Opinion & Special Articles:

A guide from fellowship to faculty

Nietzsche and the academic neurologist

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ABSTRACT

The role of the physician scientist in biomedical research is increasingly threatened. Despite a clear role in clinical advances in translational medicine, the percentage of physicians engaged in research has steadily declined. Several programmatic efforts have been initiated to address this problem by providing time and financial resources to the motivated resident or fellow. However, this decline in physician scientists is due not only to a lack of time and resources but also a reflection of the uncertain path in moving from residency or postdoctoral training toward junior faculty. This article is a practical guide to the milestones and barriers to successful faculty achievement after residency or fellowship training. *Neurology*® 2012;79:e116-e119

Physician scientists have a critical role in the translation of biomedical discoveries to clinical treatments. With training and perspective in both basic science and clinical aspects of medicine, physician scientists are in a position to identify potential clinical applications in basic mechanistic discoveries, and play an important role in the design and conduct of clinical trials for the treatments that arise from these discoveries.^{1,2} Within neuroscience research, physician scientists have identified new routes to stimulate plasticity in the brain,³ developed a genetic characterization of progenitor cells in the adult brain,^{4,5} and new cell-based therapies from these studies.⁶

Notwithstanding these advances, the status of the physician scientist within the biomedical enterprise is threatened. The percentage of physicians engaged in research has declined steadily from a peak in 1985 to a level of 1.8% in 2003.⁷ There are 25% fewer academic physicians than 10 years ago.⁸ This decline in the number of physician scientists occurred though the NIH budget went through a doubling phase during this period. Despite these statistics, the number of medical students expressing an interest in research, the number of MD trainees interested in research, and the number of MD/PhDs have grown since 1999.⁷ The continued interest in research by early medical trainees presents opportunities for a change in physician scientist training that might produce more success in the pathways that move forward in this field.^{8,9}

THE CRITICAL PERIOD Simply conducting research during a training period by itself has not translated into successful physician scientists. In recent data from NIDA, trainees with 1999 and 2000 career development awards tended to stay in academia after the award and publish, but few received grants (19%–22%¹⁰). This junior faculty interval after the career development award is a critical period. If physician-investigators are able to either renew their first RO1 grant or obtain a second RO1 grant, they are likely to remain in the investigative career track.¹¹ Practical advice is needed for physician scientists as MD NIH RO1 applicants are considerably less successful than PhD or MD/PhD applicants in obtaining independent grant funding.¹²

THE PREREQUISITES: CHOOSING A RESEARCH AREA AND LOCATION, AND PROVIDING VALUE TO THE UNIVERSITY/HOSPITAL The most important characteristic in choosing a research area is to identify the topic that brings forth the most passion. This concept has evolved into a bit of an aphorism: one must be passionate about one's research. This is no more true than for the physician scientist because of

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the huge number of roadblocks put into his or her path. The financial roadblocks are the most obvious. But other roadblocks are no less daunting. Physician researchers are more likely than other scientists to trip the oversight of possibly every regulatory bureaucracy in the academic institution: the animal research committee, the human studies board (institutional review board), the Environmental Health and Safety review board (for laboratory safety), the Biosafety Committee (for transgenics and viral gene delivery), the embryonic stem cell oversight committee, the radiation safety committee, and, lately, the financial conflict of interest committee. These agencies exist to safeguard the institution, and are beholden to it and not the investigator. It is likely that the research career of any scientist is spent in countless hours satisfying an evolving series of queries from one or more regulatory agency. If the creative enterprise of scientific study is what lured many physician scientists toward research, it is the steady drip-drip-drip of regulatory compliance that may drive them out. One needs to be fired up over a research project to be able to surmount the energy-sapping process of maintaining approval from all regulatory groups that seek to control it. The physician scientist has a unique understanding of the relevancy of his or her studies for clinical translation and this can also lead to a passion that may overcome the myriad regulatory hurdles.

Postgraduate researchers who enter the faculty track must also choose a research location. Despite the promise of Web interactions and social networking, the most successful collaborative research occurs on a local scale, often within the same building.¹³ Indeed, buildings with the most successful collaborations produce articles with the greatest impact factor.¹³ It is a lot easier to move to an institution with the appropriate facilities and collaborators at an early stage of one's career. Mentoring is another key factor that needs to be present in the local environment and is discussed below.

