

The History of Science in Sweden

I. Introduction

Today, Sweden stands as a country committed to advancing science and the benefits to humanity it can bring. It is among the world leaders for the biological sciences and communications, and it has done all this without the historical and economic advantages that other European countries on the continent have enjoyed. This paper is an inquiry into the history of science in Sweden, the key organizations and figures involved in its development through the years, and the profound influence that Sweden has and will continue have on the world at large.

II. Historical Context & the Establishment of the Royal Swedish Academy of Sciences

The 16th century was a major transformational period for Europe that set the stage for the Age of Enlightenment that would come to dominate the 17th and 18th centuries. Following Martin Luther's publishing of the 95 Theses in Germany, the Protestant Reformation quickly spread throughout Europe, loosening the grip of the Catholic Church on affairs concerning both religion and state. Spanish conquistadors were exploring the New World and Magellan completed his circumnavigation of the globe. In 1543, Polish scientist Nikolas Copernicus published his heliocentric theory of the solar system, which was the first serious Western challenge to Ptolemy's Church-endorsed geocentric view of the universe in nearly 1200 years. During the 17th century scientific academies and societies began to appear across Europe with the blessing of the crown, first in Italy then followed by England (1665), France (1666), Germany (1700), and in St. Petersburg (1725).¹ Sweden established its Royal Academy of Sciences in 1739, and with it "modern science had arrived in Sweden".¹

Before the Royal Academy was designated, it should be noted that the first scientific society in Sweden was founded in 1710 in Uppsala University under the name Collegium Curisorum. In 1728, it was first recognized by the crown as 'Societas region literaria et scientiarum Sueciae', with notable members being Carl von Linné and Anders Celsius. However, it was not until 1739 when the Swedish economy was still struggling and stagnated from the disastrous outcomes of Charles XII's military campaigns that the need became clear for an orchestrated national effort behind science. The renown botanist Carl von Linné, joined by engineer Märten Triewald, factory owner Jonas Alströmer, and politicians Anders Johan von Höpken, Carl Wilhem Cederhjelm, and Sten Carl Bielke gathered at the Palace of Nobility in Stockholm on June 2nd, 1739 and founded the Royal Academy of Sciences.¹

III. Science in Everyday Swedish Life

It is important to know the men who sought the establishment of the Academy because it enables one to understand the motives and focus of the Academy during its formative years. Triewald and Alströmer were clearly aware of the tangible opportunities in technology and business that scientific

research could open up, and such efforts that could improve the economy and general welfare of the Swedish realm were certainly political good will to von Höpken, Cederhjelm, and Bielke. Thus, the Swedish Academy distinguished itself from its more cerebral and theoretically minded continental counterparts in that from the beginning it was focused on practical research with results that could be immediately utilized by the public. While others published their proceedings in Latin, the language of scholars, the Swedish Academy published in the vernacular, spreading their findings in the *Vetenskapsakademiens Handlingar* to farmers, workers, and sailors across the realm. The emphasis on practical, useful results was entirely in line with the utilitarian mindset of the time, but in another sense it reflected a shift in the relationship between scholars and public. Swedish scientists were quick to grasp that their work could be used to help the greater good. Early articles published in the proceedings include best practices in how to tar roofs, ways of improving the harvest, or even drawing beer from cellar barrels.¹ If a crop was having trouble growing, it was entirely possible for a scientist to go out to the field and investigate the cause. Taken from a modern day perspective, this also demonstrates that the concept of 'science' had a more broader and flexible definition than what would generally be considered 'science' today. Professor Gunnar Eriksson identifies two key ways that the Academy profoundly affected the everyday life of the Swedish people: date and time issues and coordinated meteorological service.

Astronomical data was one of the first scientific measurements to be dispersed into the greater public. Every year, the Academy published an almanac which contained, among other things, detailed times for the sunrise and sunset for each day and a yearly calendar. In addition to moon phases, key dates, and events, a couple of essays were also included which often addressed agricultural, medicinal, or natural topics. It should be noted that the common Swedish citizen was not completely unfamiliar with the kind of information the Academy published in its almanac, particularly the astronomical type of data. The key difference was that the Academy imparted a more authoritative and reliable credibility on its information. The first half of the 18th century saw tremendous turmoil over the calendar. 220 years previous, a shift from the Julian to Gregorian calendar was completed by Catholic countries, but not by Protestant led ones. In 1700, Denmark and Protestant Germany agreed to convert, and Sweden attempted to compromise between the two alternatives but ended up in an awkward position instead. By 1750, the issue was becoming serious. The people were relying on the almanac more and more rather than the season's weather when performing planting or harvesting, and in one example seeds were being ineffectively planted due to the date inconsistencies.² The Academy's secretary Pehr Wargentin was influential in finally enacting a calendar reform that joined Sweden with the rest of Europe. As industrialization sped up, another problem arose involving the issue of time-keeping. In 1841, an idea called mean solar time was introduced that related the time of day to the longitude of a location, instead of what was known as apparent solar time which was arbitrarily set. The rapidly expanding railway system used the Gothenburg mean solar time as its standard operating time, which in 1864 forced railway stations in Stockholm to install an additional minute hand to the station clocks indicting to travelers the Stockholm local time (which was about 24 minutes ahead) and the time that the trains actually followed.³ The Academy was asked to resolve the matter, and after much political feet dragging, a Swedish civil time

