

The Physical Tourist

Physical Science in Oslo

Bjørn Pedersen*

I provide a tour of Oslo, Norway, concentrating on the city center and the suburbs of Blindern and Tøyen. I focus on the buildings used by the University of Oslo from its foundation in 1811 and on the physical scientists who worked in them. I also point out the cemeteries where some of them are buried.

Key words: Niels Henrik Abel; Endre Quie Berner; Kristian Birkeland; Vilhelm Bjerknes; Eyvind Bødtker; Christen Finbak; Sven Verner Furberg; Ellen Gleditsch; Heinrich Jacob Goldschmidt; Victor Moritz Goldschmidt; Cato Maximillian Guldberg; Christopher Hansteen; Haakon Haraldsen; Odd Hassel; Torstein Hallager Hiortdahl; Egil A. Hylleraas; Jens Jacob Keyser; Lorentz Christian Langberg; Sophus Lie; Justus von Liebig; Heinrich Rose; Svein Rosseland; Sem Sæland; Adolph Strecker; Georg Sverdrup; M.C. Julius Thaulow; Lars Vegard; Johan H.L. Vogt; Peter Waage; Christiania; Oslo; University of Oslo; Blindern; Tøyen; Abelhaugen; Astronomical Observatory; National Library of Norway; Mineral-Geological Museum; Vår frelsers gravlund; Gamle Aker kirkegård; Vestre gravlund.

Higher Education in Norway

In 1800 the population of Norway was less than 1 million, one-fifth of what it is today. Norway was then a part of Denmark-Norway and was ruled from Copenhagen where the King, government, and administration resided. This changed in 1814 during the Napoleonic wars when Norway got its own constitution and became a part of a loose union with Sweden. In 1905 Norway became independent.

In 1800 the population of Oslo (called Christiania or Kristiania from 1624 to 1925) was only 10,000; the major cities in Norway then were Bergen, Trondheim, and Kongsberg. Oslo, however, is an old city; it was founded around the year 1000 and was, and is, the capital of Norway. With the improvement of transportation in the 19th century, the city grew rapidly and is now by far the largest city in Norway

* Bjørn Pedersen is Professor Emeritus of Chemistry at the University of Oslo.

with a population of nearly 600,000. It is in a green area of 454 square kilometers covered with forests, islands, and lakes that includes the city center and the inner part of the Oslo fjord.

In 1800 the only institution of higher education in Norway was the Royal Norwegian Mining School in Kongsberg, 80 kilometers from Oslo and easily reached by a one-hour train or car ride. The School was founded in 1758 as part of the silver mines that opened in 1623 and closed in the early 19th century after the education of mining engineers was transferred to the University of Oslo. The building is still standing and today is part of the Norwegian Mining Museum. Silver mining ended in 1958, but some of the mines are still open to the public.* In Oslo there were only two secondary schools, the *Oslo katedralskole*, which today is in a building at Ullevålsveien 31 that was constructed in 1902 and has a library with many old books in it, and a mathematics school at Tollbugaten 10 that became a military academy from 1803 to 1899.

The first university in Norway, The Royal Frederik's University (*Det Konglige Frederiks Universitet*) was founded by King Frederik VI (1768–1838) in 1811, who was then King of Denmark–Norway until this union dissolved three years later. The University of Oslo (*Universitetet i Oslo*) was the only university in Norway until 1947; since then seven others were founded, in Agder, Bergen, Tromsø, Trondheim, Stavanger, Nordland, and Ås, as well as a number of colleges (*høgskoler*).

King Frederik VI gave the estate of Tøyen to the University, and the Botanical Garden was established there, but Tøyen was then far outside of the town, so teaching took place in rented rooms inside the town. Many streets (*gatene*) around the Botanical Garden bear the names of 19th-century professors at the University (Hersleb, Lochmann, Monrad, Platou, Rathke, Sars, Schübler, Skjelderup, Sexe, Sverdrup). Siebkes gate and Vahls gate is named in honor of the Dane Johan Siebke (1781–1857), the first Head Gardner, who was trained by the Norwegian Martin Vahl (1749–1804), Professor of Botany and Head of the Botanical Garden in Copenhagen, which became the model for the Botanical Garden in Tøyen.

City Center Circuit

The sites associated with the physical sciences are located in the center of Oslo and in the suburbs of Blindern and Tøyen. All can be reached from the National Theater (*Nationaltheatret*) subway (*T-bane*) station. We begin our tour in the city center (figure 1).

About 100 meters northeast of the National Theater subway station is University Place (*Universitetsplassen*), where we see university buildings that were constructed in 1852. From there we can walk either northwest along Karl Johans gate in the direction of the Royal Palace (*Slottet*) and then turn left into Henrik Ibsens gate, or we can walk southeast along Karl Johans gate past the Parliament

* See the website <<http://www.norsk-bergverksmuseum.no/>>.



