

Pilgrimage through the History of German Natural Science,
University City Göttingen II

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(Received 23 October 2003 Accepted 30 November 2002)

Scientists in the same generation as F. Wohlelr (Fig. 89-96).

We have seen several pictures of scientists worked in the University of Göttingen. Additional portraits of chemist outside the University have also collected in the Museum. Some of the chemists are Jöns Jacob Berzelius (1779-1848, Fig. 89), Eilhardt Mitscherlich (1794-1863), (Fig. 90), Justus Liebig (1803-1873, Fig. 91), Michel Eugene Chevreul (1786-1889), (Fig. 92, 93), F. W. Sertürmer (1783-1841), (Fig. 94) and Ernst Otto Beckmann (1853-1923), (Fig. 95, 96).

J. J. Berzelius (Fig. 89) was a famous Swedish chemist. He contributed much to the development of modern chemistry on the following subjects : [Discovery of elements, nomenclature of elements, elemental signs, atomic weights of elements, allotrope, concept of catalyst and isomer]. The accurate measurements of atomic weight based on the R. Boyl's atomic theory were his great contribution to chemistry in the first half of the 19th century.



Fig. 89 Medal of Jöns Jacobus Berzelius (1779-1848).

E. Mitscherlich (Fig. 90) was a German chemistry professor at Berlin University. When he was young, he studied abroad at Berzelius's laboratory. He studied on crystals and proposed "a rule of isomorphism of crystals". He recognized periodic property of elements, and also catalytic activity in a chemical reaction.



Fig. 90 Photograph of Eilhardt Mitscherlich (1794-1863).

J. Liebig (Fig. 91) was a great German chemist, and his young day's life was dynamic. He was a self taught chemist and he studied at Paris for two years and he polished up his chemistry. He made human relations with L. J. Gay-Lussac (1778-1850) and A. Humboldt (1769-1859) because of J. Libig's (1803-1873) interest on Arsenal. He got a position at Giessen University in the age 21 by the recommendation of A. Humboldt. He had been active in both research and education in Giessen. His chemical education with experimental research became famous and the system became a standard educational method for the study of chemistry. He moved to München in 1852 and wrote several books. J. Liebig and F. Wöhler were a life-long friends each other.

His research works were as follows [Establishment of elemental analyses of carbon and hydrogen, isomer, finding or syntheses of new compounds, radical theory, artificial fertilizer, agricultural chemistry and fermentation]. Liebig's name have been preserved in the "Liebig's method of C, H analyses", and "Liebig's condenser", a distillation apparatus.



Fig. 91 Profile of Justus Liebig made of copper plate (1803-1873).

M. E. Chevreul (Fig. 92, 93, 1786-1889) was a French chemist. He was a specialist of dye materials and dyeing, and also of the chemistry of animal fat. He discovered that animal fats were glycerol ester (glyceride) of higher fatty acids. Chevreul was interested in natural philosophy on the elements in chemistry. He has been famous of his long lived life, and he was a active research chemist until his death at the age 103 years old.



Fig. 92 A medal of French chemist Michel Eugene Chevreul (1786-1889) was on display. He started his chemical research at the age 23 and continued up to 103 years old. He was an active researcher for 80 years.



Fig. 93

F. W. W. Sertürner (Fig. 94, 1783-1841) was a German Apotheker. He studied plants Alkaloid and isolated acidic and basic materials from Opium by extraction at the time earlier than 1805. The acidic material was Meconic Acid and the basic crystal was Morphinium (later Morphine). The morphine is the first isolated plant-alkaloid and the alkaloid chemistry started by the finding of Morphine by Sertürner.



Fig. 94 The finder of Alkaloid, F. W. Sertürner's (1783-1841) medal was in display.

E. O. Beckmann (Fig. 95, 96, 1853-1923) was a German chemist, after he studied at Leipzig and, he became a professor of chemistry at Giessen in 1892, then at Leipzig in 1897. He became a first director of chemistry division of the Kaiser Wilhelm Institute at Berlin in 1911. So called "Beckmann rearrangement" was discovered by him, and the Beckmann's thermometer for molecular weight measurement was designed by him.

