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This historical vignette explores the considerations of the Nobel Prize Committee for Physiology or Medicine by vetting the Nobel Prize chances of Dr Gustaf Zander (1835–1920). His way to stardom started 150 years ago when he began mechanizing the passive and active movements that physical therapists manually used to treat diseases. A glance at his machines shows that they parallel surprisingly well what can be found in modern fitness studios. By combining files from the Nobel Prize Archive and sources from the first physical therapists, this vignette pieces together why Zander was considered one of the best candidates for the Nobel Prize in 1916. By providing this glimpse of history, questions about the origin of physical therapy concepts and the profession of the physical therapist are raised.
Did a researcher with physical therapy interests ever have a chance to receive the Nobel Prize for Physiology or Medicine? In this overview, we will examine the discussions of the Nobel Prize committee concerning a major contributor to the development of present-day fitness studios—who, as we will see, was a very strong candidate for the Nobel Prize in 1916. The aim of this article is to shed light on overlooked aspects of the history of the physical therapy profession by relating to a Nobel Prize nomination and a Nobel committee report as well as to sources from the first physical therapists. Although the Nobel Prize Archive at the Karolinska Institute in Solna, Sweden, has gained scholarly attention among historians, this specific area has, to date, been neglected. First, we will briefly contextualize the rise of the physical therapy profession and mechanomedical medicine in Sweden and identify some important historical figures. Second, we will highlight the remarkable transfer of their theories and praxis within Europe and to the United States. We argue that not only Zander's machines but also the US physical therapy profession could be better understood if the context and transfer of knowledge put forward here were better included in historical analyses. Finally, we reconstruct and discuss how the Nobel Prize committee dealt with mechanomedical medicine and in what way their arguments were tainted by the First World War.

In his will of 1895, the Swedish innovator Alfred Nobel stipulated that 1 of 5 yearly Nobel Prizes should go to the person "who [had] made the most important discovery within the domain of physiology or medicine." The first Nobel Prize was awarded in 1901. Today, it is seen as the most prestigious benchmark of excellence in medicine, and it is used for ranking universities and gauging the scientific reputation of whole nations. It is the job of the Nobel Prize committee at the Karolinska Institute to, each year, single out 1, 2, or 3 prize-worthy individuals.

In the first 2 decades of the 20th century, hundreds of scholars were nominated for the Nobel Prize for Physiology or Medicine. The majority of all nominees were physiologists, such as Eduard Pflüger (unsuccessfully nominated 40 times!); bacteriologists, such as the 1905 Nobel Prize laureate Robert Koch; or surgeons, such as Theodor Kocher, the Nobel Prize recipient of 1909, all praised for their promising lab-oriented research. However, in the Nobel Prize committee's shortlist of candidates in 1916, 1 of the 6 possible laureates was atypical: the Swedish physician Jonas Gustaf Wilhelm Zander (1835–1920). Zander's 5 competitors were very much on par with the contemporary scientific profile and reflected the kind of biomedical cutting-edge research that was in vogue at the time. Zander was nominated for his so-called medico-mechanical devices, which aimed at treating and curing many chronic diseases and orthopedic deformities (eg, scoliosis). Altogether, he had designed no fewer than 76 apparatuses to "twist every part of the body in every possible direction" (Figs. 1 and 2). Although not selected by the Nobel Prize committee, Zander did not stand out only for his physical therapy interests. He also was one of...
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Europe's leading theosophians (from the Greek the- + sophia—wisdom) and published more than 200 articles on this matter.\textsuperscript{16} The theosophians represented an esoteric and mystic philosophy in search of the divine organic truths of life and nature.

