LETTERS

'Nibbling the Bullet': Tenure, Mandated Retirement, Options

Although he is only niggling the bullet, Dan Kleppner has hit the bull's-eye once again (PHYSICS TODAY, June, page 11). I speak from the perspective of one of the victims of the Age Discrimination in Employment Act (ADEA), who was forced by his university to retire when he reached age 70 during the grace period that exempted academic institutions from the new law eliminating mandatory retirement. Given the opportunity, I would probably have continued in my faculty position indefinitely. However, I agree with Kleppner's persuasive argument about such cases, and think that my having done so would have been to the ultimate detriment of the dynamic professional community to which we physicists belong.

Kleppner's remarks should not be construed as advocacy of faculty replacements by young physicists who specialize in the same subfields as the retiring professors and who simply take over their laboratory and office space and equipment, and even their students. Sometimes, such continuity may be desirable, but more often it is better for the institution, and for the advancement of science, to scrap the old guard, make a clean break and strike out in promising new directions. Experience has taught me that such a drastic change of course, if conducted in a congenial and thoughtful manner, need not make any retiree feel let out to pasture.

One of the pleasures of retirement is having the opportunity to make close new friends among the younger colleagues who have replaced us recent retirees. I am grateful to a physics department that has encouraged such constant interactions and to the bright, productive junior faculty members who freely share with the old folks the joys of discovery and their personal concerns as they develop their careers. All generational barriers seem to evaporate at our frequent brown-bag lunches.

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In "Nibbling the Bullet," Daniel Kleppner has joined the small academic-downsizing chorus. No doubt he would recoil from sexual or racial discrimination, but he doesn't hesitate to make discriminatory remarks (which could be actionable if followed) with regard to faculty length of service.

He starts with the plausible proposition that if his Professor X cannot satisfactorily perform because of ill health or sloth, X should be fired—as should also be the case if X were to devote too much time to consulting work or serving on government committees at the expense of teaching duties. Fine, but Kleppner then somewhat gracelessly glides to the suggestion that X should be laid off for the unpardonable sin of having attained a certain chronological age while thoughtlessly retaining his or her capabilities. Surely Kleppner has noticed by now that people age at different rates. Winston Churchill, for example, was ruling the British Empire well into his eighties, and achieved that status while handicapped by several noticeably bad lifestyle habits.

The subtext for suggestions such as the one that Kleppner favors us with is not hard to find: cut costs. Such proposals are not really driven by concern for faculty or for students.

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Daniel Kleppner supports "mandatory retirement for tenured professors" and suggests they reach "a reasonable accommodation" on the issue with their universities," and he cites a variety of reasons for their doing so. He states that the Age Discrimination in Employment Act (ADEA) of 1964, as amended in 1984 to eliminate mandatory retirement, has resulted in aging faculties, with consequent high financial costs to universities and a lack of openings for prospective young faculty members.

These arguments have become commonplace, but they continue to be

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unaccompanied by an examination of whether they are correct. I do not believe they are.

First, I take issue with some of Kleppner's statements about the costs associated with older faculty members. He states that "universities now have the financial burden of paying aging professors top salaries. The burden is actually doubled since these professors must be paid twice—once in the pensions that the universities previously set aside and once in the continuing salary." This is not true. The universities do not pay pensions to nonretired professors. Furthermore, they do not pay pensions at all. Typically, they contribute a portion of faculty salaries, on the order of 10%, to a retirement fund administered by a bank or investment agency. Sometimes the university's contribution ends when a faculty member reaches a certain age, even if employment continues. In research-intensive institutions, highly paid older professors tend to bring in more money in research support than do younger faculty members; that is usually why they are highly paid.

Second, the lack of openings for new appointments is not due to the high salaries of the older professors. Kleppner states that "faculty size is usually determined by departmental budgets." In my experience, that is not the case. The size of a faculty and the budget it requires are both determined by the department's perceived needs, anticipated opportunities and institutional goals. The real blockage of new faculty, if it does exist, is more likely caused by professors not leaving while faculty size does not increase. This is a question worth examining fully.

We have now been living with the amended ADEA for 14 years. Probably the transient effects are over. We can examine how much the actual retirement age has changed, and also how much faculty sizes have changed. The answers together will determine whether there are fewer openings for new faculty.

