Careers in Virology: Teaching at a Primarily Undergraduate Institution

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A faculty position at a primarily undergraduate institution requires working with undergraduates in both the classroom and the research lab. Graduate students and postdoctoral fellows who are interested in such a career should understand that faculty at these institutions need to teach broadly and devise research questions that can be addressed safely and with limited resources compared to a research I university. Aspects of, and ways to prepare for, this career will be reviewed herein.

Graduate and postdoctoral studies typically occur at large research universities, allowing for those involved in these pursuits to learn that design, execution, and publication of high-quality research is critical for those who seek a job as a principal investigator (PI) at a research I institution. However, many graduate students and postdocs seek other careers. Recently, a Journal of Virology Gem reviewed a way to gain exposure to a career in public health (1). Here, I will review aspects of a career at primarily undergraduate institutions (PUIs), with a focus on small liberal-arts colleges (SLACs), and describe preparation for such a career requiring excellence in both teaching and research.

Types of PUIs. By definition, PUIs are institutions in which most, or all, enrolled students are undergraduates. Small regional universities may be considered PUIs if there are very few M.S. and/or Ph.D. students at the institution; SLACs usually have only undergraduates. Community colleges feature 2- and/or 4-year undergraduate programs; typically, no bench research is performed at these institutions. Therefore, this career may be of interest to those who wish mainly to teach (and leave the benchside), yet community college faculty often perform pedagogical research. In contrast, faculty at SLACs must be skilled at both teaching and research (bench, and sometimes also pedagogical, research). A frame of reference for the teaching-research balance can be found by surveying SLAC rankings in U.S. News and World Report; the higher the ranking of the institution, usually the less teaching is required, but higher-research expectations exist. A major institutional goal of SLACs is to educate undergraduates and to prepare them for their future careers. It might be surprising to learn that many SLAC biology students do not go on to medical or graduate school but instead attend dental, nursing, or veterinary school, train as a physician assistant, genetic counselor, or physical therapist, go into public health, seek to teach high school, or earn a law or business degree. Therefore, a SLAC faculty member needs to be able and willing to educate students with varied future interests and goals. While SLAC graduates pursue many directions after graduation, it might be surprising to learn that the percentage of undergraduates who attend a SLAC and go on to complete science and engineering Ph.D. degrees is higher than the percentage of those who attend major research universities (2, 3), so faculty at SLACs indeed are responsible for training future research scientists.

Job requirements at a PUI. Teaching is the main responsibility for faculty at a SLAC. When considering teaching, research, and service, especially in terms of preparing for tenure, the division of effort usually is about 50% teaching, 40% research, and 10% service, but the importance of research and the expectation for achievement (peer-reviewed publications and/or acquisition of extramural funding) have started to increase at some of the top-ranked SLACs to the point that teaching and research are equally important. Typically, one should expect to spend 6 to 12 contact hours (lecture and/or lab) per week teaching students (this depends on the teaching load of the institution); as alluded to above, the lower the teaching load, the greater the expectation in terms of achievement in the research lab. Note that the 6 to 12 contact hours per week does not include time for lecture prep, lab prep, grading, office hours, working with undergraduates in the research lab, etc. In terms of teaching, faculty need to be able to teach broadly; this includes teaching science distribution requirement courses for nonmajors and/or first-year seminars (the latter may have no connection to biology or science and typically stress writing development), introductory-level courses for potential majors (which also may have nonmajors enrolled), and upper-level courses. It is common for most or all science classes to feature a lab component that is taught by the faculty member, and laboratories should not be “cookbook” activities but have a discovery component, using current methods to address research questions (4). One must be willing and able to teach broadly at the upper level. A virologist may teach a virology course but likely also will teach one or more of the following, depending on the needs of the department: cell biology, immunology, genetics, microbiology, biochemistry, and molecular biology. As noted below, virologists typically are plastic in their ability to teach broadly because of the breadth of areas within and approaches to studying virology, which may be advantageous when applying for jobs.