It is tempting to view Zander's odd but strong candidacy as only an expression of the nationalistic "zeitgeist" found in Europe at the time and assume that he was favored because he was a Swedish physician. If you overlook the theosophian part of Zander's career, it is not hard to see why this could be the case. Few Swedish physicians can match his impact on a global scale. From 1864 (when he opened his first mechanomedical institute in Stockholm, Sweden) onward, Zander's machines reached almost every corner of the world. They were found at universities, sanitariums, and hospitals in Scandinavia, the United States, Argentina, Bulgaria, France, Great Britain, Portugal, Switzerland, Holland, Russia, Italy, and Spain. The list continues with Belgium, Chile, South Africa, Egypt, and Cuba. In Germany, the success was particularly pronounced. The first Zander institute was founded in Baden-Baden in 1884, and in 1911 about 120 Zander institutes were in operation.\textsuperscript{17,18} Moreover, large ocean-going ships, such as the\textit{Titanic}, were equipped with Zander's machines, allowing passengers to handle their ailments during the long trips.

Zander gained worldwide recognition within the scientific community. His devices were shown at international exhibitions—for example, in Brussels in 1876, in Philadelphia in 1876, and in Paris in 1878—and he received the Swedish Medical Society's gold medal for his dissertation titled "On the Treatment of Chronic Scoliosis With Mechanical Gymnastics/Physical Therapy."\textsuperscript{17}

Mechanical Medicine and Pehr Henrik Ling

As alluring as it might be to interpret Zander's Nobel Prize nomination merely as a patriotic gesture from his Swedish countrymen, there are other historical circumstances that can help us understand why Zander caught the eyes of the Nobel Prize committee. We believe that these circumstances can be best understood by relating his invention to the therapeutic and scientific discourse from which they clearly evolved. This discourse is forgotten today but was very prominent during the 19th century.

Zander's gym machines reflect the influence of the work of Pehr Henrik Ling (1776-1839), known as the "father" of Swedish gymnastics. Ling's influence on institutionalized physical education is well appreciated in international literature. His gymnastic system contained a branch of physical education (peda-
gogical gymnastics) deemed as prolific as German gymnastics (Turnen), English sports, and the Sargent system in the United States. Ling was first mentioned in the United States in sources dating back to the 1830s, although it was during the last decades of the century that his impact became immense. Many physicians favored Ling’s physical education over sports and other systems because they believed that Ling’s model was based on existing rational and scientific principles.\textsuperscript{19-21}

No longer well known, however, is how much physicians also favored a different branch of Ling’s gymnastic system, his physical therapy (in Swedish, “sjukgymnastik,” and in English, then called “medical gymnastics” or “remedial gymnastics”). Many approved of his curative movements and manipulations to the extent that it is not an exaggeration to state that Ling’s impact on 19th century medicine even trumped Zander’s—also in the United States.\textsuperscript{22} Giants in physical medicine, such as Dr Harvey Kellogg and Dr Douglas Graham, have many connections to Ling and his physical therapy, with frequent references to him in their publications.\textsuperscript{23-24} It is no coincidence that \textit{Swedish Movements on Medical Gymnastics}, written by the most authoritative author of textbooks on Ling’s physical therapy in the 19th century, the Swedish Professor T.J. Hartelius, was translated into English and published in Battle Creek, Michigan, with a foreword by Kellogg himself.\textsuperscript{25}

Ling’s legacy still is very much present. In 1813, he founded the Royal Central Institute of Gymnastics (RCIG) in Stockholm, which had a great impact on the education and professional identity of physical therapists (Fig. 3). The RCIG provided the first formal education for physical therapists more than 200 years ago. To avoid conceptual confusion, it should be noted that the title “physical therapist” or “physiotherapist” was not used as a distinct professional designation until a couple of decades into the 20th century. Today, most countries have changed their former vernacular names to “physiotherapist.” The Germans, for instance, turned “Krankengymnast” into “Physiotherapeut” in 1994, and the Swedes recently did the same with “sjukgymnast.” However, this only entails nomenclature. Movements and manual techniques are still the core of physical therapist practice and physical therapists’ professional identity.
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With this in mind, we can readdress the RCIG and its 19th century curriculum. Apart from anatomy, physiology, and pathology, the training program offered included Ling’s system of gymnastics, which in addition to physical therapy and pedagogical gymnastics (or physical education) also contained a branch of military gymnastics (mostly fencing). The system was viewed as an organism, meaning that it could not reach its full capacity unless all branches communicated with each other. An RCIG examination rendered its alumni a competence cluster, allowing them to operate with both sick and healthy bodies, in the army as well as in civil society. When training students and soldiers, he was a physical educator, and when treating sick people, he was a physical therapist. In 1887, this competence was given the right to be licensed by the government the very same year. When training students and soldiers, he was a physical educator, and when treating sick people, he was a physical therapist. In 1887, this competence was given the official prestigious title of “Director of Gymnastics,” a title referring to an owner of a clinic where sick people were treated with physical therapy. The physical therapists earned the right to be licensed by the government the very same year. When the first women were allowed to enter the RCIG in 1864, they gained the same competence as the men, the military part excluded.