It is time to stop writing amusing articles with imaginary scenarios of 95-year-old professors, and to stop setting up straw men to attack. Instead, we need to develop a reliable body of facts as a basis for discussing significant issues in our changing universities.

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Daniel Kleppner raises a number of issues that, for some of us, are not new. The problem of tenure versus retirement and of academic renewal has been building for some years. When I was on contract at a North American university, I watched as a few tenured senior faculty members, hired during the rapid expansion of universities in the early to mid-1960s, would wander in at 10 am, and leave again after afternoon tea. They published little or nothing, and often had mediocre course evaluations. There was no permanent, tenure-track position for me and many of my colleagues, and the situation frankly rankled.

Some of my friends still face similar constraints, made all the worse by the ever tighter funding of research and the increasing political emphasis on short-term research with promising commercial application. (The problems with funding arrangements in North America are best left for another discussion.) In addition, all of us are aware of institutions, thankfully only a few, where junior faculty members are so loaded down with teaching that they are unable to get an active research program going; every five to six years, their positions are advertised anew.

Many graduate students look at the situation and never consider pursuing academic careers. They see the frustrations associated with limited research funding, job security and so on, and rightly decide to go off in a different direction. That said, some of us, in spite of all of the pressures and uncertainties, enjoy university teaching and research (the two do and should go hand in hand), and pursue an academic career in spite of the social and economic costs.

So I moved to New Zealand, where there is no tenure. Once hired, you have a permanent position as long as you do the job (and the university remains solvent). The hiring process is intensive. If hirees then want to be promoted, they must demonstrate continued capability in research and teaching, with contributions as well in administration and community service (such as getting involved in societies and conference organization). If they don't or can't "front up," they don't get promoted. There can be difficulties with staff members who are not performing, but the number of such people is small and, in general, decreasing with time.

Here in New Zealand, though, we are faced with the same problems of retirement, or lack of retirement, as in many other countries. Although we recognize the need for continual renewal, there is little encouragement to engage in it. Few if any universities have any sort of long-range plan

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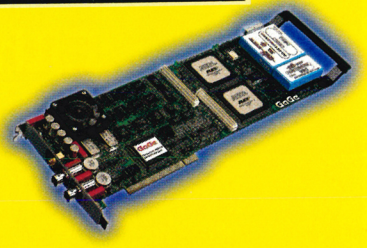

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for dealing with unforced retirement, or for encouraging retirement at all. All we can do at present is hope that senior faculty members recognize their duty to step aside—to "nibble the bullet," as Kleppner says—and allow younger individuals to take their places. This will continue to be the situation both here and elsewhere until the problem becomes more widely recognized. Kleppner's column is one small positive step in the right direction.

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In his story on Stephen Hawking at the White House (PHYSICS TODAY, June, page 52), Irwin Goodwin quotes Hawking as referring to "a manned, or should I say personned, flight to Jupiter" and as using "us"—evidently to avoid using "man" or "mankind." In all three cases, "man" is actually derived, not from the Teutonic root for a male human, but from the Latin *manus*, meaning a hand. Misunderstanding this derivation can lead to expressions that are personifestly ridiculous.

On a more serious note, I would like to take issue with Daniel Kleppner who, in his "Nibbling the Bullet" in the same issue (page 11), says that tenure's "fundamental rationale is usually based on academic freedom, though in reality political or ideological disputes rarely intrude into the physical sciences."

It is just not true that political or ideological disputes do not intrude. Within living memory, Jews were fired from, or refused, faculty positions in Nazi Germany, where it was claimed that electromagnetism was English physics, optics was French physics and relativity was Jewish physics—and the loyal were exhorted to develop Aryan physics. Shortly after that time, Soviet scientists found it expedient to add appendixes to their work confessing that their discoveries were really implicit in the works of Lenin. Both in the Soviet Union under Stalin, and in the US during the McCarthy era, scientists were dismissed from or refused positions because they held incorrect political views.

Such ideological pressure comes not only from governments, but also from within the academic community. The aversion to using "man-" as a prefix comes from internal demands to conform to what is deemed to be politically correct. We have recently heard that science is not objective, but a cultural construct, and there have been demands for a "feminist physics." I am now waiting to hear a demand for a "gay and lesbian physics." Even within the scientific subset of the academic community, there are quarrels over what is orthodox and acceptable. I once heard a member of a statistics department say, "I cannot live in the same department as a Bayesian," and I recall quarrels over a faculty appointment in an economics department that revolved around a bitter dispute between opposing schools of thought.

