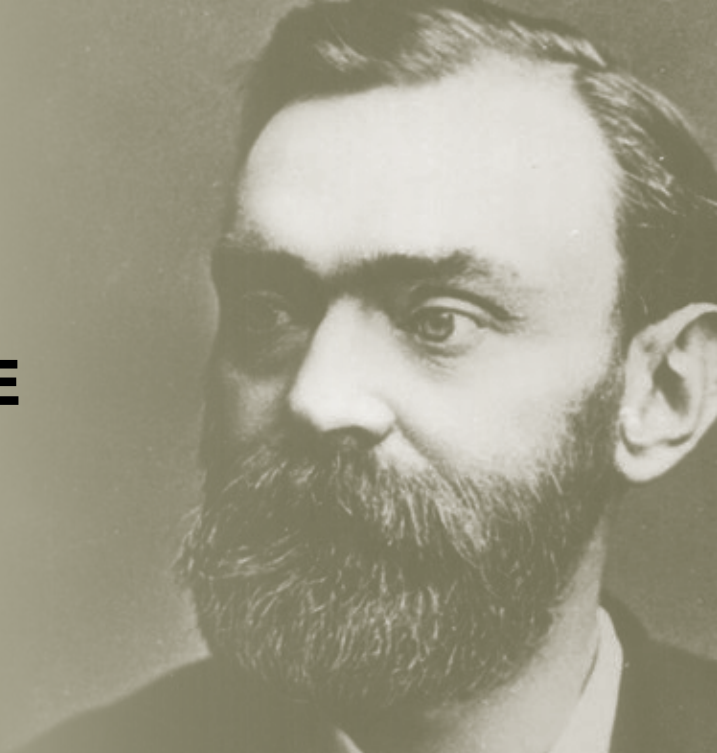


ALFRED NOBEL AND THE NOBEL PRIZES*

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The second week of October is for many a thrilling and important week, since this is the week when the names of the laureates of the five Nobel Prizes are announced. On the Tuesday of that week the name of the recipient of the Nobel Prize in Physics is revealed and recognition is given to his/her work. The awarding institution for the Nobel Prize in Physics is the Royal Swedish Academy of Sciences. The main working body, responsible for most of the work involved in selecting Nobel Prize laureates however, is the Nobel Committee for Physics. How that Committee works, from the start of the preparatory work in the month of September and throughout the process which ends with the Nobel Prize Award Ceremony in the Stockholm Concert Hall on December 10 the following year, is not so widely known. Also not well known is the story of Alfred Nobel and how he created the immense fortune which, in accordance with his will, was to be used to create a series of prizes to be awarded those who confer the “greatest benefit on mankind” in physics, chemistry, peace, physiology or medicine, and literature.

1 Alfred Nobel

Alfred Bernhard Nobel was born on October 23, 1833 in Stockholm, Sweden. He was the third son of Immanuel and Andriette Nobel. His father Immanuel was an engineer, architect, inventor and industrialist. One of his inventions was for example the rotary lathe used in modern plywood manufacturing. Following some business failures Immanuel Nobel left Stockholm for St. Petersburg in 1838 hoping to do better there. He left his wife and children in Stockholm the first years. He achieved great success in St Petersburg as a manufacturer of machine tools and explosives and, after four years, in 1842 his family joined him. Now, after having acquired a decent economy his parents could send Alfred to private tutors. Alfred was a very bright pupil

and he excelled particularly in chemistry and languages. He acquired fluency in English, French, German, Russian and later also Italian. He had the privilege to study chemistry under the guidance of the well-known Russian chemist Nikolai Zinin. In 1850 he got the opportunity to go to Paris to continue his chemistry studies and at the age of 18 he went to the United States where he studied chemistry for a further four years.

The success in St. Petersburg for the Nobel factory was to a large extent due to their production of armaments for the Crimean War. After the end of the war in 1856 there was a shift in Russian policies. The new Tsar, Alexander II, ordered a severe cut in the military budget that eventually placed Immanuel's company in serious economic

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Bertha Kinsky



Sofie Hess



Ragnar Solman

difficulties. Alfred's elder brother Ludvig took over the St. Petersburg Company and Immanuel, with the rest of the family, returned to Sweden in 1859.