was established in 1879 based on the longitudinal meridian that ran three degrees west of Stockholm. When an international standard was agreed upon in Europe, the new national time differed only fourteen seconds from the previous Swedish civil time.³

Scientists in Sweden also brought their methodical and analytical observational skills to the study of weather. In the 1850s, Academy scientists established observation stations across the realm, often utilizing lighthouses and later, even newly constructed telegraph stations.³ The telegraph technology, which was effectively demonstrated in America around 20 years previous, was rapidly becoming an invaluable tool for meteorologists. By the 1860s, Sweden was an active participant in an international arrangement of telegraphing daily weather measurements to stations, and it was possible for the first time to obtain 'live' data of the weather occurring in coastal France. In 1871, the Academy published a report which once again demonstrated its desire for practical applications, declaring to "use the information received by telegraph on the state of the atmosphere in widely separated parts to draw conclusions on the imminence of storms, of which seafarers about to leave port could be warned in sufficient time by a message on the telegraph."³ Two years later, the Central Meteorological Office was created and the quality and reliability of weather reports extended to the general public continued to increase.

It would be inexcusable not to acknowledge the cherished role that the study of natural science, particularly botany, has played in the relationship between Swedish science and the common man. Even a cursory overview of the national folklore would reveal a strong affinity and reverence for Nature. Very early on, under the guiding hand of Carl von Linné, Swedish scientists were acknowledged to be the undisputed leaders in the field of botany. They accompanied Dutch, English, and Spanish sailing expeditions (a relatively easy arrangement to make due to Sweden's unassuming national outlook at the time) to all corners of the earth. Back in Sweden, citizens were encouraged to send natural specimens and interesting finds to the natural history museum in Stockholm, which then was open to the public. Professor Eriksson notes that the Swedish scientists were "fulfilling a significant educational function here, particularly in spreading an understanding of earlier geographical epochs and their organisms."³

IV. The Influence of Swedish Science in the World

When comparing how far and varied the threads of history stretch back into the ages, Sweden does not have as storied a scientific history as countries like Italy, Germany, France, or England. Towering figures such as Galileo, Kepler, Pascal, or Newton are understandably difficult standards to match. Despite entering the Enlightenment age of scientific inquiry later than these countries, being geographically disconnected from the rapid advances occurring on the continent, and having a smaller pool of available talent on which to draw from, the profound influence that Swedish science imparted on the international scientific community is remarkable.

It is appropriate to begin with the man most likely to be identified by the Swedish community as the most revered scientist Sweden has ever produced: Carl von Linné. Born in 1707 in the state of Småland, his father was a pastor and young von Linné first entered on a track to join the clergy. One of his professors saw in him a strong interest in botany and encouraged him to follow it. After spending a

year at Lund, von Linné went to Uppsala University where he received a professorship. Carl von Linné, also known by his Latin name Carl Linnaeus, theorized a system for classifying the multitude of flora in the plant kingdom based on the idea that plants reproduce sexually.⁴ Linnaeus later established a formal system that involved a hierarchy consisting of kingdom, class, order, family, genus, and species. Though this scheme had originated 200 years before by the Bahuin brothers, Linnaeus was the first to provide the weight and serious observational backing needed to popularize it with the scientific community.⁵ Dr. Sverker Sörlin, currently the director for the Swedish Institute for Studies in Education and Research, puts forth that “Linnaeus more or less consciously tried to do was establish a national style, carve out a niche for Swedish science guaranteeing its success in the world arena, and – by no means least important – win acceptance for the Linnaean synthesis of the life sciences. That style was scientific travel.”³ This is a tremendous observation by Dr. Sörlin, because it touches upon four key points: Linnaeus understanding his role in furthering Swedish science, the need for Sweden to distinguish itself from the other science powerhouses on the continent, Linnaeus’s own healthy ego in validating his own theory, and the means by which Sweden was able to utilize its unassuming political stature to send its representatives on foreign-led naval voyages. Linnaeus mentored several pupils into his supporters of his system, and it is another indication of his status that these students became known as the ‘Apostles’. They embarked on numerous expeditions to distant lands, such as Frederik Hasselquist’s trip to the Near East, Peter Kalm to North America, Carl von Thunberg to Japan, or Pehr Löfling to South America, in order to conduct more research and bolster the body of evidence supporting the Linnaean system.⁶ These were led by world powers in Europe who had the financial and materialistic ambitions to mount such voyages, and Swedish scientists were able to secure a seat onboard. Linnaeus’s accomplishment was the creation of a common language for naturalists throughout Europe and the world that was powerful, versatile, and elegant. Today, students of biology the world over are taught the Linnaean taxonomic system, and Sweden’s ‘Prince of Botany’ graces its 100 kronor bill, a persistent reminder to a key figure in Swedish science.

