Nobel Prize in Physiology or Medicine

Mini research:

Why did Alfred Nobel (1833 - 1896) mention physiology separately?

The last will

As a childless bachelor, Alfred Nobel began relatively early to consider how the fortune he had amassed was to be used after his death. He changed his last will multiple times, but in the final version of **1895** bequeathed the major part of his estate for the purpose of funding a foundation. He stipulated the foundation's objectives as follows: 'The capital ... 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 of an idealistic tendency; and one part to the person who shall have done the most or the best work for **fraternity among nations**, for the abolition or reduction of standing armies and for the **holding and promotion of peace congresses** ...' [1]. The Nobel Prize has been awarded since **1901**.

The significance of physiology around the turn of the century

When the Physiological Society (UK) was founded in London in **1876**, 19 researchers took part that can be divided into two major groups: 12 medical practitioners (**63%**; e.g. physicians, surgeons, clinical physiologists) and 7 scholars of natural sciences (e.g. zoologists, biologists, philosophers of nature).

The researchers involved in the foundation of the *Deutsche Physiologische Gesellschaft* (German Society of Physiology; 1903 Kassel, **1904** Breslau) comprised not solely medical practitioners, but rather a mix of medical practitioners and scholars of natural sciences. Approximately 45 of the 60 physiologists were medical practitioners (**75%**), and around 15 were scholars of natural sciences (e.g. biologists, chemists or physicists). The major part of physiologists back then had a medical background, as physiology was a core subject of medical training. [2]

Significance of physiology for Alfred Nobel

The Nobel Prize in Physiology or Medicine was founded by Swedish chemist and inventor Alfred Nobel, who had amassed a great fortune thanks to having developed the explosive dynamite. The prize is awarded annually by the Nobel Assembly at the Karolinska Institute in Stockholm 'to the person who shall have made the most important discovery within the domain of physiology or medicine' in the past year, as per Nobel's instructions. Alfred Nobel succumbed to a heart attack in San Remo, Italy, on 10 December 1896. The Nobel Prizes are since 1901 awarded each year on the day of his death.

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The name of the prize is often abbreviated to *Nobel Prize in Medicine*. This is not correct, since Alfred Nobel's last will of 1895 explicitly also includes *physiology*.
Press reports often contain inaccuracies, i.e. the Nobel Prize is sometimes falsely referred to as Nobel Prize in Medicine, and sometimes accurately as Nobel Prize in Physiology or Medicine.

Physiology at the time, however, comprised a much broader area than medical physiology – in particular also fields that would today primarily be considered part of biology, biochemistry or biophysics. Back then, experimental physiology was a young field of fundamental research experiencing rapid growth. Medical progress was often directly based on physiological discoveries. Nobel therefore wanted to reward not only medical practitioners or clinical inventors, but also scientists engaged in fundamental research whose work ultimately is the foundation of long-term medical breakthroughs. It was Alfred Nobel's will that the prize should be awarded to the person whose discovery contributed the most benefit for humankind in the past year. The 'discovery' prerequisite gives preference to fields of fundamental research in medicine over applied medical specialties. The laureates in Physiology or Medicine are traditionally the first to be announced, usually on the first Monday of October. Since 1974, the prize may only be awarded if the nominee has lived to see the announcement.

Alfred Nobel's connection to physiology is based on the discovery of nitroglycerin: he discovered that nitroglycerin — which he used to manufacture dynamite — dilates blood vessels and lowers blood pressure, making it a beneficial medicine for heart patients. Nobel's primary contributions were to chemistry, but his indirect discovery concerning nitroglycerin and his visionary bequest of the prize remain his lasting connections to physiology and medicine.