Fig. 1. The center of the city of Oslo. *Credit:* Kartutsnitt fra Oslokartboka 2010, ©Cappelen Damm AS.

(*Stortinget*), turn right into Øvre Slottsgate, walk to the end of the street, and arrive at the Christiania market place (*torv*), the center of the oldest part of the city where the University opened for instruction in 1814.

Alternatively, we can walk west from the National Theater subway station, see the Abelhaugen on the right, and then either walk farther west on Henrik Ibsen gate or take a tram or bus to the National Library (*Nasjonalbiblioteket*). Directly south of it (in the southwest corner of the map) is the old Astronomical Observatory. We also can reach the National Library in 6 minutes from the Christiania market place by taking tram 12 from Akersgata (the street parallel to Øvre Slottsgate) to Solli, from which there are several trams and busses that go back to the National Theater subway station.

Christiania

In 1814 teaching took place in rented buildings close to the Christiania market place. More than two centuries earlier, in 1624, King Christian IV (1577–1648) planned the town of Christiania (hence its name), relocating it there from Bjørvigen after a fire, laying out its streets in quadratures (*Kvadraturen*), and protected by the Agershuus Fortress (*Agershuus Festning*), as seen on a map of 1840 (figure 2).^{*} The circular Botanical Garden at Tøyen can be seen to the northeast, and the Royal Palace (*Slottet*), then under construction, can be seen to the west. Note that even by 1840 both were still far outside the town.

^{*} See the website <<http://www.kvadraturen oslo.no/>>; Bjørvigen, marked *OPSLO*, is in the southeast corner of the map.



Fig. 2. The town of Christiania, planned by King Christian IV (1577–1648), as seen in a map of 1840. Source: website <http://commons.wikimedia.org/wiki/File:Oslo_kart_1840.jpg>.

The small house on the northern side of the Christiania market place, shown on the left in figure 3, is the only building still standing that was used by the University at its founding in 1811. It was built in the 1640s, has one floor and an attic, and was used by the Professor of Medicine Michael Skjelderup (1769–1852) for anatomical studies. Today it is used for exhibitions and the address is Rådhusgata 19. The large building on the eastern side of the market place was the Christiania Town Hall until 1733.

The University building used for physics and chemistry was around the corner at Øvre Slottsgate 2, but the building was demolished and replaced by a new one in 1828 that was designed by the architect Christian H. Grosch (1801–1865), who also designed the Astronomical Observatory (see below). The first professor of physics and chemistry was the Norwegian Jens Jacob Keyser (1780–1847), who had been trained in physics and mathematics in Copenhagen. In 1839, however, M.C. Julius



Fig. 3. (left) The house (Anatomigården) built in the 1640s on the northern side of the Christiania market place, the only University building still standing that was used at its founding in 1811. (left) The building on the eastern side of the Christiania market place that was the Town Hall until 1733. *Credit:* Photograph by the author.

Thaulow (1812–1850),* who had been trained by Heinrich Rose (1795–1864) in Berlin and by Justus von Liebig (1803–1873) in Giessen, was hired to teach chemistry, allowing Keyser to concentrate on physics. When Keyser died in 1847 he was succeeded by Lorentz Christian Langberg (1810–1857). Thaulow died in 1850 at the age of 37.

The University Moves to Karl Johans gate

In 1852 the physical scientists and their colleagues in the University's Faculty of Philosophy, as well as those in the Faculties of Theology, Law, and Medicine, moved into new buildings opposite the National Theater subway station at Karl Johans gate (figure 4), which also had been designed by Grosch and whose construction had begun in 1839. The building on the left is the Domus Bibliotheca, the University Library. The one on the right, the Domus Academica, housed the Aula, the large University Auditorium; the Norwegian poet Henrik Ibsen (1828–1906) is standing by the light pole checking his watch against the clock on its front. The building in the center, the Domus Media, housed physics and chemistry. To the left of its entrance is a statute of Anton M. Schweigaard (1808–1870), Professor of Law; to the right is one of Peter A. Munch (1810–1863), Professor of History. All three of the buildings are currently being renovated in preparation for the

* Thaulow's cousins were the poet Henrik Wergeland (1808–1845) and his sister, the writer Camilla Collett (1813–1895).



Fig. 4. (left to right) The Domus Bibliotheca, Domus Media, and Domus Academica, all designed by Christian H. Grosch (1801–1865) and built at Karl Johans gate 47 between 1839 and 1852. The poet Henrik Ibsen (1828–1906) is standing in front of the clock in the window on the right. Source: *Det Kongelige Frederiks universitet 1811–1911: festskrift*. Vol. I (Kristiania: H. Aschehoug & Co. (W. Nygaard), 1911), p. 243.

celebration of the 200th anniversary of the founding of the University on September 2, 2011.