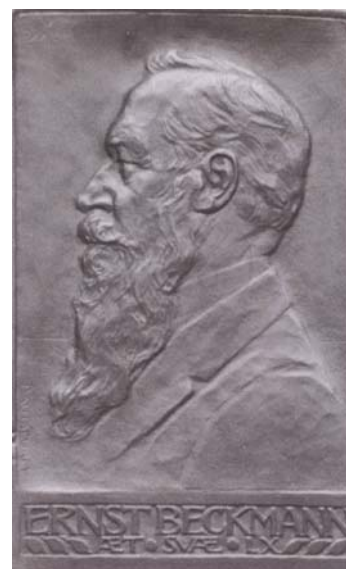


Fig. 95



Fig. 96

Fi. 95, 96 A medal of Ernst Bechmann (1853-1923) with his portrait and an equation of Beckmann rearrangement was on display.

Otto Bismarck's living house (Fig. 97-99).

In the old days, all of the German cities were surrounded by the city wall for security. However, in the 18-19 century, the city gate and the city wall were removed because of the inconvenience of the city activity. The wall and the gate were converted to a road or green belt surrounding the old city.

Some part of the city-wall is still left in Göttingen. When Otto Bismarck (1815-1898) was a student of Göttingen University, he was ordered to live in a small house in the city-wall. The Bismarck's living place is still an object of sightseeing. The scar on his face (Fig. 99) is probably due to the duel between students in his young days. When he was a prime minister of Prussen, he tried to fight duel with Rudolf Virchow (1821-1902), who was a famous physiologist and also a liberal politician.

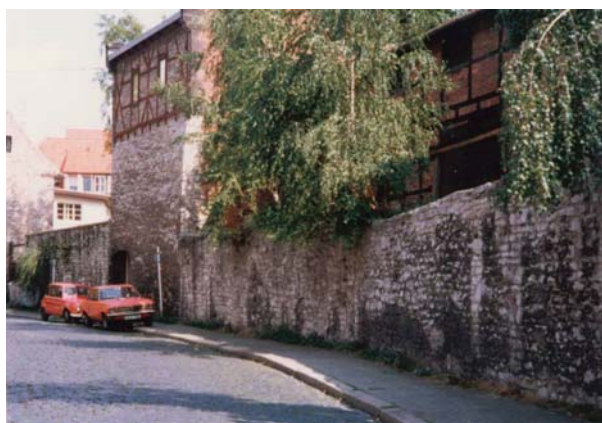


Fig. 97



Fig. 98 Bismarck's living house is now a sightseeing object, and the time schedule and entrance fee are on display.

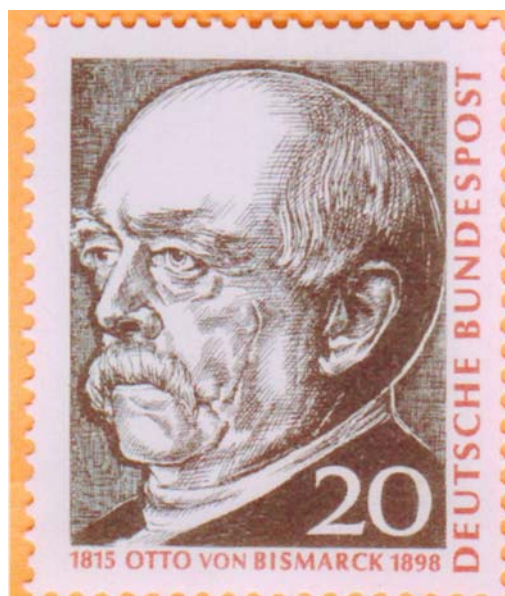


Fig. 99

Gauss Geist (Fig. 100-104).

There is an Apotheke (pharmacy) called "Gauss Apotheke" at the end of Theater Str. in Göttingen. The Apotheke has been a respectable business in Germany. The white coat pharmacists are wearing on indicates the status of Apotheker (pharmacist) in the German society. The Gauss Apotheke sells their own inexpensive medicine called "Gauss Geist" (Gauss's spirit). Gauss Geist is a Magen Bitter (stomach medicine) of alcoholic solution (40 %) which was prepared by extraction of herbs with alcohol. The Gauss Geist is filled in 20 ml small brown bottle and nice label is pasted on. Years ago they sold Gauss Geist only 1 DM each,

but now the price is up to 2 DM or so. It tastes good to me, but the Gauss Geist contains 40% alcohol, therefore, if we take too much the Magen Bitter, it makes worth our Magen problem. It should be written on the label "Only two bottles a day". Any way this is an interesting medicine. The name sounds great to me. I have bought some Gauss Geist every time when I visited Göttingen for my students working in my laboratory.



