Classifications, 2018). While once considered a default pathway to the R1 institutions (Research 1, or Doctoral universities with very high research activity), the teaching faculty has become a revered and competitive position in academia.

The types of teaching positions vary by the kind of institution and the structure of the job description. The typical primarily undergraduate institution (PUI) requires faculty to run a research lab with undergraduates and maintain a substantial teaching load. Teaching faculty embedded in larger universities including the R1 may have no requirement to remain research active. Thus, the balance of teaching versus research expectations can differ greatly.

In addition to teaching and research, academic teaching positions have at least one other area where a great deal of time and energy can be spent–service. Service is particularly important to smaller institutions in which the faculty take an active part in the running and decision making within the institution, also known as self or shared governance. There are different levels of service: to the department, the institution, and the disciplinary profession (Table 1). Service expectations reflect the culture of an institution and can be a valuable way of contributing to the greater good and preserving the values of the community.

	Department	**Institution**	**Professional**
Types of Activities	Advising majors Curriculum assessment Curriculum development Student recruitment Seminar series coordinator Hiring committees Local outreach	Curriculum revisions Accreditation reports School governance Committee service: • Tenure & promotions • Curriculum & instruction • Budgeting & oversight • Governance • Board of Trustees • Facilities • Library • IT	Manuscript review External review of departments/programs at other institutions External review of tenure and promotions Local outreach events Hosting regional conferences Membership to professional societies Poster judging at national meetings

Table 1. The types of service activities integral to the expectations of teaching faculty.

Here we shed light on the unique teaching faculty positions at the PUI and R1. Taken into account are the expectations on teaching faculty and how these expectations should be considered in the context of tenure and promotions, when applicable. Tips are given to help identify how to evaluate the right academic environment for a job candidate. Finally, we share our personal journeys of how we each discovered our love of teaching and arrived at our current positions.

Teaching at a Primarily Undergraduate Institution

The experience of working at a PUI is variable depending on the institution's expectations of *teaching*, *research*, and *service*. At the extremes are institutions that emphasize teaching by having heavy teaching loads with lower expectations on research. Others may provide support for teaching through teaching assistants (TAs) or laboratory instructors, and give emphasis to research productivity, including both the ability to publish at a high rate and acquire outside funding. In addition to teaching and research responsibilities, many PUIs have a self-governing faculty body, which means that faculty are expected to serve on a variety of

committees and play an active part in developing and implementing institutional policies (Table 1). While every PUI will have its own unique requirements of its faculty, the common thread among them all is the priority of teaching undergraduates at all levels of the curriculum. How an institution values and prioritizes teaching, research, and service is built into the ethos of a faculty's daily activities and is the framework from which faculty are reviewed for promotions.

Trainees interested in a position at a PUI should gain a clear sense of what an institution expects from its faculty prior to applying for or accepting a position. Important to determine is if the institution's expectations of research specifically are reasonable given the infrastructure, support and teaching load. For a college that expects a high number of publications and an NSF or NIH grant prior to tenure review, it is important to know what the teaching load is and if there are lab instructors or technicians responsible for teaching and/or setting up the teaching labs. Other time-saving support for teaching is the availability of TAs for grading lab notebooks and lab reports.

Equally important with the variety of PUIs to consider is how to determine what type of institution is best suited to the candidate and where they see themselves thriving. The following questions may help someone ascertain the type PUI best suited for them. These questions may also be useful for telephone and/or on-campus interviews to determine the character of an institution.

Questions for PUIs regarding *teaching*:

- How many courses does a faculty member teach per term and per year?
- What level(s) of the curriculum is the position expected to teach?
- What is the balance of the teaching load in terms of lecture or laboratory instruction?
- What are the expectations for team teaching or teaching in interdisciplinary programs?
- What is the culture of sharing existing departmental teaching resources for multi-section courses?
- What are the opportunities or expectations for teaching students outside the major?
- How often are courses in one's area of expertise offered?
- How often will new course development be expected?

Questions for PUIs regarding *research:*

- What shared equipment exists in the department and does it meet your research needs?
- What is the average start-up funding for a new faculty?
- What are the expectations for promotion in seeking external funding and at what level?
- What is the track record of current faculty in seeking funding?
- What opportunities are there to advise graduate students?
- What is the expectation that undergraduates participate in your research?
- What is the publication expectation for tenure and promotion, including undergraduates as co-authors on peer-reviewed publications?
- What support is available for meeting travel?
- What support is available to support student research: supplies, summer experience and conference travel?