From the time when Alfred came back to Sweden he devoted himself to the study of explosives. He was especially interested in trying to develop a safe manufacture and use of nitroglycerin. Nitroglycerin is a colourless, oily chemical, which is very unstable and detonates very easily. It was the Italian chemist Ascanio Sobrero, who had first discovered nitroglycerin in 1847. Nitroglycerin was the first practical explosive ever produced that was stronger than black powder.

After their return from Russia the Nobel family had built a laboratory in Stockholm, at a place called Heleneborg, where they continued their dangerous work with explosives. Several accidents occurred in the course of this work. The most disastrous one, on Saturday, September 3, 1864, killed six workers, among them Alfred's youngest brother Emil.

The breakthrough was when Alfred Nobel found that when nitroglycerin was incorporated in an absorbent inert substance like kiselguhr (diatomaceous earth) it became safer and more convenient to handle. Alfred's work with nitroglycerin had started in 1860 and he got the mixture with kiselguhr patented in 1867. This new explosive was named dynamite and its power was first demonstrated in England the same year.

Alfred Nobel continued his experiments and combined nitroglycerin with gun-cotton, which turned out to be an even more powerful explosive than dynamite and it was patented as Gelnite in 1876.

With companies in many different places Alfred had to travel a lot in order to maintain them. Alfred's success as a businessman made him finally a very wealthy man. At his time of death Alfred had 355 patents and owned factories in many countries in Europe and North America.

In 1873 he selected Paris as his permanent home and he lived there until 1891. In Paris he built a laboratory and as a curiosity one may also mention that he bought a couple of white horses, which he used for his Sunday trips in

Bois de Boulogne. These horses played, as we shall see later, a very important role in the history of the Nobel Prizes.

Alfred Nobel remained unmarried throughout his life. There were, however, two women that played important roles in his life, Bertha von Suttner and Sofie Hess. In 1876 the following advertisement appeared in the "wanted column" of a Viennese newspaper: "A very wealthy, cultured, elderly gentleman, living in Paris, desires to find a lady also of mature years, familiar with languages, as secretary and manager of his household." He got an answer from an unmarried, 33 year old woman called Bertha Kinsky. After some exchange of letters Bertha came to Paris and became Alfred's secretary. The problem was that she actually was engaged at the time to a Baron von Suttner. A week after her arrival Alfred was forced to leave Paris for urgent business matters and when he returned home three weeks later Bertha had left Paris and gone back to Vienna. Within a month she married Arthur von Suttner. Even if Alfred and Bertha were only together for a brief time they continued to keep contact and corresponded with each other throughout the years until Alfred's death. It is believed that Bertha had a major influence on Alfred's decision to include a peace prize in his will. Bertha became a leading figure in the peace movement with the publication of her novel, *Die Waffen nieder!* ("Lay Down Your Arms!") in 1889 and she founded an Austrian pacifist organization in 1891. Bertha von Suttner was awarded the Nobel Peace prize in 1905 "for her sincere peace activities".

The fact that Bertha left Paris so suddenly made Alfred depressed and he went to Baden bei Wien to recover and take care of his health. There he met a twenty-year-old girl, Sofie Hess, working as a salesgirl in a florist shop. Alfred and Sophie began a relationship that lasted for 18 years.

In 1891 he got into problems with the French authorities and decided to move to San Remo in Italy. There he bought a house, erected a chemistry laboratory (fig. 1) and carried out weapon tests (fig. 2). His house in San Remo, Villa Nobel, is today open for the general public as a museum.



Fig. 1 Alfred Nobel's private laboratory in his house in San Remo. This was the place where he was happiest and during a period of time he worked daily together with Ragnar Solman in the laboratory (photo: L. Bergström).