Fig. 100 There is "Gauss Apotheke" near the corner of Theaterstrasse. They sell "Gauss Geist" which is a Magen Bitter. The small bottle contains 20ml of liquid which is extracted with 40% ethanol.



Fig. 102 The label of Gauss Geist.



Fig. 103 The next door of "Gauss Apotheke" is "Gauss Keller" which is a kind of restaurant.



Fig. 101 The author was buying Gauss Geist.



Fig. 104 Any way Gauss is a famous person in Germany. The portrait of Gauss (1777-1855) comes from the 10 DM note.

Department of Physics and of Flight Research (Fig. 105-108).

We leave the old observatory and head towards the southern part of the old town across the Burgerstrasse, where the Department of Physics, Mathematics and the Max Plank Institute für Stromungsforschung are located. “Deutsche Forschung und Versuchungs-Anstalt für Luft und Raum Fahrten” is probably an organization similar to that of NASA in the U. S. A. When I was a young boy very enthusiastic about making model airplanes, I remember that there was a wing shape called “Göttingen -type”. The flight research institute has been here in Göttingen for long time. At the present time, rockets and satellites are the main target of this organization. We then passed a house holding a plaque of Ludwig Prandtl (1875-1953), who was a pioneer of aerodynamics in Germany. We passed by the building of the “Institute of Theoretical Physics” and “Institute of Physics”, and found a house holding a plaque of Victor Moritz Goldschmidt (1888-1947) who was a famous geochemist.



Fig. 105 There is a plaque for Ludwig Prandtl (1875-1953) who was the aerodynamics professor of the University of Göttingen and director of Kaiser Wilhelm Institute.

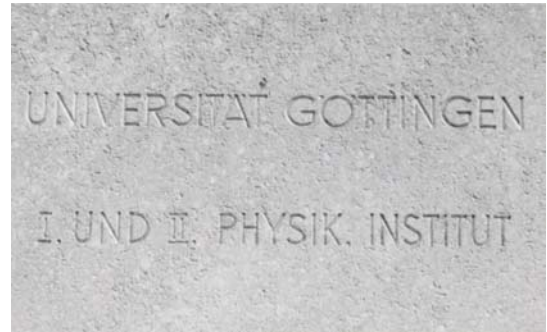


Fig. 106



Fig. 107.

Fig. 106, 107 We find plates for Institute of Physics (Fig. 106) and Theoretical Physics (Fig. 107).



Fig. 108 This is an entrance of the Institute for air-flight and space flight research. This is also belongs to the Max-Planck-Institute. The institution is probably an organization like NASA in the U. S. A..

Institute of Mathematics (Fig. 109-112).

When we entered to a building of "Institute of Mathematics", many geometrical models were on display. Near the window of the room, there was a bronze bust of the great mathematician David Hilbert (1862-1943), who was born in Königsberg, and later invited to Göttingen to become a professor of mathematics. In 1900, at the second International Congress of Mathematics held in Paris, he proposed 23 mathematical problems that 20th century mathematician should solve. Many of these problems have been solved already, and Japanese mathematician Teiji Takagi (1875-1960) who studied under Hilbert, solved the 9th problem in 1921. Takagi was responsible for raising the mathematical level of Japan (Fig. 114-116).

Takagi's white marble plaque was displayed in Kreuzbergerring in Göttingen. This plaque is the second plaque for Japanese in Göttingen. The first one is for Hisomu Nagai (1878-1957, physiologist), located in Friedländer Strasse, and the third plaque is for Kotaro Honda (1870-1954) in the same house as Takagi's (Fig. 117).



Fig. 111 We found a bronze head of David Hilbert (1862-1943, Mathematician) in the building of Mathematical Institute.



Fig. 109 I found a plaque of Viktor Moritz Goldschmidt (1888-1947) on the way to the Max -Planck Institute (Fig. 146).



