NATIONAL ACADEMY OF SCIENCES

What Should It Take to Join Science's Most Exclusive Club?

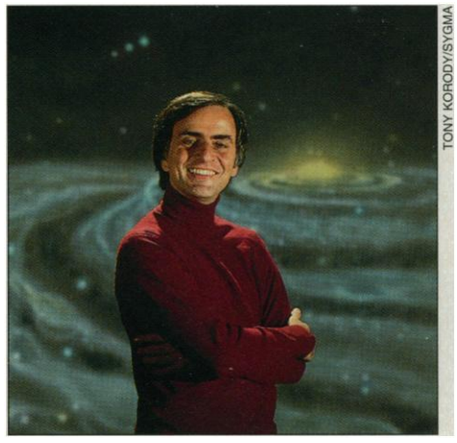
Every year, a few scientists around the country rejoice and many more are crushed when the prestigious National Academy of Sciences (NAS) selects the 60 researchers deemed most worthy of admission to their exclusive club. But while the names of the honored few are widely published, the fairness of the process by which they are chosen doesn't usually get much notice. One persistent exception has been the Washington D.C. newsletter *Science and Government Report*, in which editor Dan Greenberg has repeatedly charged that the academy is an old boys' club that accepts women only with the greatest reluctance. This year was no exception: The academy elected 54 men and five women (see accompanying list), and Greenberg opined that the august institution was "carrying on a sexist tradition that would shame a redneck beer club."

But this year Greenberg's lone voice was joined by a pair of much higher-volume media megaphones: *The New York Times* and *U.S. News and World Report*. The *Times* pointed out that "though women have been swelling the entry and middle ranks of science since the 1960s, the percentage of women elected to the high-profile academy has hardly budged for the last 20 years." *U.S. News*, on the other hand, wasn't concerned with the gender problem; it was busy sniffing out (and publishing, on their "Washington Whispers" page) news of a debate that had erupted within the academy over the credentials of a single male candidate.

When the 59 new members were announced, nothing official was said about the one person put up for membership whose name fell off the ballot at the last moment. But as *U.S. News* reported, and sources within the academy confirm, the candidate was Carl Sagan. Sagan's rejection angered some of his astronomer colleagues, who feel that his science and standing as a public educator qualify him for membership.

Sagan's case illustrates the fact that the criteria for academy membership aren't by any means crystal clear. Sagan, a planetary scientist, has taken part in many large projects, though it's hard to specify any one singular scientific discovery. He lists among his major accomplishments that he "enhanced our understanding of the greenhouse effect on Venus, dust storms on Mars, the organic haze on Titan, the origin of life, and the search for life elsewhere." But in the broader scientific community, Sagan may be better known for promoting the hotly disputed nuclear winter hypothesis—holding that a nuclear war would chill the earth's climate for years—than for any of his papers. And to the average citizen, Sagan is best known as the deep voice and handsome face that host the "Cosmos" television series on PBS and appear now and then on television interview shows.

All that was enough for many of his fellow astronomers who had already been anointed as academicians. Sagan's nomination, like the Voyager spacecraft that was one of his most important subjects on "Cosmos," calmly navigated the remarkably tough path through the celestial bodies in his own field. To them, he appeared an excellent candidate for the firmament of membership. But then came trouble. Members of the academy are sworn to secrecy on the details of how new candidates are inducted, but insiders made it clear that this was one of several historical cases in which the debate over a nominee grew to involve the entire membership after achieving consensus in a nominee's own discipline.



TONY KORODY/SYGMA

Just verdict? Carl Sagan's candidacy was supported by many astronomers, but not by the NAS membership at large.

Last-minute change. What is official, courtesy of NAS spokesman Steven Push, is that many candidates are proposed for membership but don't make it. And yet in the ordinary course of events, discipline-based sections—rather than the full membership—do most of the debating. The sections make most of the nominations and rank the candidates in order of preference. The deliberations then move up to five wider classes, resulting in a list of 60 top-ranked nominees and 30 alternates. All academy members present at the annual meeting then simply vote yes or no on the whole list of 60.

At least that's the way it usually works, but Push adds that things can change at the last minute if an academician makes a motion to delete one of the top 60 or switch him or her with a nominee on the alternate list. In such a case, the decision-making goes into the hands of all academicians present, who take a secret ballot. If one-third vote no, the candidate is out. This was apparently what happened to Sagan, since members far outside his field of planetary science confirmed that they got involved in the conflict. And while the academy can admit 60 new members per year, only 59 appear on the current list. This was only the second time the academy picked fewer than 60 new members.

