length on our image, especially the "false image" we present to the layman by dressing up and posing for photographs instead of showing what working physicists really look like.

I would like to know if the editors agree with Fowler's point, and whether they make an effort to eliminate such silly pictures of physicists supposedly at work. Please note that I don't find the other pictures in the issue objectionable as they are all either mug shots or show ceremonial occasions. None purports to show physicists at work.

STEVEN GOTTLIEB
Argonne National Laboratory
3/14/79 *Argonne, Illinois 60439*

We certainly agree with Fowler that photographs should show physicists unposed—however, no one we know of has ever seen Allan Bromley not *wearing a bowtie.*

The Editor

Mark Twain's black hole

This year, while we celebrate the centennial of Einstein's birth, the black hole is a popular object for many public lectures and articles for the layman. It is not well known that Mark Twain has described in his inimitable style some of the properties of this singular object. The following passage copied exactly is from Mark Twain's short story *Jim Baker's Bluejay Yarn.*

"Then he cocked his head down and took another look; he glances up perfectly joyful, this time; winks his wings and his tail both, and says, 'O, no, this ain't no fat thing, I reckon! If I ain't in luck!—why it's a perfectly elegant hole!' So he flew down and got that acorn, and fetched it up and dropped it in, and was just tilting his head back, with the heavenliest smile on his face, when all of a sudden he was paralyzed into a listening attitude and that smile faded gradually out of his countenance like breath off'n a razor, and the queerest look of surprise took its place. Then he says, 'Why I didn't hear it fall.' He cocked his eye at the hole again, and took a long look; raised up and shook his head; stepped around to the other side of the hole and took another look from that side; shook his head again. He studied a while, then he just went into the details—walked round and round the hole and spied unto it from every point of the compass. No use. Now he took a thinking attitude on the comb of the roof and scratched the back of his head with his right foot a minute, and finally says, "Well, it's too many for me, that's certain; must be a mighty long hole; however, I ain't got no time to fool around here. I got to 'tend to business; I reckon it's all right—chance it, anyway.'

So he flew off and fetched another acorn and dropped it in, and tried to flirt his eye to the hole quick enough to see what become of it, but he was too late. He held his eye there as much as a minute; then he raised up and sighed, and says, 'Consound it, I don't seem to understand this thing, no way; however, I'll tackle her again.' He fetched another acorn, and done his level best to see what become of it, but he couldn't. He says, 'Well, I never struck no such a hole as this, before; I'm of the opinion it's a totally new kind of a hole.' Then he begun to get mad. He held in for a spell, walking up and down the comb of the roof and shaking his head and muttering to himself; but his feelings got the upper hand of him, presently, and he broke loose and cussed himself black in the face. I never see a bird take on so about a little thing. When he got through he walks to the hole and looks in again for half a minute; then he says, 'Well, you're a long hole, and a deep hole, and a mighty singular hole altogether—but I've started in to fill you, and I'm d–d if I don't fill you, if it takes a hundred years!' "

C. KRISHNA KUMAR
Howard University
3/13/79 *Washington, D.C.*

More on OMB regulations

I was puzzled by the discussion in the "State and Society" department in February (page 85) of new OMB regulations on figuring the cost of federally sponsored research projects. In particular, I was puzzled by the fact that you thought that these regulations "may create problems for university research programs." So far as I can judge from your description, they may in fact help university research programs.

I am sure you are aware that grants made by government agencies tend to be made for a fixed sum. Insofar as payments must be made to the university for overhead and "staff benefits," the amount of money available for research is drastically reduced. The universities, who are represented by their administrators, attempt to increase the amount of the overhead as much as possible because they would like to funnel the funds as much as possible into their "unrestricted" budgets. These unrestricted funds are very seldom used for scientific research. In addition, many schools make substantial charges under the "staff-benefits" heading for graduate-student tuition scholarships, which are awarded in the institution as a whole and may have no relation to the research being supported by the grant. Insofar as the negotiations

on the overhead take place between the administration and the government, the scientist, who must pay the bill out of his grant, is unrepresented and must depend on the government representatives to keep the overhead allowance down. In many cases large computing centers and other facilities have been built by strong groups within the university and then are tossed onto the backs of all the other scientists to support, will they or not.

