

THE NOBEL PRIZES AT 90

Choosing Nobel Prize winners is an exhausting, complex process that culminates in the award ceremony each December in Stockholm.

For the 90th anniversary 130 previous laureates celebrated along with the newest winners.

Gloria B. Lubkin

When the Royal Swedish Academy of Sciences announced on 14 October that Georges Charpak of CERN is the winner of the 1992 Nobel Prize in Physics "for his invention and development of particle detectors, in particular the multiwire proportional chamber," the academy was continuing the process begun in 1901, when the physics prize was awarded to Wilhelm Röntgen for the discovery of x rays. Over the ensuing nine decades, the selection process has been remarkable for its secrecy, the care with which it is done, and the high quality of the research honored.

Last December roughly 130 previous Nobel laureates gave talks to students and attended conferences and celebrations in Stockholm, Oslo and other Swedish and Norwegian sites to celebrate the 90th anniversary of the Nobel Prizes. The Nobel Jubilee culminated in the award of the 1991 prizes on the anniversary of Alfred Nobel's death, 10 December—at ceremonies held in Oslo for the peace prize and in Stockholm for the prizes in physics, chemistry, physiology or medicine, literature and economics.

The Jubilee brought together an extraordinary assemblage of great scientists. One might have expected that the celebrations in Stockholm would be a tremendous letdown to the previous laureates, who, the last time they attended, were the center of world acclaim. But several laureates remarked that they were delighted to have the freedom from the strict scheduling they experienced the week they were in Stockholm for their own prize ceremonies. (As an example, when I was checking my news story about the 1990 Nobel Prize with Jerome Friedman in Sweden, he called me from a limousine en

FELIX AEBERLI, SWISS ILLUSTRATED



Physics laureates gathered for this group photo after the 1991 Nobel lectures in physics and chemistry on 9 December. From left: Leo Esaki, Heinrich Rohrer, Arthur Schawlow, Robert W. Wilson, Donald Glaser, Richard E. Taylor, Nicolai G. Basov, Pierre-Gilles de Gennes, Nicolaas Bloembergen, Samuel C.C. Ting, Klaus von Klitzing, Norman F. Ramsey, Melvin Schwartz. In all, 44 physics laureates attended the Nobel Jubilee.

route to a lecture, the only free time he could find during Nobel week.)

The jubilee also marked the retirement of Stig Ramel, the executive director of the Nobel Foundation since 1972. During his tenure he was so successful at investing the Nobel endowment that the value of the award increased from \$100 000 in 1972 to \$1 million in 1991 and \$1.2 million in 1992.

Many physicists dream of journeying to Stockholm to accept the Nobel Prize or, failing that, at least to attend the ceremony and festivities, and experience the excitement and glory at least vicariously. My *PHYSICS TODAY* colleague Barbara Levi and I made that journey when we, along with a handful of other journalists, attended the jubilee at the invitation of the Nobel Foundation and the Royal Swedish Academy of Sciences.

How to pick a prizewinner

The process by which prizewinners are selected is a mystery to many, although every year hundreds of scientists participate. The Nobel Committee for Physics of the Royal Swedish Academy of Sciences consists of five members of the academy who are responsible for recommending to the academy who should be awarded the prize each year. The 1991 committee members were Ingvar Lindgren (Chalmers University of Technology, Gothenburg), chair; Cecilia Jarlskog (Stockholm University), Erik Karlsson (Uppsala University), Bengt Nagel (Royal Institute of Technology, Stockholm) and Carl Nordling (Uppsala University). The secretary of the committee is Anders Barany (Manne Siegbahn Institute, Stockholm). The current system is that a member serves 12 years at

most, with the expiration of terms staggered to provide continuity on the committee. At one time, there was no limit on how long members served. Manne Siegbahn, who won the Nobel Prize in 1924, served for 40 years (1923–62).