The rarity of Sagan's rejection raises two issues: Have his research results been adequate for him to enter the academy? And should things other than research results—such as his work in educating the public and getting more funding for astronomy—be considered? Generally, his supporters say yes on both counts and his detractors say no.

"In my view, Sagan has made as great a contribution to astronomy and the intellectual life of this country as anyone," says noted astronomer and academy member John Bahcall. "I watched the 'Cosmos' series with all my three children," he adds. Population expert Paul Ehrlich, also an academy member, said he thought Sagan deserved to get in, on the basis of both his scientific contributions and his work in educating the public. Academy member and mathematician Steve Smale agrees that communication is as essential to science as research. "For me it's hard to separate the two things. If you do one and not the other it's not worth anything."

On the other side were members of the academy who think significant research is the only criterion for membership and that Sagan's science simply didn't match up with that of other candidates. And among this group were members of Sagan's own discipline. Take NAS member Donald Hunten, a planetary scientist. People should be admitted, Hunten told *Science*, "if they've done something in research that made a real contribution. There are many others more qualified than he is."

Members not in Sagan's discipline were generally unwilling to speak for attribution, but several said they became convinced during the debate that his scientific contributions didn't stack up. "It wasn't that hard for me to reach a decision," says one chemist. "There was the argument that [his membership] could open a floodgate to people whose science isn't spectacular but [who] have other credentials."

All this would be moot if there were clear guidelines about what qualifies as a major research accomplishment. But members have such widely divided opinions about who should belong to the NAS for one reason at least: The academy has no written selection criteria. Spokesman Push says there is an official understanding that membership is based strictly on scientific research contributions. Still, he ac-

knowledges, whether an individual is qualified is "based on the judgment of members." And as in any case where subjective judgments must be made, there are arguable cases.

Arguable questions. Also arguable is the question of whether there should be any public airing of the judgments of academicians—or even of the process of judgment. Many members would agree with Albert Cotton, a chemist and chief of the academy's physical sciences class, when he scolded *Science*: "Our deliberations are none of your business or anyone else's." Other members, however, feel it appropriate to criticize the election procedure, either on or off the record, in hopes of bringing about a change; several called it "baroque." And mathematician Smale says he finds the process too complicated, with too much "internal politicking" and adds that the final result is a body of members who are "quite traditional and conservative."

The one thing no one has yet argued publicly against is the Greenberg accusation that the academy, like most clubs that lack formal selection criteria designed to ensure equal representation of all subgroups, has ended up with a membership in which certain groups are under-represented. Academy president Frank Press argues that the lack of women in the academy is proportional to their scarcity in the very upper reaches of science in general. But then again he admits that "the network of men may not know about the network of women" and insists that members are making an effort to change things. "There is an old boys' network," says University of California at San Diego astronomer Margaret Burbidge, recently head of the astronomy section at the academy, but she stresses that the president and home secretary have clearly stated that they want to increase the percentage of women. And she insists that the academy does not need to alter its standards to do that. "There are plenty of highly qualified women out there," she says.

No doubt, in the long run, the NAS will change, at least with regard to women. And perhaps it may even accept more members with nontraditional qualifications, like Sagan's. But while scientists wait to see what happens, they are bound to have one of two very different ways of viewing the academy. One view is that of Groucho Marx ("I wouldn't belong to any club that would have me"). That approach was taken by charismatic Nobelist Richard Feynman, who was elected and then resigned, reportedly because he was disgusted by the in-group politicking. (It took the NAS 10 years to own up to the fact that he had quit and remove his name from the membership list.) The flip side of the coin, of course, is that any club that won't have you looks awfully good. As one member put it: "Once you're in, the academy is pretty boring, but when you're out of it—it just eats people up."

–Faye Flam

New Academy Members

The following 54 men and five women were elected to membership of the academy, bringing total U.S. membership to 1651. In addition, 14 foreign members were elected.

Jan D. Achenbach, Northwestern University; **Thomas J. Ahrens**, California Institute of Technology; **Abram Amsel**, University of Texas, Austin; **Neal R. Amundson**, University of Houston; **Hans C. Andersen**, Stanford University; **James G. Anderson**, Harvard University; **George E. Bruening**, University of California, Davis; **Donald L. Burkholder**, University of Illinois, Urbana; **John D. Corbett**, Iowa State University; **William R. Dickinson**, University of Arizona; **Anthony S. Fauci**, National Institute of Allergy and Infectious Diseases; **Jerome I. Friedman**, Massachusetts Institute of Technology.