In addition to teaching and research, academic positions at PUIs generally expect a significant amount of time and energy to be spent on service. Service may be an integral component of the institution's governance structure. Specific service expectations may be

considered along with the teaching and research as part of a faculty's reappointment review and can often be evidence of a colleague's "collegiality" in this respect. The commitment to service can vary depending on the activity, from an academic term to several years. When considering what area of service to contribute, finding an issue that is important to you on your campus is prudent. While service is an essential component of a career at a PUI, it can be amorphous and have a tendency to be all consuming if you allow it.

Teaching at a R1

Teaching positions can vary when comparing PUI and R1 institutions. The American Association of University Professors analyzed 2016 faculty position data from the National Center for Education Statistics. Overall, 27% of all faculty positions are tenure-track, with 73% of faculty working contingently (Flaherty, 2018; American Association of University Professors, 2018). These contingent faculty can be formalized teaching faculty (e.g., lecturers, instructors) or trainees (e.g., postdoctoral fellows, graduate student teaching assistants). Focusing on R1 institutions in particular, the division is similar; about 30% of positions are tenure track, while 70% are non-tenure track.

Teaching careers at R1 institutions historically constituted non-tenure track academic positions. In many cases, these academic appointments were term-limited and involved yearly renewals, which led to uncertainty with regards to career stability. Furthermore, there is no standardization for these types of positions across institutions. This leads to confusion for the applicant.

Terminology can also obfuscate candidates. In some cases the terms "tenure track" and "ladder" faculty are synonymous, while at other institutions "ladder" refers to a structure for promotion up the ranks in either a tenured or non-tenured position.

Some R1 institutions, like the University of California San Diego, offer tenure-track, ladder faculty positions. These usually have a title like Assistant, Associate, or Full "Teaching Professor". Candidates are expected to contribute through teaching, service, and pedagogical research. Most R1 institutions though lack tenure-track teaching positions. Harvard University, for example, has neither a tenure-track system nor a ladder system (in this context, meaning stepwise promotion, from Lecturer to Senior Lecturer, for example) for teaching faculty. Most non-tenure track positions are renewed yearly; however, in some cases, the renewal can be longer (e.g., every five years).

Non-tenure track positions can come in two flavors. In one instance, they are stand-alone full-time equivalents (FTEs; think of this as a 1.0 FTE representing a "full time job"). For some ranks (like Lecturer), there is a term limit for how many years the position can be renewed. In another case, they can be dependent on holding a staff position (carrying a 1.0 FTE) with the academic position a 0 FTE. These dependent positions can be renewed indefinitely based on satisfactory performance and curricular need so long as the candidate holds the staff position.

In terms of non-teaching activities, teaching faculty at R1 institutions engage in service in a variety of different ways. Many serve on curriculum committees for their departments, in some cases serving as the director of studies for undergraduate majors or graduate programs. Research is a clear expectation for tenure-track teaching faculty. For non-tenure track teaching faculty, while maintaining an active research program is not typically required, in some cases it is an unwritten expectation (Haviland et al., 2017).

Thoughts from the front of the class

The ability to teach effectively is a skill that takes years to hone. However, to thrive in a teaching position requires some unexpected dexterity, regardless of the type of institution you are in. While you may not need to hustle for grant funding to cover your salary, resources are limited and thus require creativity. For example, the types of research questions asked and how experiments are designed need careful consideration. Experiments need to be less technical so that undergraduates can do them, and the methods should consume fewer resources. Resources can be stretched; for example, restriction enzymes can last years beyond their expiration dates. To gain resources, experiments from an individual's lab can be folded into a course's teaching lab. This allows you to dedicate time to research and teaching simultaneously, while also opening up the department's purse to indirectly support your research. Many colleges have small pools of money to support undergraduate research over the summer and small grants for student research supplies. Thus, research at a teaching institution becomes a strategic game of shuffling resources.

Teaching also requires some unexpected interpersonal skills. Rates of anxiety are high in college students, and many times faculty are the only adults that students have proximity to. For this reason, students may confide in faculty and seek assistance in unanticipated ways. Faculty also serve to mentor and guide students to discover their interests, or to coach students away from their original intended area of study. Knowing how to talk to students when they are at their most vulnerable is challenging, and no postdoctoral position can train someone for this. At the same time, nothing is more rewarding than guiding a student and watching them come into their own over four years.