Fig. 112 Plaque for George Christoph Lichtenberg, physicist and writer.



Fig. 110 Sign plate of Mathematical Institute.



Fig. 113 Plaque of Robert Wilhelm Bunsen (1811-1899, Chemist).



Fig. 114 Plaques for three Japanese scholars are in Göttingen. There are plaques for Teiji Takagi (Mathematician), Kotaro Honda (Physicist) and Hiromu Nagai (Physiologist).

Fig. 115 A part of Japanese news paper concerning the plaque for Dr. Takagi is shown in Fig. 115.



Fig. 116 Plaques for three Japanese scholars are in Göttingen. The first two plaques are for Teiji Takagi (Mathematician) and Kotaro Honda (Physicist).



Fig. 117 Plaques for three Japanese scholars are in Göttingen. The third plaque is for Hiromu Nagai (Physiologist).

Albani Friedhof (Fig. 118-120).

Albani Friedhof is located in the east side of the old city. The gravestones of three important figures, Johann Friedrich Gmelin (1748-1804), Johann Friedrich Herbart (1776-1841) and Carl Friedrich Gauss (1777-1855) are located here.

J. F. Gmelin was the first professor of chemistry in

Göttingen, and Friedrich Stromeyer (1786-1865) was the 2nd professor of chemistry. However, the gravestone of Stromeyer could not find in Göttingen. The grave of Gauss (Fig. 118) is in the middle of the cemetery. The large granite grave stone is about 2 m high, and holds a bronze relief of Gauss. In front of the stone, his name and the date of birth and death are inscribed. The gravestone of J. F. Gmelin was made of sandstone, which suffered weathering easily, and it was difficult to read the letters on the stone (Fig. 119). Johann Friedrich Herbart was famous in education and his grave is an iron Cross (Fig. 120).



Fig. 118 Gauss's grave is in the Albani Friedhof. The grave is well designed and a relief of Gauss is on the high place of the stone.



Fig. 119 Johann Friedrich Gmelin's grave is in the Albany cemetery. He was practically the first chemistry professor in Göttingen. The gravestone is made of sandstone. Therefore, it suffers weathering easily and it was difficult to read the letters. Fortunately the gravestone was cleaned and inlayed with black paint and we can see clearly the letters on the gravestone.



Fig. 120 Johann Friedrich Herbart's (1776-1841) grave is a black iron cross. He is a philosopher and pedagogist.

Bartholomäus Friedhof (Fig. 121-123).

We leave Albani Friedhof and head to Bartholomäus Friedhof which is located in the opposite side of the old city from Albani Friedhof. The Friedhof was old and did not hold many gravestones. Unfortunately, the letters on the stone were difficult to read because of the weathering. I looked for three graves of mathematicians, Abraham Gotthelf (1719-1800), Alfred Clebsch (1833-1872) and Peter Gustav Dirichlet (1805-1859). But I could not find their graves probably because I could not read letters on the weathered gravestones. I visited the grave of Georg Christoph Lichtenberg (1742-1799). The gravestone is looks new. It seems that the grave was reconstructed recently. The gravestone is a cross, and Lichtenberg's and his wife's stones are standing side by side (Fig. 121). Lichtenberg was a professor of physics at Göttingen, at the same time he was a famous critic. Lichtenberg's pattern produced by electric discharge was known in physics. His wife was originally his maid. The personal relationship between the

maid and Lichlenberg proceed further to become a real couple. Gottfried Augustus Bürger (1749-1794) is a lyric poet, and his bronze bust and his grave are in this cemetery (Fig. 122, 123).



Fig 121 Graves of Georg Christoph Lichtenberg and his wife are in the Bartholomaus Friedhof. He was a professor of physics at Göttingen and also a critic.



Fig. 122



Fig. 123 Gottfried August Bürger (1747-1794) is a lyric German poet. His grave (Fig. 122) and his bronze bust (Fig. 123) are in the Bartholomaus Friedhof.

Chorus of the Church Bell

We walked quite a long distance to visit the remains of the scientists in Göttingen. Just as we came back to the “Markt Platz”(Fig. 5) to take a meal, suddenly the church bells of the four churches in the old city started to ring loudly.