Each year the academy solicits nominations from Swedish and foreign members of the academy, previous Nobel laureates in physics and chemistry, physics professors in the Nordic countries and at 40 to 50 universities around the world (typically including 5 to 10 leading US universities), and individuals on a list of distinguished physicists that typically has 150 to 200 names. The lists of universities and individuals are updated each year, and an attempt is made to rotate the university invitations—though some of the most prestigious universities are consulted more frequently than others. Over the years Harvard faculty have won so often that, according to legend, the champagne is kept chilled every year in early October, just in case. Stig Lundqvist of Chalmers University, who served on the Nobel Committee for Physics from 1971 to 1985, the last few years as chairman, and who continued to be closely involved in the selection process until 1987, says that people on the list of distinguished individuals include editors of leading physics journals, directors of big laboratories, such as Fermilab and CERN, and people from industrial labs such as AT&T Bell Labs and IBM.

Nominations are due before 1 February each year. The evening of 31 January committee members go through the mail and add additional nominations “if we missed something urgent,” Lundqvist told me. “Suppose the Bardeen–Cooper–Schrieffer theory was nominated and that all nominators forgot to nominate Bardeen.



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Chemistry laureates posed for this group photo after the Nobel lectures. From left: Jerome Karle, Sidney Altman, Yuan T. Lee, Johann Deisenhofer, Hartmut Michel, R. Bruce Merrifield, Richard R. Ernst, Herbert C. Brown, Dudley R. Herschbach. At extreme right is physics laureate Hans G. Dehmelt, who was absent when the physics photo was taken. In all, 38 chemistry laureates attended the jubilee.

Then of course we'd throw in his name to make him eligible." But such last minute adjustments are a rare occurrence.

Jarlskog explained that to be eligible for the Nobel Prize in a given year, a candidate must get at least one valid nomination for the year in question. Old nominations, although not valid for that year, are often consulted by referees and committee members.

Next the committee members make a list of top candidates for the physics prize and compile another list of external authorities who could be asked to report on the proposals and make a recommendation. "That's very important," Lundqvist said, "especially for new people, where we don't have any material on them. We'd like in our files a complete set of reports on all the strong candidates. The external reviewers can be anywhere in the world. We're just trying to find the best people who can help us. We usually avoid people who want the Nobel Prize themselves." Lundqvist recalls one well-known physicist who was asked to be an external reviewer. "He didn't do what we asked, and he more or less said, 'Why don't you give the prize to me?' It's really amusing when it happens."

Over a buffet dinner in an academy building where the rooms were decorated with 19th-century folk paintings of Bible stories, Ingmar Bergstrom (retired head of the Manne Siegbahn Institute) mentioned that when considering Peter Kapitsa for the prize, the committee knew that one of his key papers was published after a key paper by someone else had already been published in England. But the committee learned that the delay in Kapitsa's publication was a result of the slowness of mail from the Soviet Union during the 1920s. Kapitsa received the prize in 1978.

One year Asher Peres, then chair of the physics department at the Technion, in Haifa, Israel, nominated Israeli Prime Minister Menachem Begin for the Nobel Prize in Physics. Peres's justification was that Begin deserved the Nobel Prize in Physics at least as much as the Nobel Peace Prize, which he had won in 1978. After the Nobel committee received a letter of apology from a high Israeli government official, Lundqvist said, the committee replied: "We don't feel offended at all. We're just amused that Jewish humor still exists in Israel in spite of bad times."

(Hearing that story reminded me of an incident involving Arno Penzias. When he was in Stockholm to accept the Nobel Prize from King Carl XVI Gustaf in 1978, Penzias told me, he heard the king mention that the last time the Nobel Prize in Physics had been awarded for astrophysics was "the Jewish prize." Penzias was baffled for quite a while until the king mentioned "Ryle and Jewish." Then Penzias realized he was talking about the award to Martin Ryle and Anthony Hewish in 1974.)