An academic physician is evaluated by his or her employer based on the value he or she provides to the department and the university/hospital. The choice of research, clinical work, and teaching must provide value for the institution (money, prestige) or be valued by the institution. As a career evolves, faculty often maximize their value to an institution though their indirect costs from grants—providing far more money than clinical reimbursement. This allows a buying out of extended clinical commitments for more direct research time. At an early career stage this is usually not possible. An academic physician should choose a research field that will provide a clinical niche that takes them out of the burden of providing extensive general medical care. In neurology, programs within the wider department provide natu-

ral niches: including stroke, movement disorders, epilepsy, and neurorehabilitation.

Protected time that is dedicated for research is the absolutely essential element in establishing a productive research program. Consequently, the amount of protected time is a key negotiating item in a starting position. Experience indicates that the amount of protected time needs to be >70%. This number is reflected in most training grants. The burden of support for junior faculty protected time comes from the institution—it is their investment in the young investigator and a barometer of their interest. As noted in an excellent review,¹⁴ there are warning signs for a lack of protected time at an institution: frequent moving of junior faculty or high turnover; clinical coverage that appears very fluid and may serve to cover senior faculty clinical or teaching schedules; and the placement of junior faculty in administrative positions as course directors, heads of training programs, or clinics.

THE DOLLARS The current financial situation is characterized by aging grantees, competitive and uncertain funds, and evolving ideas for national research resource allocations. These factors mean that aiming for the right grant is essential. Aiming for the right grant means choosing the right research project. There are several simple rules for choosing the right project. First, avoid a research project that is interesting but unfundable. While this sounds like common sense, many junior faculty still fail to heed warnings from colleagues about this. Second, the research project must be interesting to the researcher. A mentor or forceful colleague may present a compelling set of ideas, but a young investigator must be able to say no if the project is not interesting (see passion, above). Third, the research project must pose a new question: a search of the NIH grant database and (as always) a thorough reading of the literature determines novelty. Fourth, the research project must suggest a meaty set of studies. The successful project will be a multiyear endeavor that sustains an inquiry with greater detail and focus over time. A proposal in which only studies for the first year are easily designed is bound for failure. Fifth, the project must be practical for the local scientific environment—people who have expertise in the methods and instruments, cores or clinical resources that will support the proposed studies should be in proximity.

The final 2 rules in choosing a research project are less dogmas than mantras: discuss, discuss, discuss and (with Thoreau) simplify, simplify, simplify. A research idea must be discussed thoroughly with colleagues and mentors. It is useful to bounce the Specific Aims page off of senior colleagues, as the whole grant may demand too much time for thorough review. Simplify the grant in formulating the actual

research plan. The grant should be written with direct and well-conceived studies, which have logical and simple relationships to the hypotheses/aims, and easy-to-understand limitations and work-arounds.

Once the right research project is identified, choosing the right grant can be broken down into 2 time epochs: very early stage (1 to 1 ½ years after residency/postdoctoral fellowship) and early stage (after this period but before major grant support). Very early stage is the period before the data and projects are well-developed. This stage is often premature for assembling a full package of studies and career development that are required in a K award. With only one resubmission it is important to not blow a good research project by submitting too hastily. At this very early stage the young investigator can focus on foundation, industry, and institutional grants, such as those from the American Heart Association, American Federation of Aging Research, pharmaceutical companies, and disease-specific foundations. The NIH F32 grant (postdoctoral grant) is also an option but places the investigator fully under a mentor. Grant search engines may help in identifying some of these perhaps more far-flung but still important funding opportunities: Community of Science, Grants.gov, Grantsnet, and the Illinois Researcher Information Service. An important element in this process is that, though a grant may not be funded, a good grant is reviewed by senior scientists who are associated with all of these funding agencies. They will remember the name of the investigator and the quality of the ideas and science. This is a bit of networking that will help in future manuscript and grant submissions. This networking aspect to the junior faculty transition extends beyond grant applications. Data abstracts at meetings, talks, and in symposia all help with establishing a link with more senior scientists to one's work.

Early stage grant applications should include mentored career development awards: K08 and K23. These are well-discussed on the NIH Web site and in FAQ pages.¹⁵ These grants provide the first chance to be principal investigator on a grant, although associated with a mentor. Successful K applications require a strong institutional commitment, including a Chair's letter, training plan, and concrete commitment of space, and with recent competition in this grant category, usually a recent primary research publication is necessary.