Church	established
1) St. Johannis	1230 AD
2) St. Jacobi	1360 "
3) St. Arbani	1434 "
4) St. Michael	1896 "

The chorus of the bells of the four churches were going on for a while. On the pavement of the ground at the “Market Platz”, there was a metal plate indicating the directions to the four churches (Fig.6).

Celebration for newly born Ph D

On the way to my hotel, a group of students passed by. One male student wearing a black gown was on a cart and a group of people were pulling it. I thought it was an interesting subject and I took pictures. The group went to the direction of “Markt Platz”. After I came back to my hotel I realized that the group were going to the Markt Platz to celebrate the birth of a new Ph D. There is a tradition of celebration for newly born Doctor at the Markt Platz and he gave a kiss to the bronze girl. I could not soon enough to recall the traditional ceremony for a

new Ph D, and I missed an interesting chance to take pictures.

Stadtfriedhof (City Cemetery), (Fig. 124-147).

In addition to the “Albani Friedhof” and “Bartholomäus Friedhof”, there is a large “Stadtfriedhof” about 1.5~2 km distance west of Göttingen. We can visit many graves of famous scientists in this cemetery. This is a relatively new, large (0.8 x 0.5 km), and well arranged cemetery.

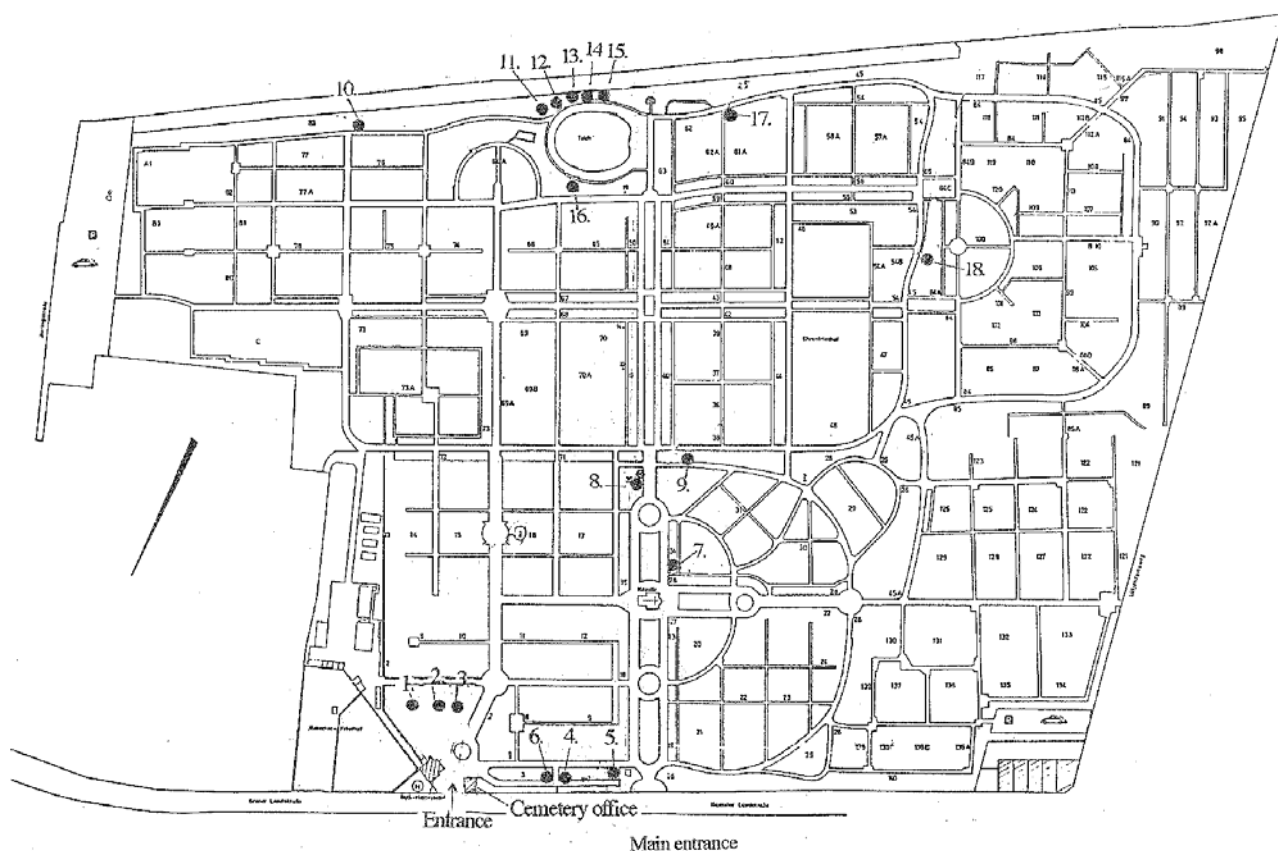
We pass underneath the railroad bridge south of Göttingen station, and followed Gronerlandstrasse, and reach the north-east corner of the cemetery. In the corner of the cemetery, there is an office (Friedhofsverwaltung) and we can get information here.