Research at a PUI. It should be evident that experimentation on viruses requiring biosafety level 3 or 4 containment is not possible at a SLAC. Working with tissue culture systems or mouse models may be possible, but not all SLACs have animal facilities,
and both of these systems are expensive. Grants from the NIH (R15 AREA) and NSF (RUI) to support research are available specifically for PUI faculty but are highly competitive. The bottom line is that one must consider safety and cost for a research program at a SLAC, and it is important to understand that a faculty member needs to teach undergraduates how to perform lab work safely and competently. It may seem challenging to teach students how to work in the lab when those students likely have not yet done so, but enthusiastic undergraduates quickly can learn to design and perform well-controlled experiments, interpret data, design the next experiment, etc. Talented students can help mentor younger/new students in the lab, which can reduce the time that the faculty member needs to teach students in the lab. Since the lab is not composed of a large team of graduate students, postdoctoral fellows, and research technicians, the pace of research is notably slower than in a research university lab. For example, during a semester, a student typically works in the lab 8 to 10 h per week, and summer (full-time) research typically lasts for 8 to 10 weeks. In other words, the manpower for a single undergraduate who works in the lab for a summer and two semesters approximates 8 to 12 weeks of lab time for a graduate student or postdoctoral fellow, so you should avoid competing with research I labs on your research question. Therefore, developing an easily performed niche project that still addresses an interesting or fundamental question is of the utmost importance for a SLAC lab. Help can come via well-planned collaborations with research labs, but the SLAC faculty member must contribute in a meaningful manner and/or take a lead role in the collaboration, as having a level of independence and/or leadership in the research program is expected as part of assessment for tenure. Planning your SLAC lab research is something to do early during your postdoctoral fellowship or, if you are currently a graduate student, is something to consider as you seek postdoctoral fellowships.

One thing that often is overlooked in terms of research at SLACs is that the cost structure is different than at a research I university. While start-up funds at a SLAC are quite modest in comparison to what colleagues can get at research I universities, they can go a long way and be spent mainly on consumables and reagents, as opposed to renovations, salaries, and costs associated with core facilities. SLAC faculty members share expensive equipment to keep costs down. Students who work in the lab during the semester typically do so for academic credit (not for pay). During the summer, financial support for student stipends often comes from institutional funds and/or any extramural funding that you obtain.

Gaining teaching experience. SLAC faculty understand that applicants coming from a research I university likely are not going to have years of teaching experience, as graduate and postdoctoral training is mainly research focused. However, ideally, one should develop a teaching trajectory during the course of graduate and postdoctoral training. While postdoctoral research is not absolutely required to get a SLAC job, at the best SLACs, it is expected and one should consider that since many job applicants have postdoctoral experience, graduate students often are not as competitive for SLAC positions since they simply have less total accumulated experience. For example, postdoctoral training provides many advantages with regard to research: (i) development of more (and perhaps broader) research experience, (ii) opportunities to secure extramural funding (success in this area suggests that you could do so again while at a SLAC), (iii) additional development in writing (grants and manuscripts [at SLACs, faculty spend a lot of time teaching discipline-specific writing]), and (iv) adding to your publication record. In terms of teaching, it allows one more time to gain more teaching experience or start to do so if none (or little) was acquired during graduate school. While doing graduate and/or postdoctoral research, there are several ways to get teaching experience, but one should work carefully with the PI to clarify that research efforts will be maintained while teaching. In fact, it is wise to be up front with PIs about your interest in teaching; finding a supportive mentor in this regard can be quite helpful as you develop your teaching skills as well as (especially for postdocs) planning a suitable research project for your future SLAC job. Teaching opportunities might be found at your research I university: you could be a teaching assistant (TA) for an undergraduate (or perhaps even a dental, vet, or medical school) lab or course. Graduate students are often TAs as part of their degree program, but consider doing additional TA work if available and possible. You might be able to give some lectures within a preexisting course (perhaps your PI, or another PI in your department, would be able and willing to let you fill in while he or she needs to attend a conference or study section). There may be a nearby SLAC or community college in which you could teach some virology (some bacteriologists who teach microbiology are a bit uncomfortable with having to teach virology, and you could help with your field-specific expertise) or serve as an adjunct to teach an entire course. Electing to work with undergraduates in your research lab will help you learn how to teach and mentor students regarding research, which is good preparation for a career at a SLAC. Although scientific outreach is not the same as teaching an undergraduate course, such efforts at local schools or science centers are evidence of your interest in education.