Faculty members are generally tolerant of the points of view of others and also profess to have an open mind, which leads to many of them being uncertain about values and hence indecisive. The result is that, on too many occasions, tenure is given to those who do not deserve it—with regrets later for the givers. As George Santayana reminded us long ago, "Those who cannot remember the past are condemned to repeat it."

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To begin, I would like to ask a simple question: Does the problem really exist? That is, has the average tenured career of professors been lengthened (more than marginally) by the 1984 amendment? If a simple statistical analysis were to show that indeed it has been, then, like Dan Kleppner, I would be totally in favor of seeking a solution, since our universities definitely cannot afford a further decrease in the intake of fresh blood.

Let's assume the problem does exist. In tossing back the ball to Congress, however, Kleppner does little to distinguish himself from the conservative academics who are his targets. It is instead clear that, in banning mandatory retirement, Congress has made a just ruling that is based on the Constitution and should not be tampered with.

I suggest that a solution should and can be found within our community, where, because of the existence of tenure, the law may be causing problems. I agree that abolishing tenure is probably not advisable and certainly not politically realistic.

What I propose is "retiring" tenure at age 65, and then using a faculty vote based on a standard evaluation every, say, five years to determine whether formerly tenured professors be allowed to stay on. With the first review coming at age 68 (that is, two years before the first five-year period is completed), this simple, fair and efficient system would put aging professors on the same level playing field as their junior colleagues with whom they are competing.

I am 63, and the absence of a mandatory retirement age was a major consideration 12 years ago in my coming to work in this country. As I intend to go as far as my decreasing physical and mental strength will carry me, I would very much welcome periodic reviews of my professional capabilities, without which the dignity of my job would be greatly diminished.

Thanks to Kleppner for one more intelligently written serving of food for thought—but no thanks for his proposed solution.

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KLEPPNER REPLIES: William Meecham has misconstrued my words. I did not suggest that professors be laid off because of age. On the contrary, I suggested that those who are active should continue their careers after retirement. What I did say was that retirement at age 70 is a reasonable price to pay for the privilege of tenure. Meecham suggests that my subtext is saving costs. What I am interested in saving are opportunities for young scientists and the vitality of physics departments. I am also interested in saving the tenure system, which is starting to crumble.

Isaac Greber takes me to task for arguing that universities must pay aging faculties twice. TIAA-CREF (the chief retirement program for teachers in the US) starts distributing pension funds to members at the age of 70, whether or not they are drawing a salary. Many other pension systems do likewise. These funds are derived from contributions from both the university and the individual, based on a schedule of payments designed to provide adequate financial support upon retirement. Faculty members who choose not to retire obviously present the university with an unwelcome burden: A senior faculty slot is blocked and the financial support that could be used to hire two junior faculty is preempted.

I thank James Daniels for reminding me that political and ideological disputes can intrude into science, though the retirement and tenure questions I addressed are particular to the US, and in the US such disputes have been thankfully rare in the physical sciences. The persecution of scientists in the McCarthy era had nothing to do with science—the victims merely happened to be scientists. Many of them suffered the

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same fate as the writers and entertainers who lost their livelihoods; a few others had the good fortune to be sheltered under academic freedom. I specifically restricted my comments to the physical sciences since I know that in other areas of academe where passions can run high, academic freedom may be essential for survival. Occasionally the borders overlap, as in the case of the cultural wars. For scientists who wish to engage in that battle, academic freedom allows hand-to-hand combat without fear of a mortal wound.

Giacinto Scoles asks quite reasonably whether or not the problem is real. My guess is that the problem is not enormous but that, when it does occur, it can have serious consequences. The underlying issue is whether tenure can survive. Scoles's proposed solution is quite reasonable but unfortunately the law is not: The Age Discrimination in Employment Act forbids changing a faculty member's status or introducing a review process purely on the basis of age. In any case, I hope that Scoles sustains his research at top speed for as long as he wishes, retired or not.

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Advancing Faddeev: Math Can Deepen Physics Understanding

In his letter to the editor in your September 1997 issue (page 15), Lorenzo de la Torre discussed the relationship between physics (the study of nature), mathematics (the study of structures) and reality. This is a topic that has provoked recurrent epistemological discussion in "Letters"—see, for instance the letters from Roman Jackiw (February 1996, page 11) and Paul Roman (June 1996, page 13), as well as the subsequent letters from Paul Roman, Alfred A. Brooks, and Roger G. Newton, plus de la Torre's response to them (January 1998, page 91). It is in this context that we think it useful to briefly mention the distinctive viewpoint of Russian mathematician Ludvig D. Faddeev (or Faddeyev), as well as to make a comment on a recent generalization of standard statistical mechanics.

