A biological head count

The new agency's most prominent job—and the one that has so far captured most of the public attention—will be to inventory the entire U.S. biota. The result would be a biennial report, called the National Biological Status and Trends, on the abundance, distribution, and health of wildlife and habitats. No one yet knows how to do it, and conservation biologist Thomas Lovejoy, on leave from the Smithsonian Institution, heads a planning team trying to figure that out. It will get help from a report expected this fall from an academy panel chaired by botanist Peter Raven, director of the Missouri Botanical Garden, setting out a vision for the survey. Academia has also answered the call. Last April, biodiversity experts gathered in Philadelphia to discuss how to survey every species on a plot of land, something that has never been done before (*Science*, 30 April, p. 620).

The new inventory will draw heavily on ongoing research and inventory efforts scattered throughout Interior. But outside help will be needed, too. "We won't have enough scientists," says Lovejoy. "There's a lot of questions in which the expertise lies outside Interior." The Ecological Society of America has asked NBS to recruit ecologists and systematists to the task, and Lovejoy says that statisticians will be hired to collate and analyze the reams of data anticipated from current and future inventories.

Science without a master

The prospect of a major new scientific mission for Interior and a reorganization of biological research along scientific lines has galvanized many Interior department scientists. Take such problems as the global decline of amphibians and the proposed North American network of wilderness reserves to protect biodiversity (*Science*, 25 June, p. 1868). "All of those things would benefit from an integrated attack" that NBS might provide, says fisheries biologist John Varley, chief of research at Yellowstone National Park. But Varley and others are also nervous about what might occur when research is separated from Interior's everyday missions.

"One of the biggest concerns," Hester concedes, "is that every bureau will put in its resources and then somehow the survey's needs will gravitate to higher national and international needs that I facetiously call 'Go study the ozone hole.'" Hester is trying to develop a strategy to prevent the bureaus from losing out; one component is a science board, composed of representatives from various bureaus, to review NBS's budget and suggest new areas of research.

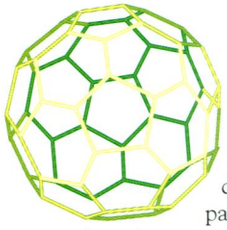
Even so, many Interior scientists about to join the survey fret about their futures and wonder what sort of research they might be doing at the end of next year. Forest ecologist Mike Collopy, director of the Pacific Forest and Basin Rangeland Systems Cooperative Research and Technology Unit for the Bureau of Land Management (BLM) in Corvallis, Oregon, heads a seven-person staff assigned a year ago to implement the spotted owl plan on BLM land. "We came here specifically to help BLM do this," says Collopy, whose team is slated to move to the survey this fall. Collopy likes the survey's attempt to forge "a lean, mean responsive agency" but he worries about what might be lost in the transition. So do some of his colleagues at other agencies. "My fear is that some of us will have a hard time working on the plan with our survey work," says Park Service forest scientist Ed Starkey.

Even some members of the academy panel that urged the Park Service to separate scientists from managers feel NBS may be too much, too soon. "Our study, and those preceding it, recommended that science be a full partner in the Park Service, not a stranger to it," says University of Idaho forest ecologist John Hendee. The survey is "a step backward for science," he says, because it "will destroy the competing hypothesis approach to science." For example, Hendee says that it was competition that shaped research on the spotted owl by scientists in different Interior bureaus.

As Interior scientists await a comprehensive survey strategy, they'll need to learn how to interact with colleagues from different bureaus. And that presents its own challenges. Last June, some 70 scientists met for a survey planning meeting in Denver. "There were a lot of tense moments," says one researcher, because scientists in the various bureaus "all speak different languages." For Babbitt, the challenge is to turn this diversity into a smoothly running machine and to avert painful collisions between the department's own scientists.

–Richard Stone

BUCKYBALLS



Patent Dispute Goes Public

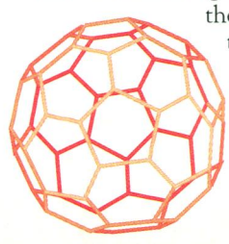
Konstantinos Fostiropoulos should be on top of the world. As a young graduate student 4 years ago, he was part of a four-person German-American team that first produced buckminsterfullerene in significant quantities—a breakthrough that made it possible for researchers around the world to study the material. The paper describing the production technique (*Nature* **347**, p. 354, 1990) became an instant "citation classic": It was the most cited chemistry paper published between 1988 and 1992, according to the Institute for Scientific Information.

