partments, who felt that opening such a Pandora's box (their words) would be undesirable. Given our increased attention to ethical and behavioral practices of the scientific community, perhaps the time has come to realize that this box is already wide open.

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I NOTED WITH INTEREST DONALD KENNEDY'S Editorial "Getting older" (11 Oct., p. 323), as it is high time that someone recognized that today's postdoctoral fellows are not the twenty-somethings of the 1960s. However, I fear that the figures Kennedy quotes—7 years to earn a doctorate in the life sciences and 2 to 3 years as a postdoc—tend to downplay the investment of time that today's junior scientists put into the pursuit of a scientific career. First, although the average of 7 years sounds correct, this number hides a tremendous variance. I have met people whose doctorates were completed in 3 years and others who spent 20 years as registered full-time doctoral students, with no correlation whatsoever between the duration of the doctorate and the quality of the work. As for the figure of 2 to 3 years as a postdoc, that is almost certainly an underestimate. Ten years as a postdoc is not unheard of, and 5 years appears closer to the norm. Finally, Kennedy omits a significant contributor to the aging of junior researchers, that is, the time that today's students spend pursuing the Master's degree. The Master's has become a de facto prerequisite for entry into doctoral programs, and students often spend 3 or even 4 years obtaining a Master's. It is not unusual today to find postdocs in their late thirties who move on to become research associates in their early forties on their hopeful path to academic seniority.

We must face the fact that the ultimate goal of most doctoral students is to attain tenure. This is a feat that cannot even be mandated by law, thanks to Supreme Court decisions that prevent the forcible retirement of college faculty. Grants or no grants, what we have here is an academic "lost generation" who will be a lot older by the time things get any better.

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AS A RECENT POSTDOCTORAL FELLOW, I AM not surprised by the decline in new NIH awards to applicants 35 years old and under ("NIH grantees: where have all the young ones gone?", E. Goldman and E. Marshall, New Focus, 4 Oct., p. 40; "Getting older," D. Kennedy, Editorial, 11 Oct., p. 323). All postdocs currently in the biomedical sciences have experienced this phenomenon firsthand; indeed, the general expectation among scientists in my age group is that when it comes to getting an NIH award the first time you apply, basically you can "fahgetaboutit!" Several factors that might partially explain this trend have been identified; however, I'm surprised that the most obvious and human one has not been mentioned. NIH award committees are made up of older scientists who have already proven themselves and tend to give awards to other scientists who have already proven themselves on the basis of past performance, i.e., older scientists. Young scientists are an unproven commodity, and no matter how many papers they may have generated during their increasingly long postdoctoral periods, they are still considered "riskier" when it comes to granting awards. There is a need for postdoctoral representatives on NIH award committees or, more properly, separate awards for first time applicants. This decline in awards to young applicants has had a marked and depressing effect, with many young scientists frustrated in their career paths and stuck in a postdoctoral limbo. In the end, many abandon academic research altogether and move into the corporate sector.

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IN HIS EDITORIAL "GETTING OLDER," DONALD Kennedy (11 Oct., p. 323) states that the average amount of time to earn an Ph.D. in the life sciences in the United States is 7 years. In the UK, the average time is 4 years. Although some might say that this is too short a time, it is surely an advantage to give scientists the opportunity to demonstrate their originality at an early age. If the Ph.D. training is prolonged, it may well take the edge off enthusiasm for original research. A shorter period of study would not solve the problem described in the Editorial, but it might help.

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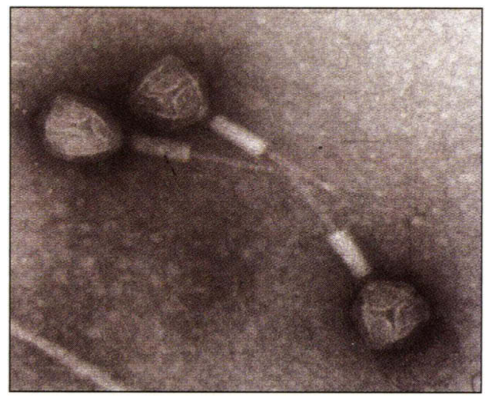
Phage Biology: Coming of Age

I AM WRITING FROM THE PERSPECTIVE OF one who spent many years studying phage biology—30 years ago, my laboratory purified and identified a protein phage receptor, the BtuB protein, which is the receptor for phage BF23. Phage biology is both a wonderfully exciting and a potentially useful field, and I applaud the efforts of my former colleagues Elizabeth Kutter and Ry Young in helping to promote interest in the practical uses of phage to fight parasites and pathogens ("Stalin's forgotten cure," R. Stone, News Focus, 25 Oct., p. 728). In their remarkable diversity, much greater than the diversity in antibiotics, phage have already provided us with the tools to meet the most serious objections to their use, such as the rapid development of host resistance.

One excellent example is the receptor specificity system of the transducing phage p1. This phage encodes two different receptor specificities, each recognizing a different region of the host lipopolysaccharide (LPS) core. The genes for these specificities are read in opposite directions from an invertible promoter, allowing the phage to toggle back and forth between the two. Because the frequency of promoter inversion is several orders of magnitude greater than the host mutation frequency, the host can never mutate to develop phage resistance without giving up the LPS core entirely, a lethal condition in a natural environment.



Bacteriophage that kill *Salmonella*.

We should be actively studying phage as alternatives to antibiotics and antimicrobial chemicals, just as we have studied microbial toxins as alternatives to insecticides and as tools for developing insect-resistant plants. This requires not only more knowledge about phage biology but also a change of thinking for study sections and funding agencies. In the past, research on phage has been justified on the basis of their ability to serve as models for human biology. For example, every successful lambda grant application began with the obligatory analogies between lambda and human cancer. Molecular biology has now matured to the point where phage research deserves funding on its own merit.

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