edited by CONSTANCE HOLDEN

Hubble Goof Gets Priced at $25 Million

The buck stopped 3 years ago at the Perkin-Elmer Corp., builders of—and the responsible party for—the flawed Hubble Space Telescope mirror. Now the government has finally decided how big that buck should be, and the company and its owners will hand over $25 million in reparations for the mirror that didn't focus sharply enough.

After a 3-year investigation by the inspector general of the National Aeronautics and Space Administration (NASA) and the Justice Department, NASA has reached a $25 million settlement with Perkin-Elmer, based in Norwalk, Conn., and the Los Angeles-based Hughes Aircraft Corp. Hughes bought the Perkin-Elmer optical division in 1989, 8 years after the faulty mirror was built. Perkin-Elmer will pay NASA $15 million by 22 October. Hughes Aircraft, for its part, will waive $3.5 million owed them under their current telescope contract, and will give NASA a $6.5 million credit line on future Hubble-related work.

Perkin-Elmer opted for a quick settlement in face of the threat of a lawsuit by the Justice Department, which had considered bringing action under the False Claims Act. That idea raised vehement objections from the company as well as from the Aerospace Industries Association, which insisted that scientific error should not be construed as fraud.

Public TV to Air Series On Women Scientists

Boston's public TV station WGBH is planning a series on women in science to be aired next fall. Shooting for the six-part series is almost complete, and the shows—each profiling a different U.S. scientist—are now in the editing process, says executive producer Judith Vecchione.

The profile subjects were winnowed from a list of more than 200, says Vecchione. The six, ranging in age from 29 to 61, are: Lydia Villa-Komaroff, biologist at Harvard University and Children's Hospital in Boston; Harvard physicist Melissa Franklin; Misha Mahowald, computational neuroscientist, currently doing a postdoc at Oxford; MIT geologist Marcia McNutt; Biochemist Lynda Jordan of North Carolina Agricultural and Technical University, and archeologist Patty Jo Watson of Washington University in St. Louis.

All these researchers "share a kind of sparkle-in-the-eyes passion for what they're doing that we think will really communicate the nature of science as a human activity," says Vecchione.

The program, which is funded by the Sloan Foundation, will probably undercut one key perception of women scientists, at the same time as it supports another one. The notion that women have a tough time in science isn't borne out by the interviews. "These are not women who think of themselves at all as victims," says Vecchione, so that's "not a very strong theme in the program." But another perception, held by many females, is that to be a scientist you have to sacrifice much of your personal life. And of these six researchers, only two have children.

MARK SELIGER

Fake smiles. Cheeks are not raised in "false" smile at left. "Polite" smile at right still lacks Duchenne's marker.

The Brain Behind That Happy Face

Psychologists have long known that if you put on a happy face you will actually feel better. The reasons for this have been debated back and forth, but now psychologist Paul Ekman, of the Human Interaction Lab at the University of California, San Francisco, has gone behind the face to the brain underneath. He and psychologist Richard Davidson of the University of Wisconsin have shown that when a person deliberately activates the muscles that are involved in spontaneous happy smiles, brain centers associated with enjoyment are also activated.

Not just any smile will do, of course. In 1862 the French neurologist Duchenne de Boulogne noted that half-hearted smiles only involve mouth muscles, and that only smiles involving certain muscles around the eye are "put into play by the sweet emotions of the soul." Several years ago Ekman and colleagues refined that generalization: They found that involuntary contraction of one of those eye muscles, *pars lateralis*, was the key to the authentic article. Such smiles are said to have "Duchenne's marker."

Most people can't come up with a Duchenne's smile on demand—but they can be trained, says Ekman. Now, in what the researchers call "the first experimental test of Duchenne's hypothesis," they have compared EEG measures of regional brain activity in subjects expressing the Duchenne's smile and smiles that don't involve the crucial eye muscles. And, as the scientists hypothesized, the Duchenne's smiles produced more activation in the left hemisphere, in an area that has been shown to be associated with positive emotions.

Ekman says most scientists "treat smiles as a single behavioral category," so his finding could help refine research that involves assessing peoples' emotional states. It also shows that "by deliberately making a facial movement you can bring about the physiological experience of an emotion." And now that the old saw is bolstered by biology, that's something that could even make a skeptic smile.

Element to Be Baptized After 19 Years

Ever since 1937, when Italian physicist Emilio Segré discovered the artificial element technetium in molybdenum that had been bombarded with heavy hydrogen nuclei, physicists have been using particle accelerators to extend the periodic table beyond the 90 naturally occurring elements. To make new elements they smash heavier elements with lighter ones in an effort to add protons and neutrons to their nuclei. Besides revealing many mysteries of the atom, the quest has produced such useful elements as plutonium.

Each of the 19 artificial elements has been named by its discoverers—except for element 106. It has remained anonymous since 1974, when a team of Lawrence Berkeley Laboratory (LBL) physicists led by Albert Ghiorso used the heavy-ion linear accelerator (HILAC) to create the isotope containing 106 protons and 157 neutrons.

But 106 may soon get a name. Ghiorso didn't want to name it until there was independent confirmation of its existence. But none was forthcoming in the years after the discovery, and to complicate matters, a Russian team had simultaneously reported a version of element 106 with 154 neutrons. This left open the question of who had been first to identify 106. That was finally resolved earlier this year when a committee of the International Union of Pure and Applied Physics and

the International Union of Pure and Applied Chemistry reviewed the work and gave credit to Ghiorso's team.