Yet Fostiropoulos is far from happy, because he believes his contribution to the project has not been sufficiently recognized. Specifically, Fostiropoulos argues that his name should be on a patent application that was filed on the technique. But only the two principal investigators on the project, Wolfgang Krätschmer and Donald Huffman, are named as inventors. (Huffman's assistant, Lowell Lamb, was also not included on the application.)

It is not unusual for graduate students to feel that they do the hard work while their supervisors get the glory. Fostiropoulos, however, unlike most disgruntled graduate students, has gone public with his grievances. Earlier this month, his patent attorney, Ulrich Naumann, lodged an official complaint with the German Patent Office arguing that Fostiropoulos should have been named as a co-inventor. Fostiropoulos' challenge now means the German Patent Office will have to investigate the researchers' relative contributions to the invention—a process that could take 6 months or more, according to Naumann.

Fostiropoulos' claim is countered by the lawyers who handled the patent application on behalf of the University of Arizona and the Max Planck Society, the researchers' employers who are set to reap most of the benefits should the patent be granted. They have looked into who did what on the project and are satisfied that the filing correctly credits only Krätschmer and Huffman.

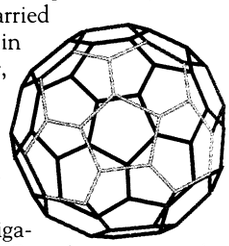
Fostiropoulos, now working at a branch of the Max Planck Institute for Radio Astronomy in Jena, says he simply wants recognition for his contribution to the discovery. However, in the worst possible case, disputes over inventorship can invalidate a patent, and a great deal of money could be riding on this one. The production technique described in the patent opened the floodgates of industrial research on fullerenes, and applications in the pipeline span everything from carbide and diamond coatings, lubricants, superconductors, semiconductors, catalysts, and even sunglasses. Companies such as Exxon, AT&T, Hughes, Xerox, Hoechst in Germany, and Sumitomo in Japan have all applied for patents on applications of fullerenes and many are using the technique at the center of this dispute to produce research quantities for sale at several hundred dollars a gram. The technique is, at the moment, the only one that can produce fullerenes in large quantities with good yields, so any future fullerene producer will probably



have to use it and pay royalties.

Nobody disputes the fact that Krätschmer and Huffman first produced fullerenes unknowingly in 1983 in Krätschmer's lab at the Max Planck Institute for Nuclear Physics in Heidelberg. Huffman, a physicist at the University of Arizona, was collaborating with Krätschmer in an effort to recreate interstellar dust by electrically heating graphite in an atmosphere of low-pressure helium. One of the samples of the dust they created had an unusual ultraviolet spectrum. Huffman says they thought it could be some new form of carbon but had no idea what it was. The discovery of fullerenes in 1985 by other researchers prompted Huffman, who had by then returned to Arizona, to repeat the experiments, he says. In September 1987, Huffman first applied for a patent on the process, with Krätschmer as co-inventor, but later withdrew it because the process did not reliably produce fullerene; sometimes it worked, sometimes not. The problem turned out to be with the pressure in the reaction vessel: It needed to be 100 torr, higher than expected—both arms of the team discovered this during 1988.

Fostiropoulos joined the project early in 1989. He first worked to produce larger quantities of the material and then, by comparing samples made with different isotopes, showed that it contained all-carbon molecules—work that he published with Krätschmer and Huffman (*Chem. Phys. Lett.* **170**, p. 167, 1990). He then worked on ways of separating the fullerene from the rest of the carbon soot produced and carried out experiments to prove the product really was fullerene: mass spectrometry, infrared absorption spectrometry, and electron and x-ray diffraction studies (*Int. J. Modern Phys. B* **6**, p. 3791, 1992). According to Lamb, similar experiments were carried out in Huffman's lab in Arizona. (Krätschmer, who was traveling last week, was the only member of the team who could not be contacted for this article.)



At Huffman's instigation, applications for U.S. and international patents were drawn up in the summer of 1990 by lawyers at Research Corporation Technologies (RCT), a nonprofit technology transfer company based in Tucson, acting on behalf of the University of Arizona and the Max Planck Society. If the patent is awarded, the proceeds will be split equally between the two institutions, and Huffman says he would get a small percentage of Arizona's share.