Fig. 2 A cannon that Alfred Nobel shipped from his Bofors factory and used for test-firings in San Remo. This cannon is still in the garden of Villa Nobel (Photo: L. Bergström).

Two years later, in 1893, he bought the Bofors Steel Factory in Sweden and made it an arms factory. He had also built a house with a laboratory in Bofors. His white horses in Paris were now shipped to Sweden and placed in a stable in Bofors. In early December 1896 Alfred Nobel suffered a stroke and died from it on December the 10th.

2 The will

Alfred Nobel's handwritten will was signed in Paris on November 27, 1895. When the will was opened after his death it was a great surprise for those present that the largest part of his estate, amounting to 33 million Swedish crowns, was supposed to be put into a fund financing the Nobel Prizes. His family were bequeathed only 2 million crowns. Another significant aspect was that Alfred put Ragnar Solman as the executor of his will. Solman, an engineer and chemist, who had been Alfred's personal assistant since 1893, now had to start the process of executing the will. Realizing that the assets of Alfred Nobel were located in several countries, the executors first decided to move most of these to Sweden. Suspecting that French authorities might make claim to the money and block its transfer, Solman together with another young engineer, Rudolph Liljequist simply went around the banks in Paris with a horse and carriage and collected the shares, bonds and other documents belonging to the Nobel estate. The documents were then packed into crates and shipped back to Sweden from one of the Paris railroad stations, Gare du Nord, as registered luggage.

Back in Sweden, Ragnar Solman played a very important role in executing the will of Alfred Nobel. He was instrumental in establishing the Nobel Foundation and organizing its cooperation with the prize-awarding institutions. Even if Solman

Alfred Nobel (on the left) with his colleague Robert Strehlenert at Villa Nobel in Sanremo, 1896.

had succeeded in bringing all documents to Sweden there was an attempt from the French authorities to get the money back since they considered Alfred's home to be in Paris. A French lawyer, working for Solman, solved this problem: He found a paragraph in the French law that stated "a man's home is where he has his horses"... In this way the stable in Bofors, where Alfred Nobel kept his white horses, became of major importance for the Nobel Prizes.

A translation of part of Alfred Nobel's handwritten will is given in fig. 3. One should especially note the clear difference between the physics and chemistry prizes. The physics prize is given for "a discovery or an invention", while the chemistry is given for "a discovery or an improvement".

The Nobel Prizes were first awarded in year 1901. The physics laureate was Wilhelm Conrad Röntgen, who got the prize "in recognition of the extraordinary services he had rendered by his discovery of the remarkable rays subsequently named after him".

3 The work of the Nobel Committee for Physics.

I was a member of the Nobel Committee for Physics for seven years and acted as its chairperson in 2012. In the following I give an outline of the way the work is performed by the Committee. The work has a general structure that is repeated year after year but in many places I just give the specific example just from the year 2012.

Selection of the Committee members

The Nobel Committee is appointed by The Royal Swedish Academy of Sciences on recommendations put forward by its Class of Physics. The Academy consists of ten classes and its third class is the Physics Class. The Committee members are elected for a period of three years and are normally selected from among the members of the Academy. The Committee members may be re-elected twice. There is also a possibility to appoint adjoint members for one-year periods. The Committee has a scientific secretary appointed without a specific time limit. Since the year 1900 there have only been seven different secretaries.

"I, Alfred Bernhard Nobel, hereby declare, after due consideration, that with regard to the estate that, after my death, I will leave behind.

(.....)

The whole of my remaining realizable estate shall be dealt with in the following way: the capital, invested in safe securities by my executors, shall constitute a fund, the interest on which shall be annually distributed in the form of prizes to those who, during the preceding year, shall have conferred the greatest benefit on mankind. The said interest shall be divided into five equal parts, which shall be apportioned as follows: one part to the person who shall have made the most important discovery or invention within the field of physics; one part to the person who shall have made the most important chemical discovery or improvement; one part to the person who shall have made the most important discovery within the domain of physiology or medicine; one part to the person who shall have produced in the field of literature the most outstanding work in an ideal direction; and one part to the person who shall have done the most or the best work for fraternity between nations, for the abolition or reduction of standing armies and for the holding and promotion of peace congresses. The prizes for physics and chemistry shall be awarded by the Swedish Academy of Sciences; that for physiology or medical works by the Karolinska Institute in Stockholm; that for literature by the Academy in Stockholm, and that for champions of peace by a committee of five persons to be elected by the Norwegian Storting. It is my express wish that in awarding the prizes no consideration be given to the nationality of the candidates, but that the most worthy shall receive the prize, whether he be Scandinavian or not."

