READERS' FORUM

The roles of research and "fit" in tenure

ISAAC NEWTON, depicted here experimenting with light, was reclusive and reluctant to publish. Would he have been granted tenure at a modern university? (Acrylic painting by Sascha Grusche, 17 December 2015, CC BY-SA 4.0.)

The most recent of Physics Today's annual careers issues (October 2023) provides insightful reading on academic tenure. Toni Feder's feature "When tenure fails" (page 44) includes discussion of the roles that publishing research and being a "good fit" play in the tenure process. The article prompted me to look into my "memory bank" developed over 50 years of involvement with the scientific community. In doing so, I conclude that we should rethink the role that those two factors play in determining the value of academic faculty members.

My views on research criteria are beautifully summed up by Kristine Palmieri in her recent feature on women working at Yerkes Observatory (see Physics Today, November 2023, page 42): "The length of one's research career or the number of one's publications are not the only measures of a scientific life."

Physicists working in government and industry often can't publish for various reasons, such as the classified or proprietary nature of their work, but they nevertheless lead productive careers. Leo Szilard published fewer than 30 papers. Some people stop conducting research as soon as they receive tenure or achieve significant recognition. Conversely, if you concentrate too much on teaching, you might fail to get tenure. I can think of at least one well-known physicist to whom that happened; the book he authored nevertheless became a classic text.

My own PhD adviser, recruited straight out of graduate school to an entry-level faculty position, had a tenure evaluation that consisted of no more than a "quiet talk" with his department head, who said that his teaching was satisfactory. He went on to win grants, advise graduate students, become director of a research laboratory, publish 240 papers and 5 books, and edit numerous conference proceedings.

Not only are publications a flawed metric, but they are the outcomes of a flawed process. Even in double-blind review processes, it can be easy to work out who authored a piece, especially in small research communities. That means that personal relationships come into play. A long time ago, I became aware of someone who, whenever he received a manuscript from a certain colleague, would toss it in the trash. (The paper would get published anyway!) I once had a reviewer make uncivil remarks on a paper. When I showed them to the editor, he apologized and told me that he did not know how they "slipped through." Another time, I had a paper rejected but then accepted once it was sent to another referee. All those scenarios exemplify the subjective nature of the process.

Meanwhile, faculty members face the challenge of getting research funding. Federal grant-awarding agencies are accountable to the public and, therefore, have less incentive to fund high-risk, potentially high-impact projects. And although projects may be evaluated by committees of experts, even brilliant scientists are fallible human beings. Ernest Rutherford famously said that any expectation of nuclear reactions producing useful energy is "moonshine." Imagine him chairing a grant committee considering proposals on stellar nucleosynthesis or nuclear reactors—the likelihood of them being funded would be next to nil. But the former was discovered by Hans Bethe and earned him the 1967 physics Nobel Prize, and the latter are a present-day reality. Encouragingly, some non-utilitarian endeavors have recently found a home in places such as the Perimeter Institute for Theoretical Physics and the Kavli Institutes.

The matter of "fitting in" is also a very real issue. At Cambridge University, Subrahmanyan Chandrasekhar encountered racism and was ridiculed publicly by his esteemed senior colleague Arthur Eddington for his proposed limit on the mass at which a dying star becomes a white dwarf. Chandrasekhar's limit would eventually become widely accepted, and he would go on to have an impressive career at the University of Chicago, receive a Nobel Prize, and have a NASA x-ray observatory named after him. "Fitting in" may not be a great criterion in determining a team member's value.

Then again, "fit" is important insofar as it refers to civility, decorum, and respectful conduct. Two bright young physicists whom I came across in the distant past saw their careers end prematurely primarily because they antagonized everyone around them. I know of one faculty member who threw a tantrum in the middle of a meeting and had to be sent for anger management training. I remember another who boasted about being known for "colorful language," wearing it almost as a badge of honor. Then there are the so-called leaders who make their staff's lives unnecessarily difficult. Such conduct has no place in a civilized society, let alone the hallowed halls of academia.

Scientists, physicists included, do not generally receive training in communication and other interpersonal skills. But active listening and the ability to engage in amicable discussion and debate are skills that can and should be included in our science curriculum. As the proverb goes, "With all thy getting get understanding."