To understand Ling’s (and hence Zander’s) impact on physical therapy historically, we believe it is important to note that it was the physical therapy component of Ling’s system that made it scientific, something Ling and his numerous followers agreed on during the major part of the 19th century.25,26

Equally important to grasp are the full intentions Ling had with his physical therapy. Ling, and the physical therapists walking in his footsteps, wanted to revolutionize orthodox medicine, which they believed was too occupied with pharmacological cures. Instead, Ling believed that orthodox medicine should be oriented more toward mechanical modes of treating illness, ergo his physical therapy movements and manipulations of the body. These were seen as potent a remedy as drugs and surgery. Hence, the medical sciences needed theoretical and practical knowledge of Ling’s physical therapy, or the physicians’ regimens would remain unbalanced and even “poisonous.” The RCIG’s main objective, in fact, was to “cure” orthodox medicine from its one-sidedness.14(p130–139) The healing powers of every undertaken movement and manipulation were declared to have a certain physiological value, which rigorous scientific work had proven valid. It also was believed possible to direct their effects to certain areas of the body via blood vessels and nerves. In light of the current popular trend in prescribing physical activity to patients, it is interesting to note that 19th century physical therapists did the same. After careful examinations in order to give a correct diagnosis, the “cure” was administered via individualized prescriptions containing a combination of movements and manipulations.

Although not free from contemporary criticism, Ling’s impact on orthodox medicine did become immense and was especially evident in Sweden. Despite the fact that Ling was not affiliated with a faculty of medicine, the government sanctioned the RCIG’s objective to educate “doctors of gymnastics,” a title referring to a “drug-physician” also competent in “mechanics,” ergo trained in the same way as physical therapists. During several occasions in the second half of the 19th century, the Karolinska Institute advocated Ling’s physical therapy as a compulsory part of physicians’ curricula. Orthopedists especially were enthusiastic, and they even used Ling to help orthopedics reach scientific and therapeutic status. The scientific status of the RCIG was so great that physical therapists, without being physicians, could receive the title “professor of the Swedish government.” Some physicians even worked as employees at clinics owned and headed by physical therapists.

Worth noting is that Ling was by no means the only person interested in systemized mechanical cures. There were others competing with him, expressing similar interests and ambitions, including physicians.27 Yet, it was his system of physical therapy that reached the greatest scientific and therapeutic recognition. One rival, for example, was Dr Daniel Gottlieb Moritz Schreber’s German “Kinesiatrìk.” But it was not until the end of the 19th century that a physician started challenging Ling’s top-ranking position in mechanical medicine: the Dutch physician Johann Metzger, who received the epithet “inventor of scientific massage.”28

Regardless, the RCIG became an international node and authoritative center for physical therapists and physicians interested in cures using movements and manipulations. The main proponents of Ling’s physical therapy outside of Sweden were his many disciples, physicians as well as physical therapists. They were convinced that they were representatives of a new science destined to convert the one-sided orthodox medicine taught at the universities. Consequently, they opened physical therapy clinics abroad and wrote books, theses, and pamphlets praising Ling and his mechanical doctrines.29–34

