have dropped. The wolf is at the observatory door.

The response of the astronomical establishment is unusually forthright. The National Academy of Sciences empaneled a committee of distinguished astronomers chaired by Leo Goldberg, director of Kitt Peak, to study the problem. The committee's main recommendation is blunt: Cut back severely on the number of new Ph.D.'s trained. Such recommendations have been privately made in other sciences and are probably being quietly acted on here and there, but official committees tend to gag on the taste of shell casing and they burble optimism even in hard times. The Astronomy Manpower Committee of the Committee on Science and Public Policy, as the NAS group is formally called, has gone so far as to draft a letter to prospective students laying out the prospects in all their grimness. Robert Kraft of the University of California at Santa Cruz, who is president of the American Astronomical Society, has mailed such a letter to the chairmen of graduate astronomy departments urging them to adopt something like it.

There seems to be general agreement that the number of new Ph.D.'s must be cut. Kraft indicates the debate is on the method. Some say raise the admission standards. Others say that's undemocratic—let them in and then be harsher with the marginal ones. But one way or another the number has to come down.

There is an optimistic side to the NAS recommendations. They urge changes in astronomical education to broaden employment opportunities for astronomers in industry and a redeployment of teaching astronomers to broaden opportunities in academia as well. Right now 50.8 percent of Ph.D. astronomers are in academic departments that offer the Ph.D., 12.3 percent in federally funded research centers, 17.7 percent in government and only 6.4 percent in industry. Thus most astronomers are engaged either in basic research or in training new astronomers or both. The NAS committee would like to see more astronomers in industry, and it would like to see more of them involving themselves with students who don't intend to become astronomers, by doing more undergraduate teaching, and especially by seeking positions in four-year and two-year colleges, where astronomy, if taught at all, is usually taught by a physics professor. (A physics professor often knows enough astronomy to teach an elementary course; an astronomer is often less versatile in the undergraduate physics courses remote from his specialty.)

The AAS has established a committee to see what can be done about all these possibilities and to see how astronomical curricula can be broadened to attract more students. Kraft stresses the cultural aspects of astronomy. "It has a lot of philosophical basis," he says. It's a good science to use as an exemplar, to show nonscientists what science is like and how it works. "Most people can understand what happens in astronomy; most people can't understand what happens in physics," Kraft points out. He also emphasizes astronomy's intimate connection with history and cultural trends. So the prescription seems to be: Down from the mountain and into the streets and the factories and the community colleges. □

# Hair dyes: Do they or don't they?

Quite by accident, a University of California biochemist stumbled upon the somewhat ominous fact that most hair dyes can cause mutations in certain bacteria. The Berkeley professor is Bruce N. Ames, who developed some years ago a way of testing suspicious chemicals on sensitive strains of *Salmonella* to watch for mutations. The accident happened when he had his students bring in chemical products to test on the *Salmonella* system, and only one product, a hair dye, was strongly mutagenic. The implications of this accident and the research that followed would be profound—if they weren't so inconclusive.

After his suspicions were aroused by the positive finding, Ames and his colleagues tested 169 permanent and 25 semipermanent hair dyes in the bacterial assay system. He tested the dyes as they come out of the bottle, mixed with hydrogen peroxide, and 18 of the chemical components separately. He found that 150 of the permanent and most of the semipermanent dyes are mutagenic and that 9 of the 18 components are mutagenic. His work will appear in the April or May PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES.

There are two facts that lend dramatic overtones to his findings. First, Ames estimates that 70 to 75 percent of substances that are known carcinogens show up as mutagens in his *Salmonella* test. Second, 20 million Americans use $250 million worth of hair dyes each year.

Although the test results raise the specter of cancer and birth defect risks associated with the use of hair dyes, the results on bacteria fall far short of making such a connection. Ames's *Salmonella* system is now widely used to prescreen chemicals for possible biological effects, but it is extremely sensitive. And the links between mutagenic effects on bacteria bred without a cell wall and without normal DNA repair mechanisms and carcinogenic effects in higher organisms is quite tenuous and still unproven.

The findings, however, have put the cosmetic industry and its regulator, the Food and Drug Administration, on the defensive. There are no regulations that force cosmetics manufacturers to prove their products safe before marketing them. But most of the big firms have done extensive testing of hair dyes and report no evidence of cancer or birth defects in higher animals. The FDA, because of the lack of preregulatory authority, is put in the position of proving a cosmetic dangerous if a warning flag is raised. So after Ames's accidental finding last year, Herbert Blumenthal, Sidney Greene and colleagues at the FDA's Division of Toxicology, repeated Ames's test on some hair dye components. They confirmed his results on *Salmonella*, but have found no mutagenesis in yeast or fruit flies. They are working in cooperation with researchers at the National Cancer Institute and the National Institute of Environmental Health Sciences who are looking for mutagenic and carcinogenic effects in higher organisms.

It is unlikely that anyone will look upon Ames's work as an indictment of hair dyes—Ames least of all. But the work has, in Greene's words, pointed out a potential problem and has caused sufficient concern that Government, and industry scientists will take a closer look at these widely used cosmetics and at others containing chemicals with similar structures. □

# No additional psi's?

Last November physicists discovered two new, unusual, extraheavy particles designated either J or psi(3105) and psi(3700) depending on which discoverers' terminology you adopt. [The latter has now been refined to psi(3695).] The new particles are raising an unprecedented storm of theoretical opinion, and the burning experimental question could be summed up in the old Hollywood cliche: "Are there any more like you at home?" The answer, according to a group of 34 experimenters from the Stanford Linear Accelerator Center and the Lawrence Berkeley Laboratory, is no, none for a fairly long stretch of mass up to 5.9 billion electron-volts, or about 1½ times the mass of the heavier of the two known ones. The physicists used SLAC's SPEAR storage ring to find out. Still there's a hope for yet higher energies, and the SLAC-LBL group intends to go on, raising SPEAR's energy step by step. □