Alfred Nobel is perhaps the most famous science related Swede in modern times. ‘Nobel’ has become a household name due to the lasting legacy Alfred Nobel established upon his death in 1896. While Nobel was quite capable with physical chemistry, he was trained as a chemical engineer and certainly thought like one. His father ran a construction company that later ventured into munitions for the Russian government. Alfred Nobel grew up with varied interests; he was fluent in five languages and enjoyed poetry, English literature, and the sciences.⁷ However, he pursued chemical engineering and in the early 1850s was working in Paris with nitroglycerin, a recently invented powerful explosive that was highly unstable. Nobel, mindful of his father’s business, strived to find ways of making this explosive safer to use. His brother and several others died during the research, but in the late 1860s he succeeded in packaging the substance into a safe and effective tool. Construction projects for bridges, canals, tunnels, etc. became less costly, required less time to complete, and was made safer. However, his continued work in refining explosives drew much criticism, and it had an effect on the socially and politically progressive Nobel. Perhaps in an effort to adjust his eventual legacy, he laid down in his final will instructions relating to the Nobel Prizes – annual cash awards to the greatest achievements in physics, chemistry, medicine or

physiological sciences, literature, and peace. Due to substantial legal and responsibility wrangling, the first prizes were awarded by the Swedish Academy in 1901. In 1968, an additional prize ‘in the memory of Alfred Nobel’ was established for economics.

The Nobel Prizes were not the only honors given at the time for scientific achievements. What distinguished the Nobel Prize was the large amount of money it supplied, and thus attracted greater attention. Over time, likely due to the fair and proper way they were awarded to an international community, the Nobel Prizes gained popularity and fame, and today they signify the attainment of the loftiest accomplishment of any researcher’s dreams. The name ‘Nobel’ now imbues the recipient with instant credibility as well as the great responsibility of standing alongside the eminent figures of history. The eyes of the world turn to Stockholm every December when the award ceremony is held, and the legacy of Nobel remains easily the most recognizable face of Swedish science today.

V. Swedish Science in the 21st Century

Until now, the discussion has focused on the history of Swedish science. We will now turn an eye towards the future. Sweden is well poised for the challenges of the 21st century. One of the strongest facets of modern Swedish science is in the biomedical sciences. As of 2002, Sweden is fourth in Europe in the number of biotechnology companies, behind Germany, England, and France (an interesting parallel to the scientific academies 250 years ago.)⁹ This feat is even more impressive considering that Sweden has just 13% of the average population of those three countries and makes just 13% of the average GDP of those three countries.¹⁰ Sweden, along with Denmark and the Øresund Consortium, has cultivated one of the most active and important centers for biotechnology and medical research in the world. Most of this activity occurs in the Stockholm/Uppsala area, but locally here in Lund there is the Ideon Park. Created during the 1980s, it was seen as an opportunity to bring industry, academia, and entrepreneurship together into a powerful mechanism for scientific and technological innovation. The science park has close links with Lund University, with whom nearly 4,500 research projects are on-going.

VI. Conclusion

Though the modern age of science did not take root in Sweden until after continental Europe, the state of Sweden ambitiously established itself as one of the key players in the development and advancement of science in the world arena. Under the guiding hand of the Royal Swedish Academy of Sciences, it played on its strengths – strong values and ideals with regard to nature, its second-tier political ranking to unassumingly conduct scientific research, and its geographical advantages – while forging new standards and traditions. The close connection is established with industry, economy, and the welfare of the people helped close the gap between the latest scientific discovery and its effect on the common person. Aided by a centuries long neutrality-centered foreign policy and domestic welfare ethic, it has emerged largely unscathed from hindering wartime effects to not only host the world’s most recognizable scientific award, but also to be a leader and pioneer in the life sciences and technologies of the 21st century and beyond.

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