Ling’s Links to Physical Therapy in the United States

Before focusing on Zander’s Nobel Prize nomination, it is worth asking
ourselves if Ling’s influence needs to be better accounted for in the analyses of the history of the physical therapy profession. Ling’s physical therapy is not touched upon in current research on the US physical therapy profession. The accepted premise is that the profession came into being during World War I. The experience of the war had made American physicians see a need for personnel able to rehabilitate soldiers who were maimed and wounded. They directed their attention toward female physical education teachers, whose knowledge of fitness, anatomy, and physiology made them ideal to be trained as “reconstruction aides” in so-called “war emergency courses.” It is also briefly mentioned in the literature that the physical therapists-to-be were already educated in techniques of manual therapy as well as massage. Little has been done, to date, to investigate what kind of “manual therapy” the first physical therapists knew and where they had acquired their skills.

Although this still is a terra incognita, this white spot is easy to map, at least tentatively, if we look more closely at what kind of physical education the first physical therapists mastered. The first 6 schools where the reconstruction aides were recruited and where the “war emergency courses” were set up are well known: Reed College (Portland, Oregon), Normal School of Gymnastics (Battle Creek, Michigan), New Haven Normal School of Gymnastics (New Haven, Connecticut), Boston Normal School of Gymnastics, American School of Physical Education (Boston, Massachusetts), and Posse Normal School of Gymnastics (Boston, Massachusetts; originally Posse Gymnasium).

When cross-referencing these schools with studies on the history of North American physical education, it becomes evident that many of these schools, if not all, had Ling’s gymnastic system as a kingpin. At the closing decade of the 19th century, Ling’s system became the favorite of the normal schools training women to become physical educators. Physical therapy (then called “medical gymnastics” or “remedial gymnastics”), therefore, was often included in the curriculum. The system’s greatest promoter during the 1880s and 1890s, Dr. Edward M. Hartwell, believed the RCIG produced the best physical educators in the world because its students were trained to also handle children not fit enough for the gymnasium. It may not be far-fetched to assume that the reconstruction aides coming from these Normal Schools did not need to be taught much of the basics. To physical educators trained with Ling’s system, working with sick bodies was not alien.

Boston Normal School of Gymnastics and Posse Normal School of Gymnastics carried the very distinctive marks of the RCIG alumnus Baron and Lieutenant Nils Posse. He is sometimes referred to as the “Father of Swedish Gymnastics” in the United States, although when he

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Figure 4.
A manual torso rotator. Here, 2 physical therapists fixate the patient’s body, and 2 physical therapists are executing the movement. This is exactly the same movement mimicked by Zander in Figure 1. A comparison reveals how labor-intensive “manual machines” could be compared with Zander’s machines. At most, 5 different physical therapists or assistants were needed to execute a movement or technique. Source: National Archives, Sweden.
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first arrived in Boston in 1885, it was as a physical therapist with the intention of propagating Ling’s physical therapy. The idea of a strong Ling connection also is reinforced when highlighting the background of 2 of the leading figures in early US physical therapy history: Marguerite Sanderson and Mary McMillan. Sanderson was sent to Walter Reed General Hospital in Washington, DC, in 1917 to organize units of the Reconstruction Aide Corps. She was a graduate of the Boston Normal School of Gymnastics. When Sanderson left for Europe to inspect her trainees, Mary McMillan took her place. McMillan, in turn, had “graduate work in physical culture and corrective exercises, including Swedish gymnastics and the dynamics of scoliosis.”

Because she advanced and became organizer of and instructor at the largest of the “War Emergency Courses” (Reed College) and founded the American Physical Therapy Association (originally the American Physiotherapy Association), we believe it is time to pay more historical and sociological attention to what McMillan says in her most influential publication, where she states that it is to “Peter (sic) Henry Ling and Swedish systemized order that we owe much today . . . in the field of medical gymnastics or therapeutic exercise.” Further research will try to substantiate the validity of the questions raised in the present article, but it is clear that students from the Boston Normal School of Gymnastics could open physical therapy clinics prior to the war.