Fig. 3 Translation of parts of Alfred Nobel's handwritten will that was signed by him on November 25, 1895. In accordance with the terms of Alfred Nobel's will the five Nobel Prizes have been awarded to laureates since 1901. For the Nobel Prize for Physics the prize-giving institution is the Royal Swedish Academy of Sciences through its Physics Class and its Nobel Committee.

The nominations

The work with the 2012 Nobel prizes started in September 2011, when the Nobel Committees sent individual invitations to thousands of members of academies, university professors, scientists from numerous countries, previous Nobel Laureates, members of parliamentary assemblies and others, asking them to submit proposals for candidates for the Nobel Prizes. For Physics the following groups are asked to give nominations:

Members of the Royal Swedish Academy of Sciences

- The Nobel Committees
- Previous Nobel Laureates
- Professors of Physics in the Nordic Countries
- Professors of Physics at selected Universities (changes every year)
- Specially invited scientists (non-university)

These nominators are chosen in such a way that as many countries and universities as possible are represented over time. There is a sharp deadline for the nominations to be in Stockholm; they have to be in the hands of the Committee before the 1st of February.

Meetings during the first six months of the year

The first meeting of the Committee takes place in early February. The received nominations have by then been bound together into a booklet where also different statistics concerning the nominations are provided. The Committee works through the nominations and discusses different subjects, proposals and names. After this meeting the members of the Committee have to continue to work in detail with the different nominations during the rest of the month of February.

The second meeting of the year takes place about one month later. At this stage the Committee discusses the nominations more in depth. The Committee collects as much background material as possible to be used in its deliberations. In addition to this an important input for the work is given by reports that the Committee may ask for from external experts. Such reports often provide additional inside information about some

important detailed issues. The nominations where the Committee feels that additional information is needed are discussed and a list of possible external experts is decided upon by the Committee. This list is then presented to and discussed with the Physics Class and a final list of experts that should be contacted is agreed upon. Shortly after letters are sent out with requests for the expert's advice, which should be sent to Stockholm in ordinary letters and be there, at the latest, by the end of May. It is maybe unnecessary to point out that this whole procedure is handled with the utmost discretion.

During the spring joint meetings with the Nobel Committee for Chemistry as well as the Nobel Committee for Medicine or Physiology are organized to discuss common issues.

The next meeting of the Committee takes place in early June. At this stage the reports from the external referees have been received and scrutinized by the Committee. Before the meeting a "Hearing together" with the Physics Class is arranged. Here different general issues, which are important for the Committee work, are taken up and discussed. During the following Class meeting the Chair of the Committee presents a summary of the reports received from the external experts and then describes the plans for the Committee's continued work.

In their closed meeting the Nobel Committee decides how to organize the writing work of the report that has to be produced. This report, produced each year, should eventually become a detailed summary of the deliberations made by the Committee ending with their suggestion of the Nobel laureates for that year.

4 The Work over the summer

The Committee members use the summer for individual writing and at the end of July the Secretary puts all parts of the future report together. What is perhaps the most important meeting of the Committee is then organized as a two-days seminar. On this occasion the tradition is that the Committee members try to meet at a relatively remote place where they may work without being disturbed or recognized. They have over the years been at

several different places in Sweden, for example in a lighthouse, a former bunker, in a small village in mid-Sweden and in the vicinity of Alfred Nobel's home in Bofors.