Personal Narratives

Ed Freeman *is an Associate Professor of Biology at St. John Fisher College in Rochester, NY. He received a B.S. in Biology from Ohio University, and a Ph.D. in Cell Biology and Neuroscience from the University of South Carolina School of Medicine. Following his graduate work he was a postdoc in Patricia Hunt's lab at Case Western Reserve University in the Department of Genetics. Ed has been at St. John Fisher College for 15 years and has served on the Professional Development and Education Committee for the Society for Developmental Biology for the last 5 years.*

During my graduate training I enjoyed the day to day experimentation, the freedom to think and develop ideas, contributing knowledge to my discipline, and general life in the lab. As a part of my program I was required to serve as a teaching assistant to medical students in the microanatomy laboratory. This experience shaped my future career goals as I learned that I would need to have a substantial teaching responsibility to be fulfilled in my academic work. With this recognition I began to seek out additional opportunities to gain further teaching experience. Training in a medical school provided numerous options and I quickly found myself continuing the teaching assistant work in microanatomy and adding to that work in the gross-anatomy laboratory. I worked on and off in these settings for multiple years and gained confidence in my ability to explain the material and assist students who were new to, and often squeamish about, gross anatomy. I learned that I enjoyed counseling students through their challenges with the coursework which would serve me well as I began work at a small teaching focused institution. It should be noted that I had numerous conversations about these opportunities with my PI. He agreed to allow me to take on these added responsibilities as long as I maintained my productivity in the research lab. Looking back I feel very fortunate that he understood not every PhD graduate wants to continue to work in an R1 setting and, further, that I was interested in training students, as he had done for several decades, but at an earlier time in their educational careers. These conversations were highly informative concerning my future career goals and spurred me to gain additional teaching experience during my post-doctoral training. During those years I again worked with the medical students in the anatomy labs and I also team taught in an undergraduate developmental biology course. This was a rich experience wherein I was responsible for multiple weeks of content coverage, quiz and exam preparation/grading, primary literature review, etc. with the students. Though my prior experiences showed me that I enjoyed teaching, this undergraduate team teaching experience revealed various aspects of the profession that I had not yet encountered. Specifically, classroom management, exam preparation, and working with students who more deeply wanted to understand the material through the primary literature. As already mentioned for my doctoral advisor, an open line of communication with my post-doctoral advisor was essential and allowed her to fully understand the specific types of positions that I was hoping to eventually apply for. Based on these interactions and my passion for teaching, my post-doctoral advisor assisted me in finding a short-term position at the tail end of my training. I was picked up by the anatomy department as a teaching assistant, based on all of my earlier teaching experience, a necessary move as my postdoctoral lab was moving across the country to Washington State.

When applying for teaching centered positions I was able to discuss teaching experiences at the graduate level, the undergraduate level and of course at the research bench. During my first effort to enter the job market this collection of experiences contributed to several phone interviews, multiple on-campus interviews, and three job offers at PUI specific positions. To say that I felt lucky would be an understatement. I owe the happiness I have in my career to multiple advisors that were open to alternate pathways from those that they had taken. I encourage interested students to discuss options, such as teaching and other passions they might have that lie outside of the traditional academic setting, with their faculty advisors. Those open lines of communication were instrumental to my ability to pursue full time teaching at the college level. Other resources include PUI faculty within Society for Developmental Biology (SDB). SDB has a committee, the Professional Development and Education Committee (PDEC), that offers multiple teaching related and professional development related opportunities during each of the national meetings.

Nicole Theodosiou *is an Associate Professor of Biology and Co-Director of the Biochemistry Program at Union College in Schenectady, NY. She received a B.A. in Biology from Swarthmore College, and a Ph.D. in Genetics from Yale University. After a postdoc in Cliff Tabin's lab at Harvard Medical School she was a Visiting Assistant Professor in Developmental Biology at Bowdoin College before moving to Union. She was recently appointed chair of the Professional Development and Education Committee for the Society for Developmental Biology.*

A brown, unmarked box sits on my office shelf. Inside are note cards, scraps of paper, and printed emails from past students. "I cannot express enough how grateful I am to have had the opportunity to take your classes. You sparked my interest and curiosity. which further motivated me to pursue graduate school." "All this rambling is to say that I couldn't be where I am today without your support and guidance, so thank you so so much." "You are a great professor!"