Gustaf Zander and Ling’s Physical Therapy

Having put forward the works and the possible early influence of Ling on the emerging American physical therapy profession, we now turn our attention to Dr Zander and his accomplishments. Zander considered himself one of Ling’s successors. He wanted to duplicate the many active and passive movements (including massage techniques) found in Ling’s physical therapy. He believed that machines could execute the movements better than humans and that machines guaranteed a more accurate way to measure results, which made them more scientific. In other words, Zander’s machines did not add anything new to the actual movements; they had been practiced systematically for a long time, but manually. Using weights and levers, Zander came up with an alternative method that was less labor-intensive. It did not require as many physical therapists who would otherwise be needed for the treatment. Steam engines were engaged for many of the so-called passive movements (Figs. 4, 5, and 6).

Given the many physicians and physical therapists depending on “manual” machines (scientifically and financially), it took a while before Zander’s inventions were accepted. Many feared that their expertise and work could be replaced with machines. Within a few years after the machines had been launched, critics questioned their effects. Some physicians were cautious and contended that the treatment had to be thoroughly evaluated before any reliable assumptions could be made. Others were much more harsh. The German physician Georg Hunerfauth ironically referred to the machines as “magnificent toys for large chil-
In the end, however, the critics could not prevent Zander from achieving success, with an epicenter in Germany. Zander appears frequently as a key figure in German books on the history of medicine.\(^47\text{-}^53\) The extreme popularity in Germany can be explained partly by the mandatory accident insurance that was imposed on employers in 1884. Through this insurance, rehabilitation and economic concerns became entangled. The worse the invalidity caused by a work injury was, the more costly the insurance became for the employer. Using Zander's machines to treat individuals with chronic or acute musculoskeletal injuries could lower their economic burden because patient care did not require a large staff of physical therapists to provide passive mobilization and 1-on-1 to 5-on-1 care. Zander's machines could lower their economic burden. Unlike a large staff of physical therapists, they did not need a salary; hence, their services were more affordable—at least this seems very likely (Fig. 7)\(^14\text{-}^{258-262}\).

It is our belief that Zander's Nobel Prize nomination cannot be fully appreciated if this lively competitive scientific discourse of mechanical medicine is not highlighted. This belief is confirmed with the Nobel Prize nomination of Zander, written by Patrik Haglund (1870-1937), Sweden's first professor of orthopedics at the Karolinska Institute and the main organizer of Sweden's care of people with movement disorders and disabilities. He also was one of those doctors of gymnastics who completed a formal examination from the RCIG, meaning he had the same mechanical training and competence as a physical therapist.

Haglund's support for Zander's medico-mechanical machines, as he wrote in his nomination, was strongly influenced by the First World War and the great effect of restoring the functional abilities of soldiers who were maimed and wounded. Haglund personally vouched for this when sharing his experiences from a trip to Germany during the summer of 1915. He had witnessed great qualitative and quantitative progress in the Zander treatment of soldiers with joint, skeletal, and muscle problems. He stressed that several surgeons and orthopedists were convinced that no alternative treatment was as effective.\(^54\) Haglund also declared that Zander training would be valuable to a wide range of patient groups, such as people with overweight, nervousness, symptoms in the digestive tract, neuralgia, and heart, vascular, and joint diseases (Fig. 8).

**Evaluation of Zander by the Nobel Prize Committee**

The surgeon Jules Akerman was chosen as reviewer of Zander. Earlier, he had evaluated primarily surgeons, such as Victor Horsley in 1911, John B. Murphy in 1912, and Alexis Carrel in 1912. In 1912, Akerman managed to persuade his peers in the Nobel Prize committee that Alexis Carrel should receive the prize because of his development of a vascular suture. He had then stressed that the suture could be of great importance during wartimes to treat gunshot wounds. The First World War facilitated the consideration of various aspects of how to treat injured soldiers, which
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were brought up in Nobel Prize nominations. Scientists who had developed limb prosthetics were repeatedly nominated, such as the German surgeon Ferdinand Sauerbruch. In that sense, the Nobel Prize committee’s interest in Zander’s devices was quite on par and not peculiar.