As Chairperson, the task of finding a suitable place for the 2012 work was entrusted to me. The Committee had until then always had this meeting in Sweden, but this is not a must. So, as a great fan of Italy I thought about San Remo. I may mention that every year at the Nobel Ceremony both the Concert Hall and the City Hall are beautifully decorated with flowers given by the city of San Remo. So, we decided to go there and we found a very nice hotel with a calm (hot) meeting room. During a break in our work we also took the opportunity to visit Villa Nobel as shown in [fig. 4](#).

During this meeting every page of the report was read jointly, discussed and polished. During the meeting we also reached agreement about our proposal for subject and laureates of the 2012 Nobel Prize for Physics. After the meeting in San Remo the changes in the text were introduced and a next to final version was sent out to the Committee within about a week. Then we met once more in Stockholm, about two weeks later, to finalize our report and to sign our proposal for laureates. This second August meeting is to a large extent the final working meeting for the entire Committee. To celebrate this event we ended the meeting traditionally with a dinner at one of the best restaurants in Stockholm. The report, called *Kapprock* in Swedish, was then distributed to the Physics Class.

The report is filed at the Academy and is, together with all minutes of our deliberations, kept secret for the coming 50 years.

5 Deliberations with the Physics Class

When the final version of the report has been sent to the members of the Physics Class, a meeting with them is arranged in the first half of September. On this occasion the Chair of the Committee presents a detailed overview of the deliberations made by the Committee and presents the main parts of the written report, ending by presenting the proposed prize and laureates. Directly after this talk one member of the Committee gives a more



Fig. 4 The 2012 Nobel Committee for Physics outside Villa Nobel in San Remo (photo: L. Bergström).

detailed expert report about the proposed prize. After that the Physics Class and the Committee discuss the Committee work in general and the proposal of the laureates in particular. There is no final decision taken during this meeting. This is instead done some two weeks later when a second September meeting is organized. At this meeting a final decision is taken. The Physics Class may then agree that the proposal made by the Committee should be considered as a joint proposal from the Committee and the Physics Class to be proposed to the Royal Swedish Academy. A short motivation of the decision to be given at the announcement of the prize in the coming October is also decided upon. It should be mentioned that, in principle, the Class might disagree and propose alternative laureates. Then they have to present their own proposal as an alternative in the meeting with the Academy.

6 The announcement of the Nobel Prize

The announcements of the Nobel Prizes are done in the second week of October and the day for the Physics Prize is Tuesday. The period from the second of September meetings between the Physics Class and the Committee was, as usual, a very hectic time for me as the Committee Chair, the Committee Secretary and the experts on the subject matter. We had to prepare talks to be given at the press conference during the announcement of the prize. There should be a written press release, a popular description of the prize and a scientific background material. All this had to be available on October 9. The experts from the Committee together with myself also had to prepare presentations similar to those presented for the Physics Class in September, but now adapted to a much broader audience – the whole Academy. All this had to be done discretely so that no one could see us travelling together to Stockholm and visiting the Academy together. For the writing and the media training, which we have to go through, we also used some hotels in my hometown Göteborg where we could work discretely.

On October 9, at 9.30 am, the general presentation for the Academy was given, the

laureates were proposed and the experts gave the scientific background. The Academy endorsed our proposal. It was a great feeling to realize that we just had decided to award the 2012 Nobel Prize in Physics to Prof. Serge Haroche, France and Prof. David J. Wineland, USA “for ground-breaking experimental methods that enable measuring and manipulation of individual quantum systems”

After the decision the members of the Academy went to a joint lunch without any possibility to connect with the outer world. This is done since it is important that the laureates first get the good news directly from us. We in the Committee went instead to a small meeting room together with the Permanent Secretary of the Academy and his secretary. There we first had a quick sandwich-lunch and then we started make phone calls to the laureates. This is generally a very special event, both touching and amusing.

It was trilling to hear the ring-tone and then getting the answer:

“Hello?”

The secretary of the Permanent Secretary of the Academy then said:

“Is this Prof. Haroche?”

