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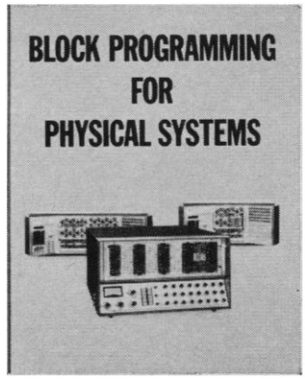

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al courses of study. Yet in most areas of modern astronomy there is already too much effort invested in theoretical research, considering the lack of observational data to test the theories. (Exception: planetary physics.) The authors of the Whitford report have indeed emphasized that astronomy today is data limited. It is dangerous for any field of science to be overladen with theories, which in the absence of checks can freely degenerate into wild speculation and eventually breed dogmas. Only 2 years ago, for instance, the remoteness of quasi-stellar galaxies was accepted dogmatically by most astronomers, and a host of theories were advanced to explain their (apparent) enormous luminosity. Acceptable cosmological theories were identified on the basis of a few spectrum wavelength shift measurements interpreted as Doppler shifts. The remoteness of the quasars is at this time seriously in doubt, so many of the well publicized theories concerning these objects may well be irrelevant.

As Irwin has pointed out, the nation's various programs in space astronomy will be less effective and more costly than necessary unless a large number of experienced observational astronomers are available to plan these programs. I agree that NASA should eventually fund the training observatory construction program, but only after the major expansion of ground-based research facilities is effected and more efficient use is made of current astronomical manpower. Irwin's training observatories will not likely begin to produce observing geniuses until 10 years from now at the earliest, yet strategic planning of space astronomical research is needed now and throughout the intervening years.

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How To Police Pollution

As a former chemist for what is now the Federal Water Pollution Control Administration, I would like to comment on certain aspects of the ninth conference on Great Lakes research (24 June, p. 1773).

How can the FWPCA expect to conduct a fair and equitable enforcement program largely based on "informal discussions"? Such a practice could easily lead to flexible enforcement. Although federal water pollution control machinery has been established for over 3 years, there are, as yet, no formal procedures for conducting hearings. I have attended such informal pollution control conferences in the past in which the government has presented an overwhelming amount of "scientific" data by "experts" who gave proof-positive conclusions about the cause, amount and source of pollution. There was no provision for cross-examination, and industry, unprepared to refute such "evidence," was reluctant to argue its side for fear of being cast in the role of an active supporter of pollution.

Finally, I disagree that it is "hazardous to swim, fish [in], or even get water spray in the face" from lake water bearing *Salmonella* bacteria. This is a half-truth, at best. Certainly no one would advocate swimming in grossly polluted water or would support the willful insult to the human body by unnecessary exposure to any harmful agent. *Salmonella* are ubiquitous microorganisms, as we know from the reported difficulty controlling them in hospitals. The alleged hazard to a fisherman or boating enthusiast by the presence of *Salmonella* in surface waters can only be labeled conjectural.

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Simplifying the Formula

The discussion (Letters, 1 April and 8 July) of N. O. Calloway's proposal (Letters, 31 Dec.) for distributing the ages of experimental animals has been made unnecessarily complicated. If A is the age of the youngest animal to be used, and B is the age of the oldest animal to be used, and $n + 1$ is the number of animals to be used, the problem is simply that of inserting $n - 1$ geometric means between A and B. This requires merely determining R such that

$$B = AR^n$$

Then

$$\log R = \frac{\log B - \log A}{n}$$

and the $n + 1$ ages are

$$A, AR, AR^2, \ldots AR^n.$$

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