

LETTERS



RICK KOZAK

Measured success?

Are "valuable research funds" being spent in a "redundant" effort to sequence the genome of the bacterium that causes tuberculosis? How might difficulties in measuring human sexual behavior best be overcome by researchers? Do some types of funding lead to better productivity among graduate students? (And what criteria should be used in seeking to answer this question?) How active should scientists become in "public outreach"? (And how should "scientific contributions" to society be assessed?)

Redundant Genome Sequencing?

I have learned that the U.S. National Institutes of Health (NIH) is to support a program to sequence the genome of *Mycobacterium tuberculosis*. While this information is desperately needed to advance studies that could provide essential clues to the pathogenesis and effective treatment of tuberculosis, I am dismayed and disappointed by the decision.

This decision was made with knowledge of an active *M. tuberculosis* genome project in place at the Sanger Centre in Cambridge, United Kingdom. The project has been in place for some time and is now providing up to 40 kilobases of confirmed sequence daily. This information is released immediately into a Website. The United Kingdom group is led by Bart Barrell, who has considerable experience in sequencing; it is expected that the complete *M. tuberculosis* sequence will be available in December 1996.

It appears that valuable research funds are to be spent in a redundant (and apparently competitive) exercise. There is already far too much repetitive effort in bacterial genome sequencing. Because of the interest of pharmaceutical companies in developing new anti-infective targets, at least two (probably three) sequences of the genomes of *Staphylococcus aureus* and *Helicobacter pylori* have been determined privately (they will not be immediately available to the scientific community—a regrettable situation).

As a scientist actively involved in studies of *M. tuberculosis*, I would very much like to know the genomic sequence of this organism, but I don't need two of them! If NIH wishes to make a major contribution to tuberculosis research, I believe that determination of the genome sequence of *M. smegmatis* would be of inestimable value. *Microbacterium smegmatis* is the only mycobacterial species

for which useful genetic techniques (gene transfer, mapping, gene inactivation, and so forth) have been established; many mutants are available (including temperature sensitives), as well as an ordered cosmid library. There is a great deal of useful information on this microbe. In addition, the sequence of a fast-growing mycobacterial species would be of great value in comparative studies with *M. tuberculosis*, to identify potential virulence genes. Such a combined set of information would advance studies on all mycobacterial diseases.

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Electrons and Sex

Measuring electrons is not easy. They are small, nearly massless, and stubbornly obey Heisenberg's Uncertainty Principle, which places an immutable limit on the precision with which an electron's momentum and position can be simultaneously determined. Indeed, measuring electrons is so difficult that these subatomic particles were quite well integrated into the theory of physics long before any of their physical properties had been accurately measured.

Measuring sexual behavior is also not easy, which has led some AIDS researchers to study monkeys rather than people (1). People lie about their sexuality, both intentionally and unintentionally. Sexuality research is plagued by methodological challenges, including sampling and response bias, mnemonic distortions, and interview effects. How best can these problems be confronted and surmounted, much as phys-

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