“Yes”

“Prof. Haroche you have a very important telephone call from Stockholm, Sweden. Please don’t hang up; I switch now over to a conference telephone.”

The Permanent Secretary was then first to give the good news about the decision made by the Academy and congratulated Prof. Haroche. Then we in the Committee also had the opportunity to congratulate and chat with him. After also having woken up Prof. Wineland, in the early morning in the US, it was time for us to go to the press conference. We went into the beautiful session chamber at the Academy, where the walls are covered with paintings of important former members of the Academy. Journalists, radio- and TV-teams from all over the world were, as usual, around. After the presentation and a direct telephone interview with Serge Haroche, there were dozens of interviews in which all the Committee members and other Physics Class members were involved.

7 The Nobel Ceremony

The laureates arrive at Stockholm about a week before the prize award ceremony. From their arrival they have a very heavy programme with interviews, receptions and dinners. They also give their Nobel talks at the AlbaNova University Centre, Stockholm Centre for Physics, Astronomy and Biotechnology, where a packed auditorium awaits them.

The magic day is, of course, December 10. Ever since 1901, the Nobel Prizes have been presented to the Laureates at ceremonies on the 10th of December. The prizes are awarded in Stockholm, except for the Nobel Peace Prize, which is awarded in Oslo, Norway. The Prize Award Ceremony in Stockholm has, almost without exception, taken place at the Stockholm Concert Hall since 1926.

At the Prize Award Ceremony in Stockholm, presentation speeches praise the Laureates and their discovery or work. The speech I gave last year started as follows (the speech was given in Swedish):

"Your Majesties, Your Royal Highnesses, Ladies and Gentlemen.

In his epilogue at the Master's Degree Celebration in Lund 1820, Professor Esaias Tegnér, also a famous poet and author, said

*This is Man's wonderful ability
to be able to grasp the inner essence of phenomena,
not what they appear to be, but what they mean,
and the reality that we see with our eye
is a symbol only of something higher.*

What is it that our eyes see? It is light. Everything we see around us – colours, shapes, and objects – comes from light that strikes our eyes..."¹

¹ The English translation of the entire talk may be found at http://www.nobelprize.org/nobel_prizes/physics/laureates/2012/presentation-speech.html

After the speech the laureates were asked to step forward and receive the Nobel Medal, Nobel Diploma and a document confirming the Nobel Prize amount from the hands of His Majesty King Carl XVI Gustaf of Sweden.

After the Ceremony there was a banquet at the Stockholm City Hall for about 1300 people, including 250 students. With a few exceptions, the Nobel Banquet has taken place at the City Hall since 1930.

8 Nobel Prizes in Physics

I end this article with some statistics: The Nobel Prize in Physics has been awarded 106 times to a total of 194 Nobel Prize winners from 1901 to 2012. John Bardeen is the only Nobel Laureate who has been awarded the Nobel Prize in Physics twice, in 1956 and 1972. This means that a total of 193 people so far have received the Nobel Prize in physics. Only two women have so far received the Nobel Prize in Physics, Marie Curie (1903) and Maria Goeppert Mayer (1963).

There can be one, two or three laureates. Over the years there has been one single winner on 47 occasions, two winners on 30 occasions and three winners on 29 occasions.

Björn Jonson

Björn Jonson, born in Sävsjö, Sweden, is presently Professor of Physics at Chalmers University, Göteborg. Since 1970 he has been working at CERN, Geneva, with different roles from NFR Research Associate to Senior Staff Member. His main research areas are radioactivity, nuclear structure, beta decay, exotic decay modes, properties of far unstable nuclei, X-rays and neutrino masses.

He has been Member and Chair of various scientific committees at CERN, GANIL, GSI, ISOLDE, Member of NuPECC (Nuclear Physics European Collaboration Committee) and IUPAP (International Union of Pure and Applied Physics), and Chairman of the Swedish Physical Society. He also had several responsibilities within the Royal Swedish Academy of Sciences among which, from 2006 to 2012, that of Member of the Nobel Committee for Physics, which he also chaired in 2012.



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