The Physics Laboratory was in the left part of the Domus Media. On its first floor and in its basement Professor of Physics Kristian Birkeland (1867–1917) built his “terrella,” the small magnetic sphere in a vacuum shown in figure 5, which he used to support his theory that the Aurora Borealis (Northern Light) was produced by high-speed solar electrons hitting the Earth’s atmosphere.¹ On its first floor, to the left of the central stairs, Birkeland’s student and successor, Lars Vegard (1880–1963, figure 6), also contributed to understanding the origin of the Aurora Borealis, and in 1915 built the first Bragg X-ray crystal spectrometer in Norway, which he used to determine the structure of several compound crystals and formulated what became known as Vegard’s law – the only law of nature formulated by a Norwegian.

The Chemistry Laboratory and mineral collection also were in the left part of the Domus Media. Although many faculty members and their families lived in these University buildings, the Professor of Chemistry lived behind them, on the corner of Frederiks gate and Kristian IVs gate, in a house that today is still called the Professor House (*Professorboligen*, figure 7), even though no professor lives there today. The successor to Thaulow was the German Adolph Strecker (1822–1871, figure 8), who had studied under Liebig in Giessen. Strecker was the first chemist to carry out basic research in this, at that time very modern laboratory, and he trained several students who later played important roles in the development of chemistry in Norway in the golden years from 1850 to 1914. When Strecker retired in 1860, he was succeeded by his student Peter Waage (1833–1900,

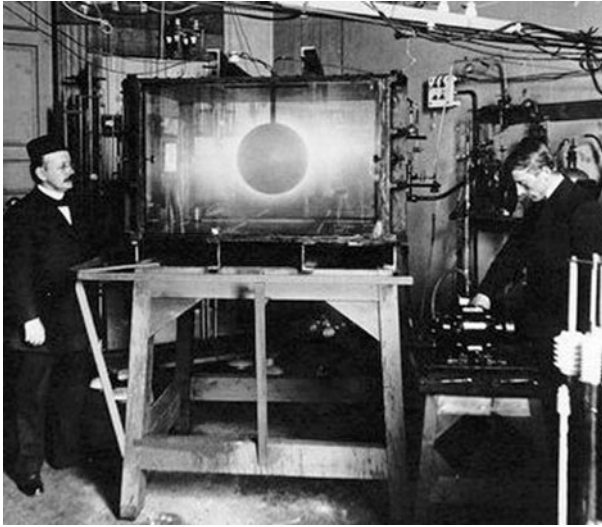


Fig. 5. Kristian Birkeland (1867–1917) standing to the left of his “terrella” in his laboratory in the Domus Media in 1913. *Source: Universitetet i Oslo 1911–1961. Vol. I* (Oslo: Universitetsforlaget, 1961), p. 513; see also website <<http://www.muv.uio.no/bildevisninger/uio-penger.xml?slide=13>>.



Fig. 6. Lars Vegard (1880–1963). *Source: Alv Egeland, Bjørn Pedersen, and Johs. G. Torstveit, Lars Vegard: Mennesket, forskeren og læreren* (Oslo: Fysisk institutt, Universitetet i Oslo (UiO) og Bokbyen Forlag AS, 2008), p. 36.



Fig. 7. The Professor House, the residence of the Professor of Chemistry and his family from 1856 to 1925. *Source:* website <<http://www.muv.uio.no/menneskene/forskeren/trekjemikere-profbolig-bpedersen-10060.xml>>.



Fig. 8. Adolph Strecker (1822–1871), the first Professor of Chemistry to live in the Professor House with his family. *Source:* website <<http://www.snl.no/bilde/Strecker>>.

figure 9), who also lived in the Professor House until his death. Waage is best known for the Guldberg-Waage law of mass action; he and his brother-in-law, Cato Maximillian Guldberg (1836–1902), presented their discovery in 1864 to the Norwegian Academy for Science and Letters, which today is located at



Fig. 9. Peter Waage (1833–1900), the second Professor of Chemistry to live in the Professor House with his family in 1873–1874. *Source:* website <<http://www.muv.uio.no/menneskene/forskeren/trekjemikere-proffbolig-bpedersen-10060.xml>>.

Drammensveien 78. Guldberg became Professor of Applied Mathematics at the University in 1869.

In 1911, on the 100th anniversary of the founding of the University, a new Aula was constructed behind the central stairs in the Domus Media and was decorated by paintings by the Norwegian Edvard Munch (1863–1944). The Aula too is being renovated for the celebration of the 200th anniversary of the founding of the University in 2011.

