Letters

Pulsar Clock

We read with fascination M. Mitchell Waldrop's article about the "Millisecond Pulsar" (Research News, 18 Feb., p. 831). There is, however, some confusion in the article in the statements about accuracy. Waldrop writes that the pulsar's "period seems to be slowing at a steady rate of 10^{-19} seconds per second." This is an apparent drift in frequency of this pulsar clock, that is, a $\delta\nu/\nu$ or a $\delta\tau/\tau$, where ν, the frequency, is equal to the reciprocal of the period, τ. The corresponding frequency drift rate for the clocks at either the National Bureau of Standards (NBS) or the U.S. Naval Observatory (USNO) is estimated to be on the order of 3×10^{-21} seconds per second. The accuracy of the USNO atomic time is quoted as being "one part in 10^{14}." This is in fact our estimate of the day-to-day or week-to-week fractional frequency fluctuations (*1*), which are random and not a systematic "slowing." It often takes many months to observe any such systematic trends in cesium atomic clocks, whereas the 10^{-19} seconds per second systematic trend of the Millisecond Pulsar can, in principle, be measured in a matter of days. In practice, of course, measuring the slowing of the pulsar's frequency is clouded by the uncertainty in modeling the earth's position relative to the pulsar's coordinates, as well as by instabilities in the reference clock used to measure this slowing.

The accuracy of the length of the second is determined by primary frequency standards such as the one for the United States at NBS in Boulder, Colorado. Its current accuracy is 8 parts in 10^{14} (*2*). This accuracy is ascribed to the uncertainty associated with the realization of the definition of the second. This definition is based on the ground state radiation frequency between the two hyperfine levels of cesium-133. Because there is no intrinsic way to define the frequency of a pulsar in terms of an adopted standard, and because of the observed drift, its accuracy has no meaning in the sense typically used in the time and frequency community. As time goes on, however, it may well turn out that the slowing of the Millisecond Pulsar is very predictable—possibly making it the most predictable clock known to man. One may in fact need to use as a reference an optimum weighted average of the best atomic clocks on the earth to assign an upper bound for its quality of predictability.

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Paying for Research

We disagree with Philip Siekevitz's letter (4 Mar., p. 1022) about the research costs of interferon development. He argues that the public is not well served by commercial development of publicly funded research. Commenting on the University of California–Hoffmann–La Roche affair, he suggests that the main point is that the public pays twice—first for the original research funded by the National Institutes of Health (NIH) and second to buy the product. However, we believe that the most important point is the rapid transfer of a research finding to a useful application, that is, getting the drug from the laboratory to the patient in the shortest possible time, consistent with safety considerations. Siekevitz's suggestion that the pharmaceutical companies cover NIH's costs for the basic research leading to a discovery would amount to a tax on the companies. A tax might delay or even negate corporate decisions to develop certain useful drugs. Furthermore, our guess is that, if such a decision were made, the extra costs would be passed on to the consumer. According to Siekevitz's reasoning, the public would then pay not just two times but three.

If interferon is successful against cancer, against a broad set of viral diseases, or against only the common cold, the essential factor is that it be made available to the public. It is time to stop quibbling over who pays the bill and perhaps remember that pharmaceutical companies also pay federal taxes. Let us instead focus on more effective means of technology transfer from the publicly funded university laboratory to the commercial sector and hence to the public.

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Antiviral Effects Without Interferon

In a recent article about the 185th National Meeting of the American Chemical Society (Research News, 15 Apr., p. 292), my work on 2-5A analogs (*1*) is quoted incorrectly. I was not at the meeting and do not know what the speakers said, but I never showed or even suggested that the 2-5A analogs may be effective antiviral agents when introduced into cells. On the contrary, I do not believe that these compounds can selectively inhibit viral replication when administered in this way, and I am convinced that the antiviral effects observed in such experiments can be accounted for by the general inhibition of protein synthesis resulting from the activation of endonuclease activity by 2-5A. I might add that a solution of the "longevity problem" for 2-5A (that is, how to overcome its rapid degradation by a phosphodiesterase) was published some time ago (*1*). In addition, there are some factual errors in the article. Double-stranded DNA introduced into cells does not provoke a sharp inhibition of protein synthesis, but double-stranded RNA does. And it is not "messenger DNA" that codes for proteins.

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