THE CLOCK The 7-year clock is in effect at most institutions: the time from initial appointment as a junior faculty member to a final tenure disposition.¹⁶ The most important element in successfully negotiating this time period is to establish a milestone-driven timetable. The time from completion of residency to

tenure seems long. This means there is a possible loss of sense of time and of the process for hitting deadlines. An excellent example of a detailed timetable can be found in the HHMI resources Web section.¹⁷ Be aware of key milestones toward promotion. The timeline from the department's perspective is that in years 2 to 3 the department will create a dossier of research, teaching, and clinical output. By the end of the third year, tenured faculty vote or participate in some sort of midterm assessment. In years 5 and 6, comments are solicited from internal and external experts on the academic output and from former students or trainees on teaching and mentorship. In year 6, the department votes on the tenure decision and this is then sent to the university committee on academic promotions. In addition to establishing a timetable, it is important to minimize clinical commitments, maximize protected time, and establish strong mentorship. It is always tempting to diffuse one's time to help out a colleague by providing coverage for a busy service, but a junior faculty member has to say no if he or she wants to succeed. Mentoring includes both formal mentoring interactions, often set in place by the department, and informal mentoring from respected colleagues. Useful indicators for a good mentor are the depth of past experience in mentoring trainees and the presence of independent research funding, particularly peer-reviewed grant support.

THE PEOPLE In planning a laboratory or negotiating for resources, it is important to focus on people and not just on space and equipment. The people in the laboratory are going to get things done and successfully run the infrastructure. In a basic science laboratory, it is important to strongly consider an initial hire to be a medium to senior level technician. This person will be able to perform the experiments without labor-intensive oversight, and can assist in training new people. Besides this technical hire, it is important to find trainees. A junior faculty member should take some of the (hopefully small) mandatory teaching commitments and volunteer for teaching assignments that will produce exposure to trainees. Avoid the animal research committee and human studies institutional review board at early career stages and focus on admissions committees, conference or seminar organizing committees, and teaching positions that expose a faculty member to potential trainees before they have chosen a laboratory or clinical research setting.

PAPERS: HIT SINGLES In planning research publications, focus on research quality and hit the academic goals that you have established, but aim for solid and reachable publications. Do not try to hit an initial home run, and risk the time and personal cost in whiffing

several times. There is nothing more paralyzing for a grant application than to have the key supportive data tied up in a manuscript that is taking the slow scenic tour of high-impact journal reviews. There are 2 main reasons for hitting the single when it comes to publishing. If put together correctly, this type of paper is a unitary output that can advance the field and one's career in a measurable, concrete fashion. It is also less prone to hyperbolic peer review. Saul Bellow wrote: "I discovered that rejections are not altogether a bad thing. They teach a writer to rely on his own judgment and to say in his heart of hearts, 'To hell with you.'" Publishing solid and regular manuscripts gives the young investigator the strength of character when the inevitable bitter reviews come curving toward the plate.

A WORD ABOUT COLLABORATION "The Main Thing is to Keep The Main Thing the Main Thing."¹⁸ The junior faculty member has identified his or her Main Thing. He or she does not want others to drag them into their Main Thing. It is best to avoid distributed collaborations, in the beginning of one's career, in which research questions are shared at the primary stage and papers and grants are evenly split; and to collaborate as needed to bring in new methods, instruments, or approaches. In these cases the research idea is the junior faculty's, and help with the methods or implementation comes from a collaborator. This process is easier to trace by committees on academic promotion. After tenure is established, or substantial peer-reviewed funding and publications are produced, collaborations that are more equal or far-flung provide interesting research directions and creative stimulation.

THE MAJOR BARRIER: NIETZSCHE AND THE ACADEMIC NEUROLOGIST Most investigators run into barriers. Usually one major barrier presents itself: the key method is not in the laboratory, the most important new piece of equipment is not available, the coolest technique for studying a phenomenon is not within easy reach. These key barriers are often in the "break-away" process—that one thing that might allow one's research to break away from the others and establish a really rigorous, complete or novel approach. This is the gut-check moment for young investigators—Will you bring this in? Will you innovate? Young investigators should work to identify the limits that are preventing their research program from truly transformative experiments, then seek opportunities to capture these approaches. Collaborators may provide the solutions, such as applying for a small grant to fund these studies, or traveling to observe the technique and bring it back. Successful scientists fill in their missing link. In fact, successful scientists at all levels are often defined by scientific publications that result from the extra effort to

surmount a weakness. That which does not kill us makes us stronger.

DISCLOSURE

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