Behind these buildings, at Frederiks gate 3, is the Domus Chemica, the Chemistry Building (figure 10), the new home of the chemists that opened in 1874. There were then two professors of chemistry, Peter Waage, who lectured to students in the sciences, and Torstein Hallager Hiortdahl (1839–1925, figure 11), who lectured to students in medicine and pharmacy. Waage's successor was the German Heinrich Jacob Goldschmidt (1857–1937), and Hiortdahl's successor was the Norwegian Eyvind Bødtker (1867–1932), the first Norwegian who was trained in organic chemistry, partly in Germany and partly in France. On the front of the Domus Chemica are five medallions depicting six famous chemists: two Swedes, Jons Jacob Berzelius (1779–1848) and Karl Wilhelm Scheele (1742–1786); three Frenchmen, Antoine Lauent Lavoisier (1743–1794), Auguste Laurent (1807–1853), and Charles Frédéric Gerhardt (1816–1856); and one German, Heinrich Rose (1795–1864).

The Domus Chemica also housed a metallurgical laboratory, which was moved to Trondheim in 1910 when the Norwegian Institute of Technology (NTH) was



Fig. 10. The Domus Chemica, opened at Frederiks gate 3 in 1874. *Credit:* Photograph by the author.

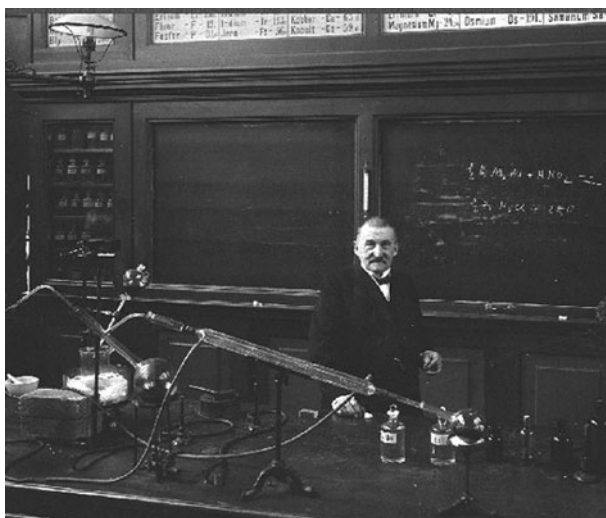


Fig. 11. Torstein Hallager Hiortdahl (1839–1925), Professor of Chemistry, lecturing to medical and pharmaceutical students in the Domus Chemica. *Source:* Fredrik B. Wallem, *Vort Universitet gjennom hundrede aar* (Kristiania: Mittet & Co. Kunstforlag, 1911), p. 19.

founded there; it is now part of the Norwegian University of Science and Technology (NTNU). The last head of the laboratory in Oslo was Johan H.L. Vogt (1858–1932), who was professor in Oslo from 1888 to 1912 and in Trondheim from 1912 to 1928. The Domus Chemica building has been renovated several times and today houses the Department of Archaeology, Conservation, and History. The chemists moved to Blindern in 1834 (see below).



Fig. 12. The monument of Niels Henrik Abel (1802–1829) on the Abelhaugen. *Credit:* Photograph by the author.

The Abelhaugen

A few hundred meters west, on the north side of Henrik Ibsens gate, is the Abelhaugen. The hill (*haug*) is named after the Norwegian mathematician Niels Henrik Abel (1802–1829); on its crest is an idealized monument of Abel (figure 12) by the Norwegian sculptor Gustav Vigeland (1869–1943) that was unveiled in 1908.*

The National Library

Farther west, on Solli place (*plass*) at Henrik Ibsens gate, is the National Library (*Nasjonalbiblioteket*, figure 13), which was the University Library from 1913 to 1999; it and a new building behind it comprise part of the National Library of Norway. Some of the University's collections were transferred to a new library in Blindern, the Georg Sverdrup House (see below), and to other University libraries.

The Astronomical Observatory

Directly south of the National Library at Observatoriegaten 1 is the Astronomical Observatory (figure 14), which Norwegian astronomers used for a century after its

* See the website <<http://www.vigeland.museum.no/en>>.



Fig. 13. The National Library, formerly the University Library, at Drammensveien 42. *Credit:* Photograph by the author.



Fig. 14. The Astronomical Observatory inaugurated in 1834. *Credit:* Photograph by the author.

construction in 1834. The first Head of the Observatory was Christopher Hansteen (1784–1873, figure 15), Professor of Applied Mathematics, who determined the geographical coordinates of the site and was a key figure in the mapping of Norway, but is best known for his studies of the magnetic field of the Earth. He



Fig. 15. Christopher Hansteen (1784–1873), Professor of Applied Mathematics, the first Head of the Astronomical Observatory. *Source:* website <<http://www.ub.uio.no/umn/hansteen/>>.

and his family lived in the Observatory until his death. The building has now been restored as a museum that will open in the fall of 2011.

