The most visible of the scientists

Listed below are the names of 39 scientists judged most visible by the panel of 24 science writers that Goodell consulted while preparing her dissertation. Each name is followed by the number of panel members who mentioned it. Goodell did the survey during August 1972, before White and Leakey died.

Barry Commoner	19	William Shockley	5
Paul Ehrlich	14	Ralph Lapp	5
Margaret Mead	10	Carl Sagan	4
Linus Pauling	10	Philip Abelson	3
Edward Teller	9	Christiaan Barnard	3
Joshua Lederberg	9	Noam Chomsky	3
Wernher von Braun	8	Denton A. Cooley	3
George Wald	8	Edward E. David Jr	3
Glenn Seaborg	7	John Foster	3
James Watson	6	John Gofman	3
Paul Dudley White	6	Fred Hoyle	3
Isaac Asimov	6	Daniel P. Moynihan	3
Michael DeBakey	6	Frank J. Rauscher Jr	3
René Dubos	6	Admiral Hyman G. V. Rickover	3
B. F. Skinner	6	Albert Sabin	3
		Jonas Salk	3
		Benjamin Spock	3
		Harold Urey	3
		Jerome B. Wiesner	3
		Philip Handler	2
		Edwin Land	2
		Jean Mayer	2
		Karl Menninger	2
		Louis S. B. Leakey	2

technology was beginning to hit science in the pocketbook. In 1971 Wolfgang K. H. Panofsky (SLAC), in an interview with Goodell, described science as caught between forces demanding a better economic return from research and forces demanding more social relevance. Simultaneously there was the ever-present eagerness of the media for exciting stories and the cooperation of accurate, fluent sources.

When the Federation of American Scientists was formed in 1946, nearly all of the founders and members were physicists; now, 25% are physicists. Goodell believes that physics, "formerly at the top of the pecking order," faded into the background as national priorities shifted from space exploration and the arms race to biological and social problems. As she sees it, the public wants "pollution solutions, not particle physics," but she does consider it reasonable to speculate that physics may return to the forefront as solutions to energy, ozone depletion and reactor-safety questions are sought.

Consequences. The visibility game has an impact on everyone involved. Popular science heroes risk ostracism by their colleagues for abandoning their laboratories, speaking outside their areas of expertise or circumventing the referees of technical journals by taking their messages right to the public. Goodell maintains that the referee system protects scientific quality control, noting that "*Physical Review Letters* set a precedent in 1960 by announcing that it would reject papers whose main contents had already appeared in the daily press." The lay press cannot provide such rigorous screening of technical material. It is also important to realize that domination of the news by a small proportion of scientists is conducive to distortion of the issues. What about the views of *invisible* scientists?

On the positive side, visible scientists are reaching out to the public, arousing its enthusiasm and maybe enlivening science's image. Goodell advocates a dual remedy for the flaws in the visibility system: More scientists must become involved, and when they speak out on science-related issues they must indicate whether they are doing so as scientific authorities or as concerned citizens. Using one's professional reputation as a springboard to publicize unrelated personal views raises sticky ethical questions.

It is interesting and perhaps ironic to note that Rae Goodell's analysis of the criteria for visibility has—unintentionally—met those very same criteria. *The Visible Scientists* is due to be published in book form in the Spring and has already been the subject of an article in *The New York Times* as well as features in several magazines. Goodell describes her situation as "a case of the biter getting bitten." —DG

Richard Roberts moves to ERDA nuclear post

The Energy Research and Development Administration has a new assistant administrator—Richard W. Roberts, former director of the National Bureau of Standards. Roberts will oversee nuclear-energy research, which is the largest share of energy R&D at ERDA.

He comes to his new position after more than two years at NBS. Before serving in government posts, he was manager of Materials Science and Engineering at General Electric's Research and Development Center. While there, he was involved in a number of nuclear programs relating to both boiling water and breeder reactors.

Guidelines issued for solar-energy institute

An interim report to the Energy Research and Development Administration recommends formation of a Solar Energy Research Institute at a single site and operated under contract by one or more universities. The institute must be independent and have its own director and mission. The National Research Council prepared the report to help determine the nature of the institute that must be established because of the Solar Energy R&D Act of 1974.

NRC notes in the report that a broad range of talent should be assembled to address both short- and long-range problems. Also, the cost of a particular solar-energy technology must be compared with other energy sources using the same level of technology.

A final report to ERDA is expected in September. In preparation for this, a workshop is scheduled for 28 July to 8 August; participants include members of the committee that produced the interim report and representatives of appropriate governmental agencies, industry, educational institutions and other organizations.

Ten nations reorganize European space efforts

Europe now has a unified civilian space agency. Ceremonies on 30 May marked the beginning of the European Space Agency, which takes over the functions of the European Launcher Development Organization (disbanded last year) and the European Space Research Organization. The new agency is designed to pool the efforts of ten countries—Belgium, Denmark, France, West Germany, Italy, The Netherlands, Spain, Sweden, Switzerland and Great Britain—for such projects as Spacelab, a launcher and several satellites. There are also nonmember countries, including Norway, Austria and Canada, that will act as observers and participate in certain of the projects.

Heading ESA as director-general is Roy Gibson of Great Britain, who joined the European Space Research Organization in 1967; he was formerly an administrator in the UK Atomic Energy Authority. The 1976 budget for ESA is expected to be $450 million.

One of the most ambitious of the projects underway is Spacelab—a fully reusable set of research modules that will be launched by NASA's Space

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European Space Agency

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Shuttle. West Germany is providing over half of the $400 million in research and development costs. ESA will give NASA the first Spacelab and the US agency will probably purchase later units. The research effort at least for the first Spacelab flight will be a joint US–Europe venture—including the possibility of a European crew member, the first western European to fly into space. A second and somewhat larger project is Ariane, a launcher (of Atlas–Centaur size) to put satellites into synchronous orbit.