Faddeev thoughtfully advances the idea that mathematics—through the concept of deformation, cohomology theory and related topological structures—deepens our understanding of the theoretical formalisms used in physics.[1] To be more precise, he argues that Newtonian mechanics is unstable with regard to Planck's constant h. Indeed, if a nonvanishing value is considered for h, no matter how small it would be hypothetically, the various physical observables would not necessarily commute, Poisson brackets between observables would be replaced by commutators and we would already be in the realm of quantum mechanics. Faddeev adds that, in the same sense, quantum mechanics is stable, essentially because, in the neighborhood of any finite value of h, no new (topologically) relevant mathematical features appear.

As a second illustration of his idea, Faddeev also comments on another instability of Newtonian mechanics. With regard to the inverse of light velocity $1/c$, he notes that for any nonvanishing value of $1/c$, Galileo's transformation becomes that of Lorentz, thus generalizing classical mechanics into special relativity (a stable theory in the neighborhood of any finite value of $1/c$). Faddeev's third and last example addresses the fact that special relativity is in turn unstable with respect to any nonvanishing value for the gravitational constant G (cause of curvature of spacetime), thus yielding general relativity, which is a stable theory with regard to G.

Although Faddeev addresses physical theories, his interesting point can be made even more transparent through the analysis of a physical *model*—say, the Heisenberg ferromagnet. If we add to the isotropic exchange coupling a further z-axis spin–spin coupling—call it "j"—then the $j = 0$ model is unstable with regard to nonvanishing j. Indeed, if $j > 0$, the symmetry of the system is reduced and belongs to the Ising critical phenomena universality class (stable model); analogously, if j is not too negative, the symmetry of the system becomes that of the XY ferromagnet (stable model).

Returning to the level of physical theories, it is useful to identify one more currently available example that reinforces Faddeev's point. As is well known, Boltzmann–Gibbs statistical mechanics is based on the extensive (additive) entropy, which, for systems at thermal equilibrium, yields an exponential dependence on energy. To study a variety of anomalous systems (long-range interactions, multifractal spacetime and so forth), one of us (Tsallis) has proposed the use of a nonextensive entropy, parameterized by a real number q. This entropy recovers the usual one in the $q \to 1$ limit, but generically provides a power law dependence on energy (with a cutoff for $q < 1$ and a long tail for $q > 1$). In this formulation, Boltzmann–Gibbs statistical mechanics is unstable with regard to $(q - 1)$ and provides two different stable theories—namely, superextensive and subextensive thermostatistics for $(q - 1) < 0$ and $(q - 1) > 0$, respectively.

Although it seems plausible that the present considerations are applicable in principle for any generalization of physical formalisms, naturally only those that receive experimental confirmation are useful in physics. Nevertheless, in Faddeev's words, "This is a kind of philosophy which underlines my own research."[3] Ours too.

References

1. See, for instance, L. Faddeev, *40 Years in Mathematical Physics*, World Scientific, Singapore (1995), p. 463.
2. C. Tsallis, J. Stat. Phys. **52**, 479 (1988). E. M. F. Curado, C. Tsallis, J. Phys. A **24**, 69 (1991). For a complete bibliography, contact C. Tsallis by e-mail at tsallis@cat.cbpf.br.
3. L. D. Faddeev, Asia-Pacific News, June/July 1988, p. 21.

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Arguing about History: Silicon versus the Industrial Revolution

However reliable Ian Ross's article may be on the technical development of the transistor (PHYSICS TODAY, December 1997, page 34), I have to question his grasp of history as reflected in this rather bizarre sentence: "The semiconductor odyssey produced a revolution in our society at least as profound as the introduction of steam engines and steel, as well as the total industrial revolution."

Although the semiconductor has very substantially improved our ability to accomplish certain tasks (such as performing massive calculations), its having become a component of various devices such as the telephone is nothing compared to the very existence of those devices. And however pervasive computers and their ilk have become, even in the home, they are still not as important for the reality of everyday living as the basic communication capability that the telephone has established or the im-