The University Moves to Blindern

As the number of students and faculty increased, parts of the University moved to new quarters. The University's historical collections were transferred in 1904 to the Museum of Cultural History (*Kulturhistorisk museum*) at Frederiksgate 2; it is the finest art nouveau building in Oslo. The University Library, now the National Library, moved to Solli place in 1910. The zoological, botanical, and mineral collections were transferred to new quarters in Tøyen in 1905–1917. The physical sciences moved to Blindern in 1934, and the rest of the University followed in the 1960s. Only the Faculty of Law has remained in the University buildings in the city center, with the old University Library, the Domus Biblioteca, becoming the Law Library.

The Blindern campus of the University of Oslo (figure 16) can be reached by taking westbound train line 3, 4, or 5 to the Blindern subway station shown in the northwest corner of the map. Information on the University is available nearby on the first floor of the Administration Building (marked *Adm*) on Problemveien; the cafeteria on its 10th floor offers an excellent view of the campus and city. The University Bookstore is next door in Velferdsbygget.

The physical sciences are located mainly southwest of Blindernveien, the street that leads to and from the Blindern subway station. The exceptions are northeast



Fig. 16. The Blindern campus of the University of Oslo. *Credit:* Kartutsnitt fra Oslokartboka, ©Cappelen Damm AS.

of Blindernveien: the Georg Sverdrup House (*G. Sverdrups hus*), the University Library for the Humanities and Social Sciences, the Sophus Lie Auditorium (*S. Lies aud.*), the Niels Abel House (*Abels hus*), and the Vilhelm Bjerknes House (*Vilh. Bjerknes hus*). There is a statue of Abel (figure 17) in front of the Niels Henrik Abel House, the Mathematics Building. To see a stature of Sophus Lie (1842–1899), another famous Norwegian mathematician, you have to go to his birthplace, Eid in Nordfjordeid on the west coast of Norway, 500 kilometers from Oslo.

The building north of the Abel House bears the name of the Norwegian physicist Vilhelm Bjerknes (1862–1951), founder of modern meteorology, who held professorships in Stockholm, Leipzig, Bergen, and finally in Oslo from 1926 to 1932. The Georg Sverdrup House (figure 18) is the newest building on campus and is named after Georg Sverdrup (1770–1850), the first University Librarian (1813–1845) and Professor of Greek and later of Philosophy. It is well worth a visit; it has a cafeteria, and each Friday at 12:00 noon a concert is held in its entrance hallway. In general, all of the above buildings are open daily from 8:00 AM to 5:00 PM except in July and during the Christmas holidays.

The Svein Rosseland House: The Institute of Theoretical Astrophysics

Southwest of Blindernveien is the Svein Rosseland House (*S. Rossel. hus*), named after Svein Rosseland (1894–1985, figure 19), who secured financial support from



Fig. 17. The statue of Niels Henrik Abel (1802–1829) in front of the Abel House, the Mathematics Building, on the Blindern campus. *Credit:* Photograph by the author.



Fig. 18. The Georg Sverdrup House, the Humanities and Social Sciences Library, on the Blindern campus. *Credit:* Photograph by the author.

the Rockefeller Foundation for the construction of the Institute of Theoretical Astrophysics in 1934. He was Professor of Astronomy at the University of Oslo from 1928 to 1964 and at Princeton University from 1941 to 1946. After the war, he played a key role in the development of other Norwegian research institutions, and he founded an observatory at Harestua, about 60 kilometers north of Oslo, where



Fig. 19. Svein Rosseland (1894–1985). *Source:* Øystein Elgarøy and Øivind Hauge: *Svein Rosseland: Fra hans liv og virke* (Oslo: Institutt for teoretisk astrofysikk, Universitetet i Oslo, 1994), p. 4.

solar research was carried out in the 1950s until 1986. Today it is privately operated and used for educational purposes.*

The Physics–Chemistry Building

In 1929 Ellen Gleditsch (1879–1968, figure 20) succeeded Heinrich Jacob Goldschmidt as Professor of Chemistry, becoming the second woman to be appointed to a professorship at the University of Oslo.² She was educated as a pharmacist in Tromsø, in the far north of Norway, studied chemistry at the University of Cristiania (Oslo) from 1902 to 1907, and became an expert radio chemist while working with Marie Curie (1867–1934) in her laboratory in Paris from 1907 to 1912. Gleditsch was the senior Professor of Chemistry when the chemists moved to Blindern in 1934.

The following year the physicists joined the chemists and moved to Blindern into the new Physics–Chemistry Building (*Fysikk-kjemibygningen*, figure 21). Physics occupied its northeastern part, chemistry its southwestern part. The main entrance is from the south and the central stairs lead into a lobby with murals by the Norwegian painter Per Krohg (1889–1965)—who also painted the scenes in the Security Council Room in the United Nations Building in New York. His painting here (figure 22) depicts the physical sciences. The man seated at the table in the lower left is Egil A. Hylleraas (1898–1965), Professor of Theoretical Physics, who was a student of Lars Vegard and is best known for his quantum-mechanical

* See the website <<http://www.solobservatoriet.no/index.php?id=1>>.