In his 13-page report, written on August 19, 1916, Åkerman summarized that Zander would be a worthy Nobel Prize candidate. He put forward several advantages already highlighted above. Zander’s apparatuses, with their precise calibration (each machine could be adjusted to suit each individual’s strength, and the machine was targeted at a specific set of muscles), were of paramount significance. They also reduced the labor force (ie, massage therapists and physical therapists) and could handle many patients.

According to Åkerman, the remarkable number of Zander’s machines was due, to a large extent, to the German physician Hermann Nebel (1835–1930). Nebel was one of the strongest promoters of the machines in Germany. He was head of Zander institutes in Hamburg and Frankfurt and was convinced that the machines could strengthen muscles and bring about a better life for each new user. He was also a prolific writer on the subject. The many German physicians praising Zander probably gave a silver lining to his candidacy. Swedish physicians at the time were strongly influenced by medical progress in Germany. After Åkerman had recommended Zander, the other members of the Nobel Prize committee requested more information about him. Patrik Haglund was called upon to elaborate, and he submitted a more comprehensive background to his nomination. In this written supplement, Zander’s recognition in Germany was reinforced. It primarily dealt with the opinions of German physicians. At the end of the letter (dated September 21, 1916), Haglund even gave this a patriotic twist. He stated, “In contemporary Germany, all manifestations of life breathe Germanism, ‘Deutsch’ and ‘Deutschland über alles,’ the Germans have recognized a very important therapeutic method by a foreigner as superior. This seems to be the best proof of what Gustaf Zander has done to benefit mankind.” In other words, there was some chauvinistic flavor to Zander’s nomination, but not in the simple form the first impression provided us with.

However, the Nobel Prize candidacy of Zander had an unexpected turn. The reason for this sudden turn harbors a good dose of historic irony. The Nobel Prize became a victim of World War I. Due to the war, the Nobel Prize committee chose not to award the prize to anyone in 1916. Thereby, Zander’s Nobel Prize case was closed. As Zander was not nominated in the following years, the Nobel Prize committee never again brought him up as a candidate.

By the time Zander died in 1920, the popularity of his machines had decreased. The distribution of Zander’s machines reached its peak during World War I, but the interest
dropped to a minimum a few years later. The lack of interest in his machines was probably due to 2 intertwined factors. One factor was the ongoing advances in medicine that had opened up new possibilities, such as the scientific progress of orthopedic surgery, including anesthesia and asepsis/antisepsis procedures. The other was the depression caused by the war. The high initial costs of installing a full gym of machines were no longer affordable in the bleak economic times. It would take almost 50 years for the gym machines to make a comeback, then in the form of the Nautilus concept, which was invented by Arthur Jones (1926-2007). Nowadays, gym machines can be found in fitness studios everywhere. In terms of their biomechanical function, they seldom differ from Zander’s machines.

The only thing that strongly separates Zander’s machines from modern gym machines is that they were primarily intended for people who were sick and not used for bodybuilding.

**Conclusion**

The Nobel Prize was, and still is, not seen as a reward for a lifetime achievement. It usually is awarded for a discovery or an innovation that has the character of a breakthrough—the establishment of a new fact or technique that is intended to open up new ways of treating patients or understanding the natural world. It is easy to view the Nobel Prize as merely an arena reflecting what we often understand as hard-core science. But as displayed in this article, excellence in science and medicine can sometimes mean something else, especially if not focusing on the actual laureates. Thereby, one can better understand the medical profession and its allied professions historically: how they evolved, took different shapes, and engaged different levels of society.

Gustaf Zander was a candidate rooted in a tradition “scienticized” by physical therapists outside the ranks of physicians. When looking beyond the realms of the medical profession and contextualizing Zander’s scientific success historically, a window is opened into a forgotten past of the history of the physical therapy profession.

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