Reflecting on these acknowledgements of my classroom successes allow me to realize that this is the area within science where I find the most positive affirmation. An academic position at a liberal arts college is not all rosy, but the hours spent preparing for lectures, holding office hours, and doing college service are all worth the contents of my brown box. I wouldn't trade this box for a career of grant writing and pushing publications. Knowing that I am helping to shape a new generation who may not go into science, but who appreciate my mentorship, teaching, and understands the scientific process keeps me motivated and striving to be a better version of myself. My undergrads make me a better teacher-scientist.

My journey from bench to board was not planned. Unlike my roommate at Swarthmore College who always knew she wanted to be a college professor, I did not plan for this. My journey is one of a two career couple struggling with the back and forth of whose turn it was to advance their career. Add starting a family into the mix and the negotiations make the G20 summit look easy. I was in the middle of a postdoc in Cliff Tabin's lab, 9 months pregnant with my first child when my husband opted to put Maine Medical Center as his first choice for pulmonary fellowship. I was on maternity leave when he matched in Portland. Facing the choice to stay in Boston with my newborn versus going to Maine was heart-wrenching. Commuting from Portland to Boston was out of the question for my idea of a family. Walking into Cliff's office to talk to him felt like I was holding up a white flag that read 'I give up (on research science)', even though now I know that wasn't true. Cliff was disappointed but also

understanding, encouraging and supportive. When I returned from maternity leave, someone had placed a note on my lab bench with a cut-out ad from Science magazine "Visiting Assistant Research Professor, Bowdoin College". The application date had passed, but I picked up the phone and called. Within 2 days I had written and submitted my materials, by 2 weeks I had an interview and a few months later we were moving to Maine and I would start my first faculty position.

At Bowdoin I was surrounded by bright students who were excited by science. I found their excitement infectious. As I wrestled to put together lectures and teach students how to do PCR reactions, the energy emanating from them kept me motivated. When I started my lab, students asked great questions and it was their interest in evo-devo that moved my research into a new direction that has continued to be the focus of my lab a decade later. I found fulfillment in mentoring students in both lab and classroom, discovered the synergy between the two, and realized for the first time that I wanted to be a teacher-scholar.

The 4-year visitor position afforded me unexpected benefits. In that time, I honed a developmental biology curriculum, built a lab and independent research program, and had my second child all off the tenure clock. In retrospect it was a gift, though in the craze of the experience I didn't realize it at the time. When I did go on the job market for a tenure track position, I felt emboldened. I had a job packet that essentially read 'I've done it all already, I will be successful at your institution.' My packet was primed with teaching evaluations to prove my effectiveness as a teacher, letters from research students regarding mentorship, publications with undergraduate co-authors, and I had two toddlers which could be interpreted as 'my breeding years are over.' I was lucky to choose an institution and department that I felt was the best fit for me.

This was all very hard. My spouse was happily settled now as an attending physician in Maine and it was my turn to move the family for my career. Just as I had a few years earlier, he wrestled with the realization that he was moveable and a *captive spouse*. That dynamic had the biggest toll on our relationship, but we worked through it and over time learned how to support each other in our personal career paths.

I've been at Union College for 12 years. I have an active research lab with 2-6 undergrads in any given semester. Research progress is slow as a whole, and it is hard to get a publishable unit when your lab members are just learning to pipet and may only work with you for a short six months. The expectations for publishing have also become a very high bar to reach. When I got my Ph.D., I could clone a gene, characterize the mutant phenotype, show epistasis with a known signaling pathway and get published in a top tier journal (Theodosiou et al., 1999). This type of science has been moved to the endless supplemental materials section, and replaced by transcriptome analyses. I confess that the time consumed by training students in the lab, teaching and limited resources renders the research I do 'small scale.'

The flip side is that I have the freedom to pursue scientific questions that fascinate me and my students without the pressures of publishing papers and grants. I focus on helping my students find what they are good at and assist them in discovering career options best suited for them. In teaching, I contribute to all levels of the curriculum, from introductory courses to an upper level course in developmental biology and a seminar in evolution and development. Outside the introductory courses, I have complete freedom in course content and pedagogy – and I've explored and developed my own way of teaching (Theodosiou, TEDx). The liberal arts college setting allows the freedom and encourages faculty to pursue other interests as well. I have taught a class called *Illustrated Organism* with a colleague in the studio arts department,

and a course on *Food, Culture and the Land* with a classicist. My college has extensive offerings in terms abroad, and I have been fortunate to direct two terms in Australia, taking my children with me all on the college's expense. While resources may be more limited at the small liberal arts colleges, the benefits can be broad and unexpected.