Fig. 20. Ellen Gleditsch (1879–1968). *Source:* website <http://www.snl.no/bilde/Ellen_Gleditsch_som_nyutnevnt_professor>.



Fig. 21. The main entrance to the Physics–Chemistry Building on the Blindern campus. *Credit:* Photograph by the author.

calculations of the helium atom. Depicted at the top in the center is the structure of graphite, which Odd Hassel (1897–1981) determined in 1928. He had learned crystallography in Berlin and returned to the University of Oslo in 1926, working as a structural chemist and building up a research group on electron diffraction that clarified the structure of cyclohexane, for which he shared the Nobel Prize in Chemistry for 1969, becoming the only Norwegian scientist to receive a Nobel

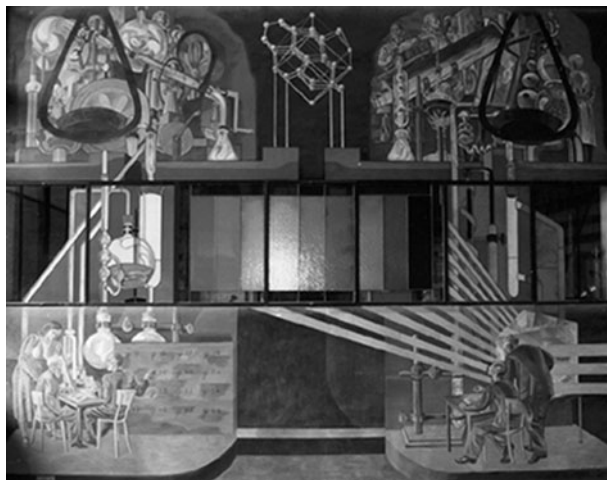


Fig. 22. The painting by Per Krohg (1889–1965) in the lobby of the Physics Building on the Blindern campus. Egil A. Hylleraas (1898–1965), Professor of Theoretical Physics, is seated at the table on the lower left, and the structure of graphite, which Odd Hassel (1897–1981) determined in 1928, is at the top in the center. *Credit:* Photograph by the author.

Prize for work carried out in Norway. A central scientist in Hassel's group was Christen Finbak (1904–1954), who developed the sector method in electron diffraction before leaving Oslo to become Professor of Theoretical Chemistry at the Norwegian Institute of Technology (NTH) in Trondheim in 1948.

The Physics Building

In 1969 the chemists moved into a new building in front of the old Physics–Chemistry building, which was then renamed as the Physics Building (*Fysikkbygningen*). Going from its lobby into its western part, you see busts of three of the best-known Professors of Physics, Kristian Birkeland, Lars Vegard, and Sem Sæland (1874–1940), who was Rector of the University when the building was finished in 1934. The faculty library and administration office are in its eastern part; a cafeteria (*Blindernkjelleren*) whose walls are decorated by Guy Krohg (1917–2002), Per Krohg's son, is in its basement.

The Chemistry Building

In the 1950s there were three chairs in chemistry: Haakon Haraldsen (1906–2003) was Professor of Inorganic Chemistry; Endre Quie Berner (1893–1983) was Professor of Organic Chemistry; and Odd Hassel (1897–1981) was Professor of Physical Chemistry. During the following decade the number of students and faculty in chemistry grew rapidly, and in 1969 a new Chemistry Building (*Kjemibygningen*, figure 23) was constructed in front of the former Physics–Chemistry Building. Then,

in 1970, physics and chemistry were reorganized; an elected administrative council was introduced, and the professors lost some of their privileges.

The main entrance to the Chemistry Building is on Apalveien and opens into a long corridor with several exhibits in it. Turning left at its midpoint, you come to the Chemistry Library, in which there are busts of Odd Hassel and Adolph Strecker. Hassel's student, Sven Verner Furberg (1920–1983, figure 24), was a X-ray crystallographer who determined the structure of small molecules of biological importance and is known for his contribution to understanding the structure of DNA. A cafeteria is at the end of the corridor; it is open for lunch from 10:30 AM to 2:00 PM.

Tøyen

The Tøyen estate was initially considered to be the campus of the University of Oslo, but in 1814 only the Botanical Garden (*Botanisk hage*) was established there. Tøyen is a subway (*T-bane*) station close to the Munch Museum (*Munch-museet*) on the eastern side of the map shown in figure 25; you can get there by taking any eastbound train from the National Theater subway station. On leaving the station, turn right and follow the path along the apartment building to the Munch Museum, then turn left and go along the front of the Museum until you see the main entrance to the Botanical Garden. Beyond its gate is a trail leading to the Mineral-Geological Museum (*Geologisk museum*, figure 26), which was constructed from 1915 to 1917. After it and other museum buildings had been built in Tøyen, the Norwegian Parliament decided that the University would be located in Blindern. Today all of the Tøyen museums are merged into the Natural History Museum (*Naturhistorisk museum*, UiO).