After many experiments, chemist Alfred Nobel happened upon the successful mixture of nitroglycerin and diatomaceous earth, a very porous sediment from algae containing silica. As diatomaceous earth reduces the explosive power of nitroglycerin by no more than a quarter, but in turn prevents accidental detonation, that discovery was more than promising. Alfred Nobel named the new explosive 'dynamite' after the Ancient Greek word for power, *dynamis*. He then patented his dynamite in many countries. Throughout his life, he founded companies and laboratories in more than twenty countries, filing over 350 patents. Most discoveries relate to tunnelling and mining operations as well as the arms industry.

Nobel's last will might have been the famous inventor's way of showing the world who he truly was. And Alfred Nobel indeed began from then on to grapple with the question of how later generations would see him. He also discussed the topic with his close friend **Bertha von Suttner**, who briefly worked for Alfred Nobel as his private secretary and went on to become a peace activist and Nobel Peace Prize laureate. 'Nobel wanted the money to go to people who have worked hard for their success and have good ideas. Especially researchers that may have trouble earning money with their ideas.'

Bertha von Suttner, née Countess Kinsky von Wchinitz und Tettau, came from an impoverished Bohemian aristocratic family. She had applied to function as Alfred Nobel's private secretary in Paris, but only worked for him for a short time, as Nobel had to return to

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Sweden. The two were, despite an age difference of ten years, a great fit for one another, engaging in long and deep conversations. However, Bertha — later to become a writer, peace researcher and pacifist — already lived together with her fiancée Arthur Gundaccar von Suttner, whom she also went on to marry. Chemist Alfred Nobel and journalist and pacifist Bertha von Suttner remained friends throughout their lives, frequently exchanging their thoughts about war and peace. 'I would like to be able to create a substance or machine of such terrifying, massively destructive power that wars would be rendered impossible through it', Nobel wrote to this friend. While Alfred Nobel continued to work on explosives to achieve peace through deterrence, Bertha von Suttner founded various peace societies in Austria, Germany and Hungary, and published an anti-war novel that became a worldwide success: *Die Waffen nieder!* (Lay Down Your Arms!).
In 1905 — ten years after the founder's death — Bertha von Suttner was the first woman ever to receive the Nobel Peace Prize. [3, 4, 5, 6]

Physiology and animal testing

In 1898, Bertha von Suttner's novel *Schach der Qual* (literally: 'Check[mate] to torment'; figuratively 'Put an end to torment') took a decisive stance against animal testing (then: vivisection). 'Whoever suffocates empathy anywhere and privileges cold-heartedness does more harm to the world around and coming after themselves than could ever be outweighed by any physiological and medical — and furthermore problematic — results.' She compared physiologists to hunters and warmongers, but referred to them as 'our refined executors of cruelty', whom she considered to act out of a motivation 'where the force of habit or duty is so strong as to anaesthetise any other understanding in them'. *Schach der Qual* (1898) is a noteworthy novel by Bertha von Suttner that, in the form of a 'piece of fantasy', takes a stance against animal testing and for animal rights. The work is considered a *roman à clef* that translates the author's pacifist conviction to the suffering creature and takes a critical view of science. [7]

Alfred Nobel and his health issues

Alfred Nobel suffered from poor health throughout most of his life. He complained about digestive issues, headaches and occasional depressive phases, spending multiple weeks at spa resorts even as a young man. His first stay at a spa took place in Franzensbad in Bohemia in 1854. The inactivity at the resorts rendered him restless and bored him. He spent long hours in the laboratory and worked under primitive conditions with toxic chemicals.

Alfred Nobel's interest in physiology and medicine

Alfred Nobel's interest in physiology and medicine was purely scientific in nature. In his laboratory notebooks, he often took down ideas to be tested 'to alleviate or cure illnesses'. He was interested in anaesthesia and listed substances and alcohols that might be useful for this purpose. He also considered the intravenous injections of anaesthetics as an alternative to sedation with ether or chloroform, as common at the time.
The discoverer of nitroglycerin, Ascanio Sobrero, had noticed at the time that contact with this chemical substance may cause major headaches.