Yuan-Chen B. Fung, University of California, San Diego; **Robert G. Gallager**, Massachusetts Institute of Technology; **Margaret J. Geller**, Smithsonian Astrophysical Observatory and Harvard University; **William T. Greenough**, University of Illinois, Urbana; **Carol A. Gross**, University of Wisconsin, Madison; **Martin C. Gutzwiller**, IBM T.J. Watson Research Center, Yorktown Heights, N.Y., Columbia University; **John C. Harsanyi**, University of California, Berkeley; **James J. Heckman**, University of Chicago; **Stephen F. Heinemann**, The Salk Institute, University of California, San Diego, Medical School; **Melvin Hochster**, University of Michigan; **Daniel H. Janzen**, University of Pennsylvania, Philadelphia; **Thomas J. Kelly Jr.**, Johns Hopkins University School of Medicine.

Henry W. Kendall, Massachusetts Institute of Technology; **Hans (Janos) Kende**, Michigan State University; **Robert S. Langer**, Massachusetts Institute of Technology; **John H. Law**, University of Arizona; **Ronald D. Lee**, University of California, Berkeley; **Stanley Lieberson**, Harvard University; **Olga F. Linares**, Smithsonian Tropical Research Institute, Balboa, Panama; **Richard M. Losick**, Harvard University; **Phillip F. Low**, Purdue University; **George Lusztig**, Massachusetts Institute of Technology; **Robert MacPherson**, Massachusetts Institute of Technology; **Christopher F. McKee**, University of California, Berkeley.

Steven L. McKnight, Carnegie Institution of Washington, Baltimore, and investigator, Howard Hughes Medical Institute; **Henry Metzger**, National Institute of Arthritis, Musculoskeletal and Skin Diseases; **Harry F. Noller**, University of California, Santa Cruz; **Bert W. O'Malley**, Baylor College of Medicine; **Thomas D. Pollard**, Johns Hopkins University School of Medicine; **Stanley B. Prusiner**, University of California, San Francisco; **Randy W. Schekman**, University of California, Berkeley, and investigator, Howard Hughes Medical Institute; **Stuart F. Schlossman**, Harvard Medical School and Dana-Farber Cancer Institute; **Richard R. Schrock**, Massachusetts Institute of Technology; **George E. Seidel Jr.**, Colorado State University; **Paul B. Sigler**, Yale University, and investigator, Howard Hughes Medical Institute; **Susan Solomon**, Aeronomy Laboratory, National Oceanic and Atmospheric Administration, Boulder, Colorado.

JoAnne Stubbe, Massachusetts Institute of Technology; **F. William Studier**, Brookhaven National Laboratory; **Harry L. Swinney**, University of Texas, Austin; **Jan Tauc**, Brown University; **George A. Thompson**, Stanford University; **Wylie W. Vale Jr.**, The Salk Institute; **Peter M. Vitousek**, Stanford University; **Bert Vogelstein**, Johns Hopkins University School of Medicine; **Allan R. Wagner**, Yale University; **Raymond L. White**, University of Utah Medical Center, and investigator, Howard Hughes Medical Institute; **David J. Wineland**, National Institute of Standards and Technology, Boulder, Colorado.

Foreign Associates

Carl J. Ballhausen, University of Copenhagen (Denmark); **Amyand D. Buckingham**, Cambridge University, England (Australia); **Cornelis T. deWit**, Agricultural University of Wageningen (Netherlands); **Jacques Friedel**, Université Paris Sud, Paris (France); **Stephen W. Hawking**, Cambridge University (England); **Paul F. Hoffman**, Geological Survey of Canada (Canada); **Robert McC. May**, Oxford University and Imperial College, London, England (Australia); **Ernesto A. Medina**, Instituto Venezolano de Investigaciones Cientificas, Centro do Ecologia, Caracas (Venezuela); **Lennart Philipson**, European Molecular Biology Laboratory, Heidelberg, Germany (Sweden); **David Pilbeam**, Harvard University (England); **Jacques Tits**, Collège de France, Paris (Belgium); **John C. Waterlow**, London School of Hygiene and Tropical Medicine (England); **Kurt Wüthrich**, Eidgenossische Technische Hochschule, Zurich (Switzerland); **Meinhart H. Zenk**, Munich University (Germany).