Each year early in March the Nobel Committee for Physics meets with all the physicist members of the academy (25 to 30 people), who make the decision on the external reviewers. The reviewers are given until mid-May to return their reports. "Then we start the serious work," Lundqvist said. "The Nobel committee has a series of meetings over the summer. Sometimes it goes quick. Sometimes we meet all summer, every week or every two

weeks." By the latter part of August, the year's work is written up and made into a book, typically one inch or so thick. "That contains the discussion and conclusions of the committee and also the external reviews. We go through physics by subfield. In each field—particle physics, nuclear physics, astrophysics, plasma physics, atomic physics, condensed matter physics—we discuss the best candidates. Then we write a final section where we say out of all these excellent people we now propose to give this year's prize to Doctors X, Y and Z, and we give the citation. Then we all sign it. We mention about ten people who could receive the prize—maybe three or four names in particle physics, some in lasers and atomic physics, some in condensed matter and so on. That's what the menu looks like. Then we make a final recommendation for just one. Usually this proposal works. We have two meetings with all the academy physicists in September or early October before the thing goes to the entire academy. We're just doing the homework for the academy. The Nobel committee has no decisive authority." The academy physicists either approve the committee's recommendation or change it. "It doesn't happen often, but it has happened," Lundqvist said.

All members of the academy (including economists, chemists, biologists and so on) meet during the second week in October to vote on the physics prize. The committee chairman presents a sort of "state of the union" talk to the entire membership, telling about candidates in different fields and the outcome of the referees' reports. Afterwards a more detailed presentation of the proposed award is given by an expert, usually a committee member. Then the president of the academy asks if anyone wants to give a different proposal. "Sometimes someone in the audience objects. He'll propose you delete one of the candidates from the list because he doesn't like the guy," Lundqvist remarked. A secret ballot is held to select the winner. There is also the option of not giving the prize at all; that has happened six times since 1901.

In the past the academy sent the winner a cable, which sometimes didn't arrive until the following day. But journalists would call the winner as soon as the prize was announced. The announcement is now handled differently: The secretary general of the academy calls up the winner or winners, and only then is the press informed.

How the winner learned the news is often an amusing tale. At a luncheon one time, Eugene Wigner described to me his attitude toward honors in science. He said he was opposed to the whole idea of the National Academy of Sciences and to the awarding of prizes such as the Enrico Fermi Prize, the National Medal of Science and so on (all honors he'd received). One time, however, the canonical phone call in the wee hours of the morning occurred. His wife answered the phone, he told me, and a reporter said to her, "Your husband has won the Nobel Prize in Physics." She replied, "But he doesn't want it." Wigner told me he grabbed the phone away from his wife at that point.

The day J. Robert Schrieffer's Nobel Prize was announced, he had driven from Philadelphia in a heavy rain to do some consulting at Exxon. As he drove into the parking lot, his Exxon colleague Fred Gamble stopped him to say, "Bob, you got the Nobel prize." Schrieffer thought it was a joke designed to divert his attention from a manuscript he was to discuss that day with Gamble.

Lindgren recounted the tale of attempting to call

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Jubilee session at Stockholm University on 7 December dealt with the boundaries of physics, from the smallest to the largest. In front row are laureates Charles Townes (third from left) and Ivar Giaever (fifth from left). Second row contains laureates Wilson, Glaser, Jerome Friedman, Ramsey, Ting. Laureates Dehmelt and Simon van der Meer sit in the third row.

Norman F. Ramsey (Harvard University) in October 1989 to tell him he had won the Nobel Prize. The committee thought he was in Washington, DC, at the time. When the committee reached the phone number listed for Norman F. Ramsey, the person who answered the phone said he didn't think his father could have won the physics prize because he was an economist. The day after Lindgren told this story, Ramsey, hearing it for the first time, told about the time the Nobel Committee for Chemistry reached a dry cleaner by mistake and informed him he'd won the Nobel Prize. He responded, "I knew there was chemistry in dry cleaning, but I didn't realize there was that much!"

