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The Nobel Prize Centennial 1901—2001 Some aspects on Alfred Nobel, the Selection Procedure and a few Prizes

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Alfred Nobel

There are few individuals that are so well known to the worldwide scientific community as Alfred Nobel. He was born in 1833 in Stockholm. His father, Immanuel Nobel, was a chemist and inventor. Alfred and his three brothers, Robert, Ludvig and Emil, grew up in Stockholm but parts of their teens were spent in St Petersburg, Russia. Alfred Nobel developed into a cosmopolitan. Throughout his adult life, he lived in many places.

When Alfred was 20 years old he was sent to Professor Pelouz, a world-famous chemist, in Paris, France. It was at Professor Pelouz's laboratory that Alfred Nobel learnt about nitroglycerine from another visiting scientist at Pelouz's laboratory, Ascani Sobrero. It was Sobrero who discovered nitroglycerine when he mixed glycerol with nitric acid and sulphuric acid. The clear liquid was highly explosive. Alfred Nobel was fascinated by nitroglycerine and realized its potentials as an explosive. While working with the explosive liquid at one of Alfred Nobel's factories, Heleneborg outside Stockholm, a severe explosion occurred and Alfred Nobel's younger brother Emil was killed. This incident was most probably a key factor for Alfred Nobel's determination to invent new ways of how to be in command of nitroglycerine and allow a safe-use. In 1867 Alfred Nobel discovered that nitroglycerine mixed with silica, kieselguhr, resulted in a paste-like material, dynamite, that was not explosive until it was ignited. Alfred Nobel's first dynamite patent was filed in Hamburg, Germany, 1867. It was then to be followed by several other dynamite patents in other countries.

During his last 10 years, Alfred Nobel lived in San Remo, Italy. In these years he suffered from angina pectoris and was prescribed, by his doctors in Paris, to take nitroglycerine for his chest pain. He could not invision how this substance could be taken internally!! He refused and did not follow his doctor's orders. Alfred Nobel died, in his San Remo home, from a stroke on December 10, 1896. This is the reason why the Nobel Prize Ceremony is still held on December 10 and that the decorations of the Concert Hall and the City Hall in Stockholm are made up of flowers from San Remo.

The Testament

In his will and testament he states that the majority of his fortune (31 out of 33 million Swedish kronor) should be used for five prizes to those who "have conferred the greatest benefit on mankind". The five areas that should get equal parts were :

- * Physics; for the most important discovery or invention.
- * Chemistry; for the most important chemical discovery or improvement.

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- * Physiology or Medicine; for the most important discovery.
- *Literature; for the most outstanding work of an idealistic tendency.
- * Peace; to the person(s) or organizations who have done the most or the best work for fraternity between nations, or for the reduction of standing armies, or for holding peace congresses.

In addition to the five Nobel Prizes a prize in economics was added in 1969. This was based on a generous gift from the Swedish National Bank in the memory of Alfred Nobel.

The Nobel Foundation

In order to fulfil Alfred Nobel's will a Foundation was established in 1900. It is the Foundation that is responsible for organizations and structures around the Nobel Prize. The Foundation is also the visionary body embracing strategies for the future.

The Nobel Foundation has delegated the scientific working process on the different prizes to the Nobel Assembly/Nobel Committee at Karolinska Institutet in Stockholm for the prize in Physiology or Medicine, to the Norwegian Nobel Committee for the Peace prize (Sweden and Norway were in a union till 1905), to the Swedish Academy for the prize in Literature and to the Royal Swedish Academy of Sciences for the prizes in Chemistry and Physics. It is also the Royal Swedish Academy of Sciences that appoints the prize winners in economics (**Fig. 1**).

The Nobel Prize in Physiology or Medicine

Nobel Assembly and Committee

The Nobel Assembly, 50 professors at Karolinska Institutet in Stockholm, decides based on the scientific material presented to the Assembly by the Nobel Committee. Hence, it is the Nobel Committee that carries the responsibility for the in-depth scientific evaluation of each candidate or group of 2 to 3 candidates. The Nobel Committee has 5 regular members. Each member can sit no more than two times in three years (**Table 1**). In February every year, after the



Fig. 1 The Nobel Foundation delegates the scientific working process

Table 1 Nobel Assembly and Committee

Medical Nobel Assembly	
Members	50
Medical Nobel-Committee	
Regular Members	5
Associate Members	10

nomination deadline, the Nobel Committee selects 10 other professors at Karolinska Institutet as adjunct members. This way the most appropriate expertise matches the nominations to guarantee competent scientific evaluations.

The Selection Procedure

In order to be awarded the Nobel Prize in Physiology or Medicine the candidate must have been **nominated during the year**. The **moment of discovery** is the most important scientific criterion. The discovery must have resulted in a paradigm shift proven to be **good for mankind**. All these three criteria must be fulfilled. Some delay between the actual discovery and the award is often required before a discovery proofs to be good for mankind.

It is the intention that researchers all over the world shall have the possibility to initiate the nomination procedure. All professors at the Scandinavian universities can nominate each year and there is also a rotating list between various universities all over the world. In September about, 4,000 letters are sent out as invitations to nominate (**Table 2**). The deadline for nominations is February 1st. Then, the Committee investigates nominations and a protocol is written for each new nomination. In April and May preliminary reports on selected candidates are ready and full reports are produced during the summer. In September, after careful evaluations of all reports, the most interesting Prize candidates for the year are presented by the Committee for the Assembly. Assembly /Committee discussions take place and a decision is taken late in September/early October. The announcement is made in the first half of October each year. The awarding ceremony takes part December 10.