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Alfred Nobel, whose experiments more often than not involved this substance, must have experienced this effect, and later, when nitroglycerin was manufactured on industrial levels, nitroglycerin can be assumed to have constituted a serious medical and ecological concern, also for his employees. However, nitroglycerin is also beneficial in some situations to treat illness. Lauder Brunton, a renowned British physician, found in 1867 that organic nitrates were useful to alleviate angina pain. When Nobel's doctors in 1890 offered him nitroglycerin as a treatment for his heart condition, he refused this.
Nitroglycerin has been used to treat angina for more than 100 years, for the longest time without anyone being able to explain the physiological mechanism of action.
Thanks to the work of Nobert Furchgott, Louis Ignarro and Ferid Murad, who shared the 1998 Nobel Prize in Physiology or Medicine, we now know that nitroglycerin works by releasing nitrogen monoxide (NO), a widespread gas that is toxic to the environment. The gas is released in the endothelial cell layer lining the internal surface of blood vessels. It diffuses from there into the layer of smooth muscle cells and causes its myofilaments to relax. The blood vessel thus dilates, allowing more blood to flow through it. Improved blood supply results in more oxygen for the heart muscle, and pain is alleviated.

Dr. Sten von Hofsten, paediatrician and assistant professor at the Karolinska Institute, was surprised by Alfred Nobel's interest in biology and physiology, and the two had long conversations on both subjects. In 1890, von Hofsten met with Alfred Nobel in Paris, and found that the latter had a genuine interest in medical science. Nobel expressed the wish to be connected with a young, well-educated Swedish physiologist with whom he could cooperate — or, more precisely, who would be capable of implementing some of the manifold original and brilliant ideas in the field of physiology that germinated in Nobel's highly inventive mind.
Thus, Johan Erik (Jöns) Johansson was invited via von Hofsten to work on blood transfusion in Alfred Nobel's laboratory in Sevran near Paris. Johansson accepted the invitation and spent five months in Sevran. These ideas came to nothing until the issue of blood groups was resolved. [8]

Nobel Assembly at the Karolinska Institute in Stockholm

'The prize is given for works within the field of *Physiology or Medicine*, not Medicine alone. Since *Physiology* in the days of Alfred Nobel implied the preclinical medical sciences and *Medicine* the clinical sciences this makes it possible to consider work within the entire field of experimental medicine, as well as research aimed at curing human diseases. This makes it possible to select prize laureates from all areas of the biomedical field, including related behavioral sciences, such as was the case when Karl von Frisch, Konrad Lorenz and Nikolaas Tinbergen received the Nobel Prize in 1973 *for their discoveries concerning organization and elicitation of individual and social behavior patterns*.
Alfred Nobel had been very interested in physiology as well as in medicine in general, as can be judged from his private book collection. This may have influenced his choice of *Physiology or Medicine* as a prize field. In fact, it has been claimed but not verified that he had originally intended to provide for only one prize – in *Medicine*. The key words in the will are *discovery* and *greatest benefit for mankind*. This means that prizes are not awarded for illustrious

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scientific careers, however long and rewarding, but for specific discoveries. And benefitting mankind can include anything from increasing our basic knowledge within a particular subject to actually saving people's lives. The wording might seem loosely defined, but it has turned out to work satisfactorily, and it forces the Nobel Assembly in Physiology or Medicine to constantly review how the meaning of the will should be interpreted in light of developments within the biomedical field. ...' [9]

Letter from Alfred Nobel to Axel Winckler dated July 1890

'Do you have lots of time and enjoy research of a purely scientific nature, that is, in the fields of physiology or medicine? If this were the case, we could perhaps form a small association. Medicine and chemistry are nowadays so entangled that medical scientists and chemists should indeed work together. Moreover, I am extraordinarily interested in physiology and bacteriology, hoping to be able to propose a few innovations, despite being a layman. […]
I have funds, and, in my view, money — as long as it suffices to assure one's independence — only has value if it is used to facilitate the work of scientists and to benefit science.' [10]

Translated from German by Gideon Henner

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