Lundqvist says that serving on the Nobel Committee for Physics is hard work. "We read all the important papers as well as the reports for all the prominent nominations. We discuss the actual physics in our meetings. Several times we've asked an outsider to present a private seminar to us. We want a firsthand understanding of what we're recommending."

Over the last two decades or so, committee members have had better international connections than did earlier committees. Members serve on journal editorial boards, attend lots of conferences and get acquainted with experts throughout the world. However, some distinguished committee members of the past, such as Oskar Klein and Ivar Waller, were very well connected internationally. Waller served 28 years on the Nobel committee and helped it in its work almost until his death two years ago at age 92.

Nobel Jubilee

At one of the many jubilee sessions, this one held at the Royal Institute of Technology in Stockholm on 6 Decem-



Lunching at the Grand Hotel were Val Fitch and Dehmelt.

ber, the topic was the relationship between science and technology. Dudley Herschbach (Harvard) told a story about David Hilbert, who was both a pure and an applied mathematician. At a special congress held to reconcile pure and applied math, Hilbert declared: "There can be no conflict. They have nothing to do with each other." Herschbach doesn't share that view about pure and applied science. He went on to say: "I think of chemistry as a Cinderella science. The sister sciences of physics and biology have gotten a lot more attention than chemistry." But now, he said, Cinderella is rising from the ashes and soot. One such example is buckyballs, which were discovered in ordinary soot during basic research but are likely to lead to important applications.

Val Fitch (Princeton) raised the question of how one can convince the public that basic research is valuable. "The public always extols the invention rather than the basic discovery." Fitch cited Edward Purcell's Nobel lecture, in which he said that after his discovery of nuclear

magnetic resonance he looked at snow with new eyes—"the snow lying on his doorstep full of protons quietly precessing in the Earth's magnetic field." Fitch noted that the public has shown no appreciation of Purcell's discovery despite the impact of magnetic resonance imaging.

Fitch also recalled an episode from when he was president of The American Physical Society. He appointed a committee to look at the future of publishing, which he thought would recommend putting the journals on compact disks. It didn't. Ramsey remarked that the missing step is how to get the idea out of the paper or the compact disk and into the mind of the scientist who can best use it.

A member of the audience asked, How can a small country like Sweden justify doing basic research? Herschbach noted: "In the limit, if all countries adopt that attitude, humanity will suffer. When a country does have basic research, you're more likely to have people who recognize the possibilities. What these Nobel prizes deliver each fall is the message 'These kinds of efforts really are important to mankind.'"

Another session, later in the day, dealt with creativity and big science. Friedman gave an intriguing look at the impact of a large group on creativity. (A table he presented is reproduced below.) He noted that a discovery can be planned (such as the W or the top quark) or a surprise (such as strange particles, CP violation or the tau). Friedman had a controversial suggestion: For the first few years of a detector's operation, he proposed, all members of a collaboration should be authors on publications reporting planned discoveries. But on papers reporting surprise discoveries or topics not in the proposal, the authorship should be limited to the members of the collaboration who motivated the search and did the analysis. After five years, the detector should be treated like any other laboratory facility, in which outside groups can join in experiments. He also proposed that the data be made available to any qualified physicist five years after they are obtained.

(When Jarlskog presented Friedman, Henry Kendall and Richard Taylor at the 1990 Nobel Prize ceremony, she recalls, Queen Silvia became so interested in quarks that she asked Jarlskog for a later meeting to hear more about them.)