Jeff Jacob, project manager for the fullerene patents at RCT, says the company makes every effort to get inventorship right. "Based on the facts available [in 1990], we chose those inventors [Krätschmer and Huffman]," he says. The Max Planck Society carried out a similar inventorship investigation. According to Heinrich Kuhn, the society's patent lawyer, "It makes no difference if it is a professor, a scientist, or a technician...we make our investigations very thoroughly."

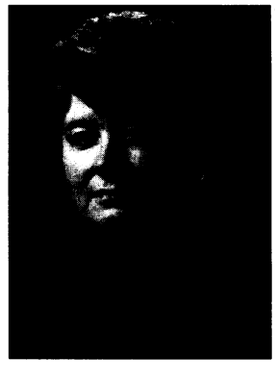
Harry Kroto, one of the original fullerene discoverers in 1985, says RCT got it right. Kroto argues that Huffman and Krätschmer had the key insight that led to the invention. "The real science was to think C_{60} was there," he says. "It is a research student's job to confirm or otherwise that insight. But it is hard for them when the discovery is of this magnitude."

–Daniel Clery

OSTP

Gibbons Breaks Mold on Appointments

Science adviser John Gibbons last week rounded out his top staff at the Office of Science and Technology Policy (OSTP) with two appointments that, by gender and background, signify a break with tradition. President Clinton has nominated an academic biologist, M.R.C. Greenwood, dean of graduate studies at the University of California, Davis, as associate director for science. That's a new position, having been split in the past between two people, one with responsibility for the physical sciences, the other for the life sciences. Clinton also nominated Jane Wales, a former journalist and arms-control activist who runs a program on cooperative security at the Carnegie Corporation of New York, as associate director for international affairs.



UC DAVIS

Chief scientist. Biologist M.R.C. Greenwood.

Greenwood, 50, and Wales, 45, would be only the second and third women to hold top jobs at OSTP since it was created in 1976. (Bernadine Healy, who later became director of the National Institutes of Health, was the only other woman to have held an associate directorship.) They will join two previously announced members of Gibbons' top team: Skip Johns, 59, a policy analyst who came with Gibbons from the Office of Technology Assessment to handle technology and space issues, and atmospheric chemist Robert Watson, 45, who has moved from NASA to coordinate environmental and energy-related matters.

The selection of Greenwood, a biologist, may smooth some feathers ruffled earlier this year when Gibbons announced that he would combine the life sciences and the physical sciences into a single unit at OSTP. Life scientists feared the loss of a voice at OSTP, but Greenwood has a Ph.D. in physiology, neuroscience, and developmental biology from Rockefeller University, and her research has focused on the genetic bases for obesity.

Greenwood says that her background in biology "is a good thing" for OSTP because "many of the potentially most lucrative areas relating to commercialization relate to the life sciences." But with scientists already worried that Clinton favors technology over science, Greenwood knows that she must reach out to all segments of the community. "I'm sure that I will be spending a lot of time meeting people from the physical sciences, and I hope to have an assistant who is well-connected to that community." In fact, one of her first jobs will be to select assistant directors for the life, physical, and social and behaviorial sciences.

Wales will also have some bridges to build. A decade ago, as executive director of Physicians for Social Responsibility, Wales was on the front lines in the battle to reduce the spread of nuclear weapons while the OSTP director, ex-weapons designer George Keyworth, was the Reagan Administration's chief spokesman for Star Wars. Wales, who has a bachelor's degree in comparative literature and worked in the State Department during the Carter Administration, has a reputation as a politically savvy administrator. "Jane's strength is that she's been around Washington defense policy circles and she knows the games that people play," says Chris Paine, an analyst at the Natural Resources Defense Council.

To shore up OSTP's technical expertise in weapons-related issues, Gibbons has tapped Princeton physicist Frank von Hippel, 55, to serve as an assistant director for science and security under Wales. A professor of public and international affairs, von Hippel has spent the past decade working on nonproliferation and testing verification issues, and pioneered nongovernmental efforts to improve East-West cooperation. An advocate of a comprehensive test ban, von Hippel participated in a May meeting with Energy Secretary Hazel O'Leary and the directors of Department of Energy's weapons laboratories that led to the Administration's decision to extend a moratorium on testing.

Greenwood and Wales must be confirmed by the Senate, which is not expected to take up their nominations for another month or so. Of the four associate directors, only Johns' appointment has so far been blessed by the Senate.

–Jeffrey Mervis