The liberal arts college environment has allowed me to realize other interests and talents, and to effect real change at the institutional level. After a power failure pre-tenure in which I lost all my reagents and ongoing experiments in my freezers, I became personally invested in advocating for better infrastructure. That eventually led me to chair the space committee and present to the Board of Trustees the need for a new Science and Engineering Complex. We are now at the end of building a new $100 million Integrated Science and Engineering Complex. With half the building open, already I have seen an increase in student-faculty research activity. While service can be an unexpected part of the job, being an active part of solutions makes you realize you can have a big impact. The key is finding those things that you are passionate about and dedicate your service in those areas.

In my brown box, a note from a student reads "I just wanted to say thank you for inspiring me so much and equipping me with a set of knowledge and skills from which I will benefit for years to come." As a teacher-scientist at a liberal arts college, I feel that note could just as easily have been from me to my students.

Bill Anderson *is Senior Lecturer on Stem Cell and Regenerative Biology and Associate Director of Education in the Department of Stem Cell and Regenerative Biology at Harvard University. He received a B.A. and M.S. in Biology from Rutgers University, and a A.M. and Ph.D. in Biochemistry from Harvard University. After remaining in Doug Melton's lab at Harvard for a brief postdoc, he was a Visiting Assistant Professor of Biology at Swarthmore College before returning to Harvard. He is a former chair of the Professional Development and Education Committee for the Society for Development Biology.*

As a child, I always thought I would grow up to be a physician and follow in the footsteps of my uncle, who I deeply admire. Dan Lipinski's biology class in high school fostered my love for science. I attended Rutgers University for my undergraduate degree, majoring in biology. After watching an eye surgery on television one day, I realized that medicine might not

be the career for me. I went to talk with the department chair, Hsin-yi Lee, about careers in academia. I was fortunate that he took an interest in me and helped me find a position in a research lab in the department. I had the pleasure of working first with Corey Nislow and then Bob Nagele as an undergraduate. I stayed in Bob's lab for my MS before coming to Harvard to work with Doug Melton for my PhD. I served as a teaching assistant during both my MS and PhD, and quickly realized that I very much enjoyed teaching. Doug was kind enough to let me pursue that passion while a graduate student.

When I was wrapping up my doctoral thesis, I realized that I wanted to pursue a career that heavily involved teaching. While Doug was able to advise on tenure-track positions at R1 universities, he was less familiar with life at small liberal arts colleges. Being a great mentor though, he suggested that I reach out to Scott Gilbert at Swarthmore College. I did not know Scott at all personally aside from his reputation as the author of the "Bible for Developmental Biology". I took a chance and emailed him. Much to my surprise and delight, he replied quickly and offered to chat with me. As it turned out, he was planning a sabbatical the following year. Swarthmore has a generous leave policy and hires Visiting Assistant Professors to cover key courses normally taught by faculty on leave. I decided to apply for the position and luckily I was offered the job. I taught a course each semester and ran a research lab. My year at Swarthmore was filled with bright students, wonderful faculty colleagues, and extremely helpful staff.

During the year I was at Swarthmore, Harvard started the first cross-school department (Stem Cell and Regenerative Biology; HSCRB) in its history, sitting in both the Faculty of Arts and Sciences and the Medical School. The department wished to establish an undergraduate and graduate educational program, and so I returned to Harvard after my year at Swarthmore to lead those efforts. Planning a brand-new curriculum excited me. I also made it a goal to bring a small liberal arts feel to a large research university. Swarthmore's emphasis on personalized advising, a strong sense of community, and inquiry-based labs all carried over to my department.

My current position consists of both a staff and academic appointment. What I found most engaging in HSCRB is the potential for growth. Since I started in the role, we have engaged more fully in medical education and started a new joint degree program with the Business School. Importantly, the culture in my department values teaching and so I am lucky to be treated as a valued colleague. Never once have I felt less than the tenure-track faculty; I am fortunate to work with genuinely good people.