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A note on 100 kW laser power

The January 2024 Physics Today article titled "The new laser weapons" (page 32), by Tom Karr and Jim Trebes, reports, "In 2015, General Atomics, the contractor for the distributed-gain laser, achieved 100 kW class power—at the time the highest average power ever achieved in an electrically pumped laser." In fact, Northrop Grumman and Textron Defense Systems—in 2009 and 2010, respectively—had already each independently demonstrated 100 kW average power from solid-state slab lasers.[1] I was the vice president of directed-energy weapons at Textron Defense Systems at the time of that work, which took place under the Joint High Power Solid State Laser program, funded by the Defense Department's High Energy Laser Joint Technology Office under contract with the US Army Space and Missile Defense Command.

The subsequent General Atomics demonstration, funded under the Defense Advanced Research Projects Agency's High Energy Liquid Laser Area Defense System program, focused on significant weight and volume reductions compared with the earlier demonstrations in order to facilitate integration into airborne platforms.

Reference

1. J. Hecht, "Photonic frontiers: Military lasers: A new generation of laser weapons is born," *Laser Focus World*, 1 April 2010.

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► **Karr and Trebes reply:** Due to length constraints, we omitted discussion of many significant directed-energy efforts, including the Joint High Power Solid State Laser (JHPSSL) program. We regret any misunderstanding resulting from the briefness of our article. It was never our intention to slight the accomplishments of the JHPSSL program, its contractors, or the many other directed-energy-weapons achievements of other contractors.

We are happy to set the record straight. John Boness is correct. The JHPSSL program had two competing contractors: Textron Defense Systems and Northrop Grumman. Both contractors built electrically pumped solid-state lasers. The architecture of both JHPSSL lasers was a coherent phased array of solid-state media pumped by laser diodes and lasing in a "zigzag" geometry. Each demonstrated 100 kW average power with good beam quality in 2009–10. It was a great achievement by both contractor teams, and it motivated the high-energy-laser community to focus additional effort on electrically pumped solid-state lasers. We noted the achievement and included references to work by Textron Defense Systems and Northrop Grumman[1–3] in our initial manuscript. We deleted discussion of the JHPSSL in later revisions, shortening the article and focusing it on current developments. Despite its success, the JHPSSL architecture was not used in any subsequent US Department of Defense high-energy-laser program.

The Defense Advanced Research Projects Agency (DARPA) in 2004 funded General Atomics for its distributed-gain laser—a laser architecture that promised better scaling to higher power, lower specific volume, and lower specific mass than the JHPSSL architecture. The exact power achieved by the DARPA program has not been publicly released; we can say that by 2015 it achieved "100 kW class power." We stand by our statement that General Atomics' solid-state, distributed-gain laser in 2015 had "the highest average power ever achieved in an electrically pumped laser." General Atomics further advanced its distributed-gain laser under the DOD's High Energy Laser Scaling Initiative (HELSI). In 2023 a General Atomics distributed-gain laser achieved average power greater than 300 kW.

In 2022 under the HELSI program, nLIGHT and Lockheed Martin also demonstrated 300 kW average power high-energy lasers with diode-pumped fiber lasers—coherently and spectrally combined, respectively. Northrop Grumman is under contract to achieve a similar milestone. As part of the Solid-State Laser Technology Maturation program, in 2019 the US Navy installed Northrop Grumman's Laser Weapon System Demonstrator—a 150 kW average power diode-pumped fiber laser weapon—on the USS *Portland*, where it stayed until 2023. It is the highest average power directed-energy weapon ever deployed by the US.

References

1. D. E. Klimek, A. Mandl, in *High-Power Laser Handbook*, H. Injeyan, G. D. Goodno, eds., McGraw-Hill (2011), chap. 9.
2. Northrop Grumman Corp, "Northrop Grumman-Built Joint High Power Solid State Laser Keeps Lasing . . . and Lasing . . . and Lasing . . .," press release, 8 December 2010.
3. J. Hecht, "Photonic frontiers: Military lasers: A new generation of laser weapons is born," *Laser Focus World*, 1 April 2010.

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