Fig. 23. The entrance to the Chemistry Building, inaugurated in 1969, on the Blindern campus. The Physics Building is to its left. *Credit:* Photograph by the author.



Fig. 24. Sven Verner Furberg (1920–1983). *Source:* website <http://www.snl.no/Sven_Verner_Furberg>.

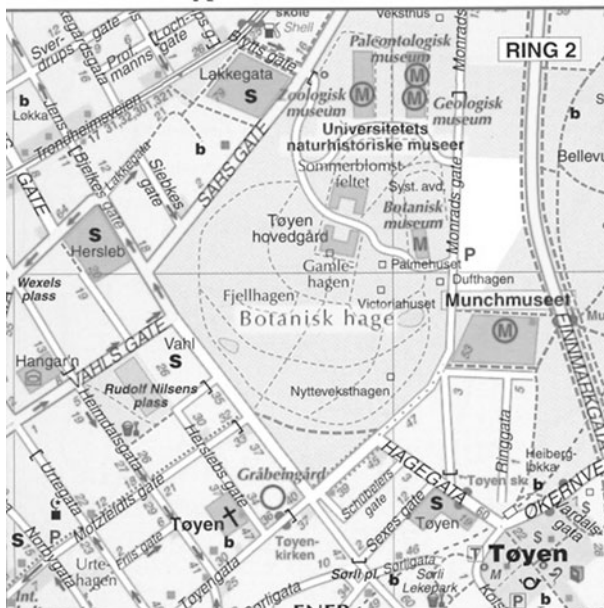


Fig. 25. The Tøyen campus of the University of Oslo. *Credit:* Kartutsnitt fra Oslokartboka, ©Cappelen Damm AS.

The Mineral-Geological Museum

The Institute of Mineralogy along with its mineral collection was moved from the center of the city into a new building in Tøyen in 1917. Its Head was the Norwegian Victor Moritz Goldschmidt (1888–1947, figure 27), who was already famous for his work on the geology of the Oslo region. He now established a research group that founded the science of geochemistry.³ He also was appointed as Head of the State Raw Materials Laboratory (*Statens råstofflaboratorium*) whose purpose was to find materials to replace those that could not be obtained during the Great War. Its purpose, however, changed and became to find practical uses for Norwegian raw materials, work that continued after the war and garnered the financial resources required to support his research.

Goldschmidt and his group determined the compositions of minerals by X-ray spectroscopy and their crystal structures by X-ray diffraction, which led him to propose a set of atomic radii (the Goldschmidt radii). In 1929 he accepted a call to the University of Göttingen, but in 1935, as a Jew, he returned to Oslo. Five years later, Norway was occupied by the German army, and in 1943 Goldschmidt fled, first to Sweden, then to Scotland. In 1945, when the war ended, he was in very poor health and died two years later. His famous book, *Geochemistry*,⁴ was published posthumously in 1954.

Many of Goldschmidt's students had successful scientific careers. Tom F.W. Barth (1899–1971) succeeded Goldschmidt at the University of Oslo in 1937. Lars Thomassen (1896–1972) built much of the X-ray equipment used at Tøyen and later became Professor of Metallurgical Engineering at the University of Michigan in Ann Arbor. Gulbrand Lunde (1901–1942) became Head of the *Hermetikkindustriens laboratorium i Stavanger* (a canned-food laboratory). William H.



Fig. 26. The Mineral-Geological Museum, constructed from 1915 to 1917, on the Tøyen campus. Source: website <<http://www.nhm.uio.no/om-museet/museets-bygninger/geologisk-museum/>>.

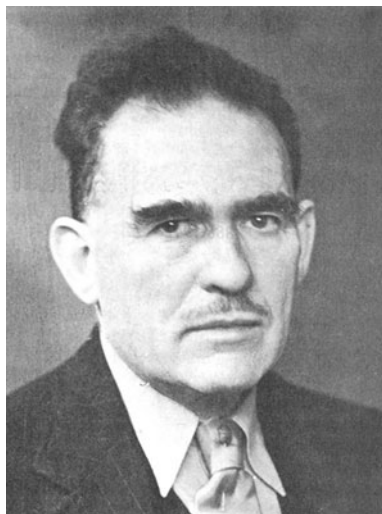


Fig. 27. Victor Moritz Goldschmidt (1888–1947). *Source:* Paul Rosbaud, “Victor Moritz Goldschmidt 1888–1947,” in Eduard Farber, ed., *Great Chemists* (New York and London: Interscience, 1961), pp. 1562–1586, on p. 1564.

Zachariasen (1906–1979) was a master at determining crystal structures and became Professor of Physics at the University in Chicago.