Some Nobel Prize Statistics

Over the 100 years, there were 9 years during which Nobel Prizes were not awarded. For the Prizes in Physiology or Medicine, Chemistry and Physics the US has been the dominating country during the last 50 years. Prizes awarded in Literature and Peace have, however, a different geographical distribution. This is illustrated, in **Fig. 2**, for the four 25-year periods.

It is also of interest that 28 women have been awarded Nobel Prizes. Six of them in Physiology or Medicine, 3 in Physics and 3 in Chemistry. In Literature and Peace there are 9 and 7 women Laureates respectively. The Peace Prize has also been given to 18 organizations. According to Alfred Nobel's testament it is not possible to award institutions in Physiology or Medicine, Chemistry, Physics and Literature.

The 10 first and the 10 latest Prizes in Physiology or Medicine

A comparison

Immunology was of interest in the beginning of the 20th century and the first Nobel Prize in Physiology or Medicine was given to Emil Adolf von Behring, in 1901, for his work on serum therapy with regard to diptheria. A few years later, 1908, another prize in immunology was awarded to Ilya Mechnikov and Paul Ehrlich "in recognition of their work on immunity". Today, immunology continues to be an important field of research and development of medical treatment illustrated by the fact that Peter Doherty and Rolf Zinkernagel were awarded the Nobel Prize, in 1996, "for their discoveries concerning the specificity of cell mediated immune defence". Another area of initial interest was infectious diseases. Sir Ronald Ross showed how parasites could cause malaria, in 1902, and Charles Laveran was, in 1907, awarded the Nobel Prize for showing how schistosoma parasites caused the African sleep disorder. Perhaps the most important discovery in relation to infectious diseases at this time was done by Robert Koch who got the Nobel Prize in 1905 for his studies of tuberculosis. These new principles for infections in the early 20th century are indeed paralleled by the 1997 award to Stanley Prusiner for his discovery of prions. Prions constitute a new biological principle of infection that occurs without the presence of DNA or RNA in the infectious agent. Camillo Golgi and Santiago Ramon Y Cajàl were in 1906 awarded the Nobel Prize for the understanding that the central nervous system was not only a chaotic network but consisted of separate neurons that were in contact with each other via synapses. Almost 100 years later Arvid Carlson, Paul Greengard and Eric Kandel were awarded the 2000 Nobel Prize for their work on how signals in the nervous system were transducted, with particular reference to dopamine, its cytoplasmatic activation of phosphorylation and for the learning process via nuclear transcription. Finally, there are close bonds also be-

Table 2 Selection procedure

Year 1	Invitation to nominate world wide
September	some permanent others on a rotation list
Year 2	
February	Deadline for nominations 250—300 nominations per year
March	Nominations examined. Protocols
April—May	Preliminary reports
June—August	Full reports by experts
September	Committee examines reports. Discussions with the Nobel Assembly
October	Nobel committee proposes and
	Nobel assembly decides. <u>Announcement</u>
December 10	Awarding ceremony



tween the 1910 Nobel Prize award to Albrecht Kossel for his work on proteins, including the nucleic substances, with the 1999 award to Günther Blobel who discovered that proteins have intrinsic signals of importance for their transport and localization within the cell.

Nobeliana Japonica

Today, there are 8 Japanese Nobel Laureates. The first Japanese Nobel Prize was awarded to the physicist Hideki Yukawa, in 1949, for "his prediction of the existence of mesons on the basis of theoretical work on nuclear forces". Also the second Japanese Nobel Prize was in the field of Physics. It was given to Sinichro Tomonaga, in 1965, who together with Julian Schwinger and Richard Feynman were awarded for "their fundamental work in quantum electrodynam-



Fig. 2 Some Nobel Prize Statistics

ics, with deep-ploughing consequences for the physics of elementary particles".

The first Nobel Prize in Chemistry for Japan was given to Kenichi Fukui who, in 1981, together with Roald Hoffman from the US, was awarded for "their theories, developed independently, concerning the course of chemical reactions". In 2000, a Nobel Prize was awarded to the Japanese chemist, Hideki Shirakawa, who in conjunction with Alan J. Mac Diarmi and Alan J. Heeger had discovered conductive polymers. The first Japanese Nobel Prize in Physiology or Medicine was awarded to Susumu Tonegawa in 1981. He received the Prize for "his discovery of the genetic principle for generation of antibody diversity". In 1974, Eisaku Sato shared the Nobel Peace Prize with Sean Mac Bride from Ireland.



Fig. 3 Selma Lagerlöf and Kenzaburo Oe

It was of great importance for the western culture that Yasunari Kawabata was awarded the Nobel Prize in literature in 1968 for "his narrative mastery, which with great sensibility expresses the essence of the Japanese mind". The second Nobel Prize to Japan in literature was given to Kenzaburo Oe, in 1994, for that he "with poetic force creates an imagined world, where life and myth condense to form a disconcerting picture of the human predicament today".

Kenzaburo Oe shares with Selma Lagerlöf, Swedish Nobel Laureate in literature from 1909, the imaginative and mysterious world filled with fantasies. One of Kenzaburo Oe's wishes during his Nobel week in Stockholm 1994 was to sit at the same desk as Selma Lagerlöf used for her writing. When he visited the Selma Lagerlöf museum, Måbacka, Värmland, in Sweden a picture was taken to commemorate this event (**Fig. 3**). It is with freedom and the free word that fantasy can survive and without which creativity does not exist.

An Idea Lives On

The Nobel Prizes award:

- extra ordinary achievements in natural sciences
- promotion of peace
- idealism in literature

that are being publicly recognized worldwide in December each year. Most importantly, however, the Nobel Prizes stimulate freedom of thought, fantasy and creativity in the young generation. Key factors for continued development and for the making of new discoveries of importance for mankind.

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