Melvin Schwartz (Brookhaven National Laboratory) recalled that in 1970 he proposed to put 42 feet of steel shielding between the beam dump at SLAC and a detector and see what happened, looking in particular for any

neutrino-like objects, such as heavy leptons. After a committee turned the proposal down three times, "I cooked up a cockamamie idea: Shaking strange particles might make strange light." The committee finally approved the proposal with a reduced scope, using earth as a shield and putting the detector 200 feet away. By 1972 Schwartz's team had found events with no muons that in retrospect were clearly neutral-current events. At the time of the experiment, "the world wasn't looking for them yet," Schwartz said. "The events were called Melons." Meanwhile Schwartz had founded a computer company called Digital Pathways. By 1979-80 he got tired of commuting to Fermilab and Brookhaven and left Stanford to spend full time running a successful business. "When I got the Nobel Prize [in 1988] I felt it was time to go back to physics." He is now an associate director of Brookhaven, where he oversees nuclear and high-energy physics. Schwartz told the audience that two large detectors will be built at Brookhaven's Relativistic Heavy Ion Collider. After the first few experiments, the detectors will be available as a user facility.

(One additional outcome from Schwartz's winning the prize is more personal. When he came to Stockholm with his family for the Nobel Prize ceremony, they stayed, as all laureates do, at the Grand Hotel. His daughter Betty, who was studying to be a professional baker, spent a morning in the kitchen at the hotel during Nobel week. She returned to the Grand Hotel in 1990 to work there for a year. While working in the kitchen she fell in love with a new chef, Fabrice Marcon, who had previously studied with Paul Bocuse. During the Nobel jubilee she married Marcon in a ceremony held at the Stockholm City Hall.)

John Heilbron (University of California at Berkeley) proposed that the Royal Swedish Academy of Sciences reinterpret Nobel's will so that a Nobel Prize can be given to a group, instead of limiting the awardees to three people. (See his article in this issue on page 42.)

Samuel Ting (MIT) told the audience, "One of the problems of getting the Nobel Prize early is you get to run a large group."

That evening, after the creativity session, over dinner at the Manne Siegbahn Institute, Lindgren commented on the meat being served. Some thought it was elk, others that it was venison. Lindgren said that at the small dinner for the year's prizewinners hosted by the king the night after the huge banquet of 10 December, it is traditional for the guests to eat venison from the king's own hunt.

The 1991 laureates

Despite the galaxy of Nobel laureates assembled in Stockholm, the 1991 laureates were still the focus of world attention. At a press conference held at the Academy of Sciences on 7 December the laureates for physics, chemistry and economics sat at a marble table, surrounded by about 50 reporters and photographers.

Levi asked the winners how creativity can be encouraged. Physics winner Pierre-Gilles de Gennes (Collège de France) said that France's form of education is very strict, so that students "are exhausted by the time they graduate. In my case, because of World War II, I was never in a conventional school until the second year of high school." He considered that happenstance very fortunate. Chemistry winner Richard Ernst (ETH, Zurich) said that in an educational system where students have to sit for 20 or more years on school benches, it is astonishing that anyone can remain creative. "You have to

Creativity and big groups

Aspects of creativity	Impact of big group
Generally younger people	Collaborations managed by older people
Creativity is driven by one or a few people	Group consensus needed
Unorthodox approaches— involves risk taking	Groups tend to be conservative
There should be appropriate recognition and rewards for creative people	"Who did what?" is the question re promotions



Press conference at the Royal Swedish Academy of Sciences on 7 December. From left: Ronald H. Coase (1991 economics laureate), Ernst (chemistry), de Gennes (physics), Carl-Olof Jacobson (secretary general of academy). Photos by Lars Falck, Stockholm.



De Gennes and Ernst (right) respond to reporters' questions.



work actively on a project that really interests you. Then the ideas will come." Economics winner Ronald Coase (University of Chicago) said: "It's easy to be creative in Chicago because the weather is so bad. It's not so easy in California." Coase remarked that never having taken a course in economics "has meant I'm very free in my thinking."

On 9 December, the Nobel lectures in physics and chemistry were presented in the auditorium of the academy. DeGennes's lecture was called "Soft Matter: A Tale of Mud and Dust." The title, he said, was inspired by the tales of Lawrence of Arabia. His talk ranged from polymers to colloids to smectic crystals. He concluded with a slide showing an 18th-century painting of children blowing bubbles. Below it was a caption in French that translated roughly as "All is illusion: fame, wealth, power. In the end it is just soap bubbles." Ernst's lecture was devoted to nuclear magnetic resonance Fourier spectroscopy.