Even the NSF salary ceiling, which appears to bother university administrators, does not worry me much. Anyone paid that much is probably not going to be working very seriously on a grant; most grants support post-docs and the rest of the poorly paid proletariat of the universities. If the universities want to pay that much, they should consider the source of the funds before they commit the money.

The article points up the basic problem in sponsored research: University administrators look at it as a goose that lays golden eggs with which to hire more administrators; principal investigators must depend on the shrinking difference between limited and reduced awards and ever-increasing overhead and staff benefits to carry out their research. I am astonished to see PHYSICS TODAY and the scientific establishment taking a critical view of the new regulations.

HAROLD ZIRIN
California Institute of Technology
3/12/79 *Pasadena, California*

Cost benefit of radioastronomy

Rustum Roy, in his "Guest Comment" (January, page 9) compared radio astronomy to environmental chemistry in his questioning of the dogmatic value system of science. In his call for improvement in the national process of research money allocations, one could easily expect a damaging coincidence of budget-cutting mania and shallow cost/benefit analysis. Radio astronomers are certainly a relatively expensive breed of scientist to maintain, but we feel that the quality of the discoveries of our science (pulsars, quasars, the 3K cosmic background, and many other basic and unexpected facts about our universe) should justify such expenses in a prosperous and enlightened society. Nevertheless, in some quarters we are regarded as the epitome of rarefied scientific purity, and quantitative justification of our expensive instruments is then a difficult and subtle task. It is not easy to attach dollar values to ideas. It might be useful, therefore, to remind Roy of a few representative instances where radio astronomy has played a role that might even have consequences for environmental chemistry.

- NASA and NOAA alone have invested over 50 million dollars in applying radio-astronomy methods to global environmental measurements. Measurements of atmospheric temperature and water-vapor profiles, precipitation, sea state, soil moisture, and snow and ice cover can all be made by radio-astronomy methods worldwide, independent of cloud cover. An extensive operational temperature-sounding system is now being implemented by NOAA, and radio-astronomy techniques appear destined to play an even more central role in the next generation of operational meteorological satellites to be introduced in the mid-1980's.
- The ground terminals of satellite communications systems need calibration of their antenna gain, receiver sensitivity and pointing accuracy. The radio astronomers at Bell Labs pointed out that celestial radio sources were ideal for the purpose, and the methods of radio astronomy are now in use for checking satellite communication ground terminals. The alternative, a system of calibration satellites, would have been expensive (many millions of dollars), wasteful, and less reliable.
- A strong radio source outside the atmosphere was needed by Bell Labs communications engineers for predicting atmospheric effects over a wide range of frequencies. Again, the radio astronomers pointed out that the Sun was just such a source, and demonstrated its use for that purpose. Again, many millions of dollars were saved.
- When the Space Age arrived radio astronomers had already developed the large steerable paraboloids that were needed for tracking satellites. Both NASA and the military adopted these designs immediately. The 250-foot radio telescope at Jodrell Bank was the mainstay in the west for tracking the first Soviet Sputnik.

Many physicists would prefer, of course, to have their work judged by its intellectual value, but we can certainly claim that radio astronomers help to advance the frontiers of practical electronics and radio science. We are probably not inflationary, the public appears to enjoy hearing about our discoveries, and our total budgetary demands are about an order of magnitude smaller than the national expenditures on astrology. The more general message, however, should be that Roy's apparently common-sense proposal could, with careless formulation, cause enormous damage to the intellectual edifice of science, and would probably have unpleasant practical consequences for our country, which has enjoyed such great prosperity in large part because of our willingness to push science and technology to the frontiers.

BERNARD F. BURKE
Massachusetts Institute of Technology
2/20/79 *Cambridge, Massachusetts* □