My advice for those interested in pursuing a career in teaching at a R1 institution is:

- Don't be shy. Reach out to those with positions similar to what you wish to obtain. If I had not done so, I might have missed the opportunity to teach at Swarthmore.
- Find good mentors. I have been very fortunate throughout my education and career to have wonderful mentors. Bob Nagele, Doug Melton, and Scott Gilbert in particular have been very good to me. Bob and Doug not only taught be how to be a good scientist, but also some of the soft skills necessary to do well in academia. Scott had no formal "obligation" to me whatsoever, as I was not his trainee, yet he has always been generous with his time and advice whenever I have needed it, both when I was at Swarthmore and afterward.
- Obtain as much teaching experience as you can. It would be ideal if you had an opportunity to teach your own course, say at a community college or through an extension school. These opportunities can be difficult to obtain. Serving as a teaching assistant for a course is also very useful.

- Connect with resources at your institution that advise on pedagogy. In particular, become familiar with the importance of active learning in the classroom.
- Try to get a sense as to how education is valued in the department you wish to apply. Whether entering a tenure-track or non-tenure track position, you want to ensure that you will be supported by your colleagues and valued for your work.
- Stay on top of the science education literature. This will allow you to teach your students using the most effective, evidence-based methods to enrich their learning.
- Consider delving into educational research. It serves many purposes – for example, it will allow you to contribute to the literature, demonstrate to your colleagues that you take your role as an educator seriously, and most importantly it is a lot of fun. You could share active learning activities in the online journal *CourseSource* (https://www.coursesource.org), or publish a research study in a journal like *CBE-Life Sciences Education* (https://www.lifescied.org).

Acknowledgements

We thank our significant mentors who guided us through our careers. NT thanks Scott Gilbert, Cliff Tabin, her colleagues at Union College, and current and past undergraduate students for supporting her through transitions and lighting the path forward. EF thanks Fritz Hagerman, Clarke Millette, Scott Simpson and Patricia Hunt, and all of the students he has had the pleasure to work with and to learn from. WJA thanks Corey Nislow, Bob Nagele, Hsin-yi Lee, Doug Melton, Scott Gilbert, Kathryn Link, Willy Lensch, Heather Rooke, the entire HSCRB faculty, and all his former students for the impact they have had on his career.

References

American Association of University Professors. (2018) Data snapshot: contingent faculty in US Higher Ed https://www.aaup.org/sites/default/files/10112018%20Data%20Snapshot%20Tenure.pdf

Anderson, S. (2019) Make science PhDs more than just a training path for academia. *Nature* 573:299-300. *doi: 10.1038/d41586-019-02586-5*

Carnegie Classification of Institutions of Higher Education. (2018) 2018 Update Facts & Figures. http://carnegieclassifications.iu.edu/index.php

Flaherty C. (2018) A non-tenure track profession? *Inside Higher Ed* https://www.insidehighered.com/news/2018/10/12/about-three-quarters-all-faculty-positions-are-tenure-track-according-new-aaup

Haviland D, Alleman NF, Allen CC. (2017) 'Separate but not quite equal': collegiality experiences of full-time non-tenure-track faculty members. *J. High. Educ.*88(4): 505-528. doi: 10.1080/00221546.2016.1272321

Theodosiou, NA, Hall, DA, and Jowdry, AL. (2007). Comparison of acid mucin goblet cell distribution and *Hox13* expression patterns in the developing vertebrate digestive tract. *Journal of Experimental Zoology PartB* 308B(4):442-453.

Theodosiou, N. (2018) My EvoDevo Teaching Story, TEDx Union College. Available at https://www.youtube.com/watch?v=jpCH2fwbGiw

U.S. Department of Education, National Center for Education Statistics. (2019). *Digest of Education Statistics, 2017* (NCES 2018-070), Chapter 2. Available at https://nces.ed.gov/fastfacts/display.asp?id=84

From Bench to Board-side: Academic Teaching Careers
DEVELOPMENTALBIOLOGY_2019_399

Highlights

- Teaching positions are revered and competitive, and available at primarily undergraduate institutions as well as research-centered universities.
- Teaching positions have different expectations for promotion, and balance teaching and research differently depending on the institution and the job description.
- In addition to teaching and research responsibilities, service to the department and institution can be a significant expectation of the position.
- Candidates should consider different factors when determining whether a PUI or R1 is the better work environment for them.
- Teaching positions require creative use of resources and interpersonal skills, and unexpected rewards and benefits.
- Provide narratives of three different careers at different institutions to illustrate the variety of teaching positions available.