The awards ceremony itself was held for the first time in the Stockholm Globe Arena, a new sports complex, rather than the Stockholm Concert Hall, to accommodate the 5500 guests invited for the event. All the guests wore formal clothes—men in white tie and tails, women in long evening dresses. As I checked my coat and saw the elegantly attired guests, many of whom wore military decorations, I felt like I was part of an operetta. Once in the huge auditorium of the arena, many of the guests took turns photographing each other on the stage, which was decorated with banners, flowers, a bust of Alfred Nobel and a gigantic Nobel medal.

When the ceremony began at 4:00 pm, about 130 pre-1991 laureates, some in academic gowns, marched to their places on stage while the Stockholm Philharmonic played. After the king and queen made their entrance, the 1991 laureates entered and were seated on the left. The seating order is governed by protocol, with the highest rank



Reception at Royal Swedish Academy of Sciences. Top from left: Steven and Louise Weinberg, Leon Lederman, Guy von Dardel (academy member). Second from top: Coase, de Gennes, Ernst. Third from top: Per Carlson (academy member), Rita and Richard Taylor. Bottom: Hans Frauenfelder, Alex and Inge Müller. Photos by Falck.



determined by the order of the disciplines in Nobel's will. Seated closest to the audience was the physics winner, de Gennes, then Ernst, then Erwin Neher and Bert Sakmann, who shared the prize for physiology or medicine, then Nadine Gordimer, the literature winner, and finally Coase. Each of the winners was introduced by a member of the appropriate Nobel committee. Following the presentation of the awards by the king, an 80-person choir performed a jubilee cantata composed for the occasion.

Because of the jubilee, instead of a single banquet after the award ceremony, three were held. The banquet held in the Blue Hall of Stockholm City Hall was hosted by the king and queen. At the head table were the king and queen, the laureates and their spouses, and the ambassadors from the prizewinners' countries. After a toast to Alfred Nobel's memory, the Nobel Prize winners were asked to give brief speeches of acceptance.

Chemistry winner Ernst said in his speech: "Science prizewinners have a tendency to distort science history. Individuals are singled out and glorified that should rather be seen embedded in the context of the historic development. Laureates are suddenly supposed to behave like unfalling sages, although they might have been just work addicts in the past."

Physics winner de Gennes said: "This is the first and probably the last time in my life where I have dinner with queens and princesses. I am worried. I suspect that with the chimes of midnight I will be turned into a pumpkin."

"I have come often to this beautiful city of Stockholm. As a matter of fact once in 1974 I attended a banquet in this very same room. This was during a conference on liquid crystals and I was asked to give a three-minute talk. But in those days I still had some common sense. I said, 'No, this is too hard.' My friend Tony Arrott took over and did very well."

"But now I finally understand why I have been given this fabulous prize—not because of some scientific achievement but because the Swedes are stubborn. They wanted me to give a three-minute talk in this hall."

When the acceptance speeches were concluded, we were served a four-course banquet. The china, glasses, linens and flatware had all been designed especially for the jubilee. Each course represented one of the four seasons and was carried into the Blue Hall in a choreographed procession. Dessert, *glace Nobel à la vanille et aux myrtilles*, was introduced by a wintry ballet.

At 10:00 the banquet ended, and we moved upstairs to the Golden Hall, where a lively orchestra played dance music until midnight. Laureates jitterbugged, danced to rock and roll, and generally had a ball. At 10:30 the proceedings were interrupted by a gala fireworks show; most of us headed for the lawn to watch the dazzling display in the chilly Stockholm night air. A student carnival began in the Blue Hall at midnight and wound up at 2:00 am.

Murray Gell-Mann (Caltech) remarked after the Nobel Jubilee: "I visualized a great many people with large egos packed into a bus and imagined the Jubilee might be painful. Instead, it was really a lot of fun." ■