There are opportunities that allow for dedicated time for teaching; these can be pursued before or after a research-based postdoctoral fellowship. SLAC faculty can take periodic research sabbaticals; therefore, “sabbatical replacements” are hired for a semester or year to substitute for the faculty member taking leave. These positions therefore allow one to gain focused teaching experience and receive mentoring from the current SLAC faculty (time permitting, working with one or two undergraduates in the lab also may be possible). A few SLAC faculty members with NIH/NSF grants have funding for a postdoctoral fellow; these fellows do research and mentor students in the SLAC faculty member’s lab and also may do some teaching. Ultimately, acquiring teaching experience is important to help you gain experience that you can bring to a SLAC job but also to help you determine if this is an activity that you enjoy and wish to do as a major element of your future career. Multiple teaching opportunities over time provide breadth in teaching experiences, activities, and responsibilities and illustrate that teaching is important to you because you have made time during your training to do so.

Applying to PUIs. Because it is time-consuming, it is important to begin to assemble job materials well in advance of the start of the application cycle. Most tenure-track job ads for SLACs are advertised in Science, The Chronicle of Higher Education, and at the HigherEdJobs website. These advertisements start to appear in July, 1 year before you would start the job if you were hired. The majority of the ads are posted between August and October, though a few ads may be posted later in the autumn. It is less common to find a job first being advertised during the winter or spring prior to the upcoming academic year. For most jobs,
phone/Skype interviews (if done to focus a “short list”) occur in October/November, with on-campus interviews usually held in November; many of the top-ranked SLACs wish to complete the hiring in December, before winter break (which can be as long as 4 to 5 weeks). However, first-choice candidates sometimes decline job offers, extending the hiring process into spring semester (February or even later). For those looking to obtain experience via sabbatical replacement positions, advertisements for these positions typically arise in winter/spring, though due to unexpected needs, such ads can be listed as late as summer. However, most campus interviews for sabbatical replacement positions occur in March/April. For an on-campus interview in either case (tenure-track or sabbatical replacement position), the candidate meets with department faculty, students, the Dean/Provost of the faculty, and sometimes other faculty in the sciences. Most candidates will be asked to give a research talk that should be pitched to students (sophomores/juniors should be able to access most of the key elements of your talk). Considering that the department faculty have broad expertise, you will want the ecologists and botanists also to be able to understand the significance and importance of your work; by pitching to the majority of the student majors, you should be able to meet this goal. At many institutions, you also will be asked to give a teaching demonstration or perhaps even teach a lecture of an in-progress course (to prepare, you would be given the topic for that class day in advance).

For more information about the contents of a PUI/SLAC job application, interviewing, and (hopefully) negotiating a job offer, excellent resources include a PDF file posted at the career development page of the American Society for Cell Biology website (5) and The Academic Job Search Handbook by Vick and Furlong (6).

Connecting virology to PUI jobs. Most PUI biology (or chemistry) departments, when hiring tenure-track faculty, look for a good fit to complement the composition of the current faculty. It is quite rare for a department to advertise for a virologist; typically, an advertisement will be for a molecular biologist, geneticist, microbiologist, cell biologist, or biochemist. However, a virologist usually fits into one (if not more than one) of these categories. As such, you need to explain to the relevant department (in your cover letter, teaching philosophy describing your approach(es) to teaching undergraduates, and research statement) that, for teaching, you have and can provide the breadth and expertise being sought and, for research, you use viruses as your “model” system in terms of questions relating to molecular biology, genetics, microbiology, etc. Clear communication of your ability to fit what the department needs both in terms of teaching and research will help you be a competitive applicant.

Summary. A job at a PUI is not easier than a job as a PI at a research I university; it simply is a different kind of job in which you need to be interested in both teaching and research, while working (nearly) exclusively with a diverse undergraduate student population. As you pursue your graduate and postdoctoral training, building up your teaching résumé and developing research plans suitable for a SLAC can help you be a competitive applicant for jobs in which you can explain how you are a good fit for the needs of the hiring department/institution. A job at a PUI is an extremely rewarding one if you think you will enjoy devoting your energies to the education and development of undergraduate students.

REFERENCES