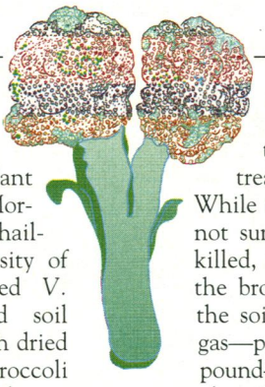
Confirmation has now been supplied by a new LBL team, led by Darleane Hoffman and Kenneth Gregorich. Using LBL's 88-inch cyclotron, they bombarded atoms of californium-249 with atoms of oxygen-18, to produce atoms of element 106. Like most of the heaviest elements, 106 falls apart quickly. But during the 1-week experiment, the team caught nine atoms of the element in the process of decaying, and confirmed its half-life of just under a second. They reported their result at the Actinides '93 conference last month in Santa Fe, New Mexico.

So what about the name? The team hasn't made its final decision, but Ghiorso says he favors Alvarezium, for the late Berkeley nuclear physicist Luis Alvarez, inventor of the HILAC where the original work was done, and well-known for his role in formulating the theory that an asteroid impact killed the dinosaurs.

Veggie Cure for Plant Fungus

Kids who hate their vegetables will be gratified to learn that broccoli can kill. They'll be disappointed, though, to find out that what broccoli kills isn't children, but a pesky crop fungus called *Verticillium dahliae*. That's not likely to convince parents to stop making kids eat the green stuff, and what's worse is that it could make it easier to bring more childhood favorites, such as eggplant, to the table.

V. Dahliae, which can survive in unplanted soil for up to 10 years, creeps into the rootlets of plants such as cherry tomatoes, eggplant, cauliflower, strawberries, pistachios, and several hundred types of ornamental plants. Sending spores in every direction, the fungus invades the plant's vascular system, plugging it up and eventually killing the plant by cutting off its oxygen. Some plants, like cotton, are bred to be resistant to the fungus, but, in California in 1992, *V. dahliae* nevertheless destroyed 5% of the cotton yield. Farmers try to protect other crops like strawberries, which cannot be bred to be resistant, by fumigating with chloropicrin-methyl bromide—but that could soon be taken off the market due to its suspected ozone-depleting qualities. Without the fumigants, strawberry yields could drop by as much as 50%.



Bringing broccoli to the rescue, plant pathologists David Morgan and Themis Michailides of the University of California pretreated *V. dahliae*-contaminated soil in a greenhouse with dried and powdered broccoli leaves and stems. Only two out of 24 eggplant plants and pistachio trees were attacked by the fungus, as opposed to 13 out of 24 untreated control plants. While the two scientists are not sure how the fungus is killed, they believe that as the broccoli decomposes in the soil it gives off a toxic gas—possibly a sulfur compound—very similar to a chemical fumigant. There's not enough gas to harm plant roots, but it seems to destroy the fungus.

Next summer, Morgan and Michailides hope to test whether the broccoli cure works in the field. More bad news for those broccoli-hating kids, though—the two scientists only use the broccoli plants after the edible part has been harvested.

Curbing Harmful Exotica

Kudzu vines creep inexorably over everything in their path, strangling all other plants in their way. Zebra mussels multiply uncontrollably, clogging pipelines and destroying municipal waterways. Gypsy moth caterpillars descend on leaves by the thousands, eating their way through more than 500 species of trees and shrubs. These and countless other harmful plants and animals have been introduced—often by hitching an undetected ride with other imported goods—into the United States within the past century. With no natural predators to curb them, the results have been unexpected, appalling, and expensive: In a report* released last week, the Office of Technology Assessment (OTA) says that in 1991, 15 of the most harmful of these species cost the U.S. $134 billion, most of it in crop damage.

The report emphasizes that the country needs to stop more of these species from establishing beachheads in the United States. To that end, OTA urges more rigorous guidelines for screening new species and assessing their potential risk before allowing them into the country. The House Merchant Marine Committee is listening—its subcommittee on environment and natural resources met on 5 October to discuss the report and it plans to look into possible amendments to the Lacey Act, which regulates import of flora and fauna.

RON PEPLOWSKI

Ugh. Golfball-sized clusters of zebra mussels clog the heat exchange pipes at the Detroit Edison Co.'s Monroe Power plant in Lake Erie, Michigan.

*"Harmful Non-Indigeous Species in the United States."

Radon Regs Shot Down for Now

Just last month, the Environmental Protection Agency (EPA) was preparing to impose a safety standard for radon levels in drinking water following a prolonged and heated debate over the hazard (*Science*, 17 September, p.1514). But now EPA must put the regulations on hold. The agency's appropriation bill this year contains an amendment, offered by Senator Bob Kerrey (D–NE), prohibiting it from regulating water-borne radon.

EPA estimates that 192 people will die of cancer each year after exposure to waterborne radon, an invisible, radioactive gas. So in 1991 it proposed a maximum exposure of 300 picoCuries per liter, a level calculated to eliminate 85 of those annual fatalities. But Congress is worried that the cost of compliance would be excessive. Filtering out the radon would cost about $272 million a year, the agency estimated, but water utilities have protested that it could be five to 10 times higher.

A House-Senate conference committee last week approved the amended measure, which virtually insured its passage. The bill covers 1 year, so EPA can't try again until after October 1994.