Several satellites are nearly ready or planned under ESA auspices. Celestial Observatory Satellite-B, scheduled for launch this month from California, carries instruments capable of detecting gamma rays with energies above 20 MeV. For 1976, there is GEOS, which will continue studies of the Earth's magnetosphere begun by earlier satellites. Also planned for that year is the International Ultraviolet Explorer, a joint venture with NASA and the UK Science Research Council. For 1977 there is the three-satellite International Sun Earth Explorer Project, also in partnership with NASA. EXOSAT, planned for 1979 will measure locations of x-ray sources using lunar occultation.

Plutonium recycling

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breeder reactors of the 1980's, the interim waste problem becomes less serious."

Frank von Hippel (Princeton) agreed that it is economically close to breakeven and this is one reason why the plutonium-recycle industry has developed so slowly. He told us: "I would speculate that ultimately, the government might have to take over that part of the fuel cycle. The idea originally was that recovered uranium and plutonium would more than pay for the process, but this is coming into question now. There is no great incentive with the price of uranium what it is." Recycling of nuclear wastes would add only about 20–30% to the available fuel supply—a far cry from the 50-fold increase in fuel-use efficiency expected for breeder reactors.

In any event, many power plants are filling up their spent-fuel storage pools. Taylor outlined for us the options the utilities have:

- They can hope for relaxation of safety criteria thereby allowing more spent-fuel rods to be placed into the same volume (this, Taylor says, is not likely to happen).
- They can look for offsite storage capacity that now exists, either in someone else's reactor storage pool or in one of three other limited storage places (see box).
- They could possibly use temporary storage facilities that can be built, but it would take about three years for one to be ready for operation.
- They might make use of the hot storage facilities at Hanford, Washington and/or Savannah, Georgia; there has been serious consideration to reactivate these installations.

According to Taylor, it is not clear which, if any of these routes will be taken.

Effects on the breeder. According to the people we spoke to, plutonium recycling during the coming several years is not crucial to breeder-reactor development, although as Taylor put it, "The longer plutonium recycling is held off, the more it delays the time when more-or-less routine operating experience with plutonium fuel has been developed. And, of course, an NRC decision *not* to allow recycling, depending on how long the freeze lasts, could have a severe impact on the breeder, perhaps to exclude it altogether." He further mentioned the financial considerations involved: "At some point industry will have to consider fairly heavy investments in gearing up for the breeder and they may not want to make those investments if there is any danger that the safety and safeguards requirements will cause them not to want to go the breeder route at all."

Safeguards alternatives. Perhaps the most pressing problem with plutonium is its possible diversion by thieves. The recycling process is the first place in the commercial fuel cycle where plutonium is isolated and available for diversion, but there are several measures that can be taken. The first solution is not to process the spent fuel at all and perhaps bury it when it has cooled down. Second, a more on-line and accurate fuel-assay system is useful to tell quickly of a discrepancy in the amount of plutonium in the system.

A third possibility is more secure physical barriers: fences, alarms, heavy containers, and guard and reserve forces. Taylor commented about this: "In principle you could make a trade-off between physical barriers and guards. I think, generally, people are tending to want to rely on equipment and as little as possible on guards who have the authority to shoot at people."

Another safeguard Taylor told us about is the use of a hot isotope such as cobalt-60 mixed in with the plutonium to "spike" it—that is, make it too hot for a thief to handle. He noted, of course, that it is also too hot for authorized workers and the public. —RAS

Plutonium storage and recycling facilities

There are three plutonium recycling plants in the United States where utilities could send spent fuel rods should their own storage capacities fill up. None of these plants is recycling plutonium at the moment, but their storage areas are nonetheless potentially usable.

1. General Electric has invested in a small plant in Morris, Illinois, but there have been design difficulties and it probably will not be able to recycle plutonium.
2. At Barnwell, South Carolina, Allied Chemical and Gulf General Atomic have nearly completed construction of a facility that is more likely to be operable, although now it is likely to be caught in the NRC freeze.
3. The Nuclear Fuel Services Plant in West Valley, New York, has been shut down since 1972 because radiation doses to workers were exceeding permissible levels. An improved and expanded version of the plant is scheduled to open in 1979.

The storage capacity of these three plants, however, is relatively small compared with the rate at which light-water reactors are discharging spent fuel rods. It is expected by 1977 that storage capacity for 1170 metric tons of waste will be available—storage for 50 tons that was available as of March 1975 and 1120 tons that is expected to open up. For 1975, 1976 and 1977, projected spent-fuel discharges are 698, 1101 and 1402 tons, respectively. For more details, see *LWR Spent Fuel Disposition Capabilities, 1975–1984*, US ERDA report #25, March 1975.

in brief

A Consumers Guide to Instrumental Scientific Equipment, including the names of knowledgeable users to contact for each of the 2000 items listed, is available for $1.50 from the US Government Printing Office, Washington, D.C. 20402.

A bimonthly newsletter, *Atomic Data for Fusion*, published by the Holifield National Laboratory and NBS has appeared. Inquiries should be addressed to C. Barnett, Holifield National Lab, PO Box Y, Bldg. 9201-2, Oak Ridge, Tenn. 37830

Wave Electronics, a new bimonthly journal published by Elsevier, will cover the field of wave interactions used for communication purposes. Subscriptions are available for $48.50 from Elsevier Publishing Co, PO Box 211, Amsterdam, The Netherlands.

Energy Review, a bimonthly edited by A. I. Berman, is available for $18.00 a year from Energy Review, 200 West 57 Street, Suite 708, New York, N.Y. 10019. □