Cemeteries

There are many cemeteries in Oslo; I concentrate on three, two of which, *Vår frelsers gravlund* and *Gamle Aker kirkegård*, are not far from the center of the city (figure 28); the third is at Borgen. The location of each grave is identified by three numbers. The first number designates the field in the cemetery where the grave is located; the second number designates the row in the field; and the third number designates the location of the grave in the row. A map at the entrance of each cemetery shows the locations of the fields.

Vår frelsers gravlund

In the central part of this cemetery, at Akersbakken 32, is the grove for the honored (*Æreslunden*) where famous Norwegian writers like Henrik Ibsen (1828–1906) and politicians like Carl J. Hambro (1885–1963) are buried, but no scientists. The grove was opened in 1903 and closed in 1981. Other parts of the cemetery were filled by 1911 and were closed in 1952; today the cemetery is maintained as a national memorial. Odd Hassel and his mother and father are buried in this cemetery (007-07-023), as are Cato Maximillian Guldberg and his wife and daughter (411-00-055), and Peter Waage and his family (the tall monolith



Fig. 28. The *Vår frelsers gravlund* and the *Gamle Aker kirkegård* in Oslo 2007. Credit: Kartutsnitt fra Oslokartboka, ©Cappelen Damm AS.

(*bauta*) close to 026-09-010). Near the grave of Henrik Wergeland (045-15-001) is the grave of Lorentz Christian Langberg, his father, his two unmarried daughters, and his married daughter and her husband (044-03-001).

Gamle Aker kirkegård

This cemetery, at Akersbakken 26, is northeast of of the *Vår frelsers gravlund*. It dates to the Middle Ages, and the church, *Gamle Aker kirke*, which dates to the year 1100, is the oldest church still standing in Oslo. M.C. Julius Thaulow and his grandson Axel Aubert (1873–1943) are buried here (004-11-008). Aubert was educated as a chemical engineer in Oslo, received his doctoral degree in Basel in 1895, and was Managing Director of Norsk Hydro from 1926 to 1941 and Chair of its Board until his death. Also buried here are Christopher Hansteen (008-01-003) and Christen Finbak (027-05-026).

Vestre gravlund

To go to this cemetery, you take the westbound train line 2 or 6 from the National Theater subway station to Borgen. This cemetery, at Sørkedalsveien 66, was opened in 1902 and today is the largest cemetery in Norway. Danish, Dutch, Polish, Soviet, Swedish, and Norwegian soldiers are buried here, and there are war memorials for France, Great Britain, the United States, and Yugoslavia. The urn containing the ashes of the Goldschmidts, father Heinrich Jacob and son Victor

Moritz, are in the crematorium (910-00-018) and are made of olivine, a mineral that the son studied and commercialized. Also buried in this cemetery are Endre Ovie Berner (065-04-001), Kristian Birkeland (057-03-006), Ellen Gleditsch (321-15-002), Haakon Haraldsen (214-00-035), Egil Hylleraas (018-00-051), and Sem Sæland (030-01-001).

Further Information

Further information on the University of Oslo is available in Blindern on the first floor of the Administration Building (website <<http://www.uio.no/english/>>), and on the University's Faculty of Mathematics and Natural Sciences in the west wing of the Physics Building (website <<http://www.matnat.uio.no/english/index.shtml>>). Further information (in Norwegian) on the people mentioned in the text is available at the website <<http://www.snl.no/>>. Historical artifacts of the University of Oslo are preserved in the Norwegian Museum of Science and Technology; see the website <<http://www.tekniskmuseum.no/>> or <<http://www.muv.uio.no/>>.

Acknowledgment

I thank Roger H. Stuewer for his thoughtful and careful editorial work on my paper.

Open Access This article is distributed under the terms of the Creative Commons Attribution Noncommercial License which permits any noncommercial use, distribution, and reproduction in any medium, provided the original author(s) and source are credited.

References

- ¹ Alv Egeland and William J. Burke, *Kristian Birkeland: The First Space Scientist* (Dordrecht, Berlin, Heidelberg, New York: Springer, 2005), pp. 27-43; Sidney Borowitz, "The Norwegian and the Englishman," *Physics in Perspective* **10** (2008), 287-294; especially 288-291.
- ² Annette Lykknes, Helge Kragh, and Lise Kvittingen, "Ellen Gleditsch: Pioneer Woman in Radiochemistry," *ibid.* **6** (2004), 126-155.
- ³ Helge Kragh, "An Unlikely Connection: Geochemistry and Nuclear Structure," *ibid.* **2** (2000), 381-397; especially 388-392.
- ⁴ V.M. Goldschmidt, *Geochemistry*. Edited by Alex Muir (Oxford: Clarendon Press, 1954).

Department of Chemistry
University of Oslo
Box 1033, Blindern
NO-0315 Oslo, Norway
e-mail: bjorn.pedersen@kjemi.uio.no