Map 1 shows a total area of the cemetery and the following three maps (Map 2- 4) are the magnified partial maps of the cemetery

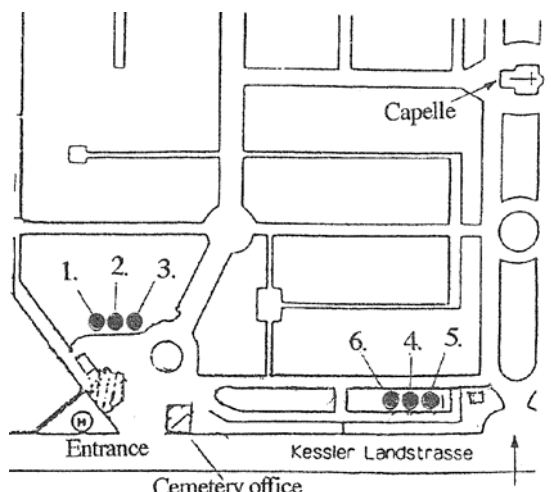
Map 2 is the north -east corner of the cemetery, and the grave sites of the famous persons are shown on the maps. As we enter the north east entrance of the cemetery, we find the office of the cemetery on the right, and a residential house on the left. At the entrance, there is a small rotary, and on the left side

across the rotary, there are gravestones of three famous persons. These are Wilhelm Eduart Weber (1804-1891) (Fig. 124), Rudolf Jhering (1818-1892) (Fig. 127) and Max Born (1882-1970, Fig. 126). W. E. Weber was a founder of the theory of electricity and he made the first telegram with Gauss. Many other researches were made with cooperation with Gauss. In 1837, he protested against the abolishment of the constitution and was expelled from Göttingen but he returned in 1849. He was one of the so called Göttinger Sieben.

On the right side of the Weber’s grave is Max Born’s grave (Fig. 126). His gravestone is a stable thick large plate which is in good shape. On the gravestone following his name and his birth and death dates, quantum mechanical equation was described ($pq - qp = h/2\pi i$). Born was a professor of physics at the University of Berlin and Göttingen, and many young physicists were born from his school. After the Nazi rose, he left to the United Kingdom and became a professor at the University of Edinburgh. He is one of the founders of quantum mechanics and received the Nobel Prize of physics in 1953.



Map 1. Stadtfriedhof Göttingen



Map 2. Stadtfriedhof Göttingen,

1. Wilhelm Weber (Physicist, 1804-1891).
2. Max Bom (Physicist, 1882-1970).
3. Rudolf von Jhering (Jurist, 1818-1892).
4. Friedrich Wöhler (Chemist, 1800-1882).
5. Hans Hübner (Chemist)
6. Georg Merkel (Mayor of Göttingen).



Fig 124 There is a large cemetery in the north west direction of the old city of Göttingen. The cemetery is called Stadtfriedhof (city cemetery). Many famous people were buried here. We can enter to the cemetery from the north east corner.



Fig. 125 When we entered to the cemetery from the entrance near from the office, there is a small rotary. In the left side across the rotary, there are three graves. These are Wilhelm Weber (1804-1891, physicist), Max Bom (1882-1970, Physicist) and Rudolf von Jhering (1818-1892, Jurist).



Fig. 126 Grave stone of Max Bom (1882-1970, Physicist).



Fig. 127 Graves tone of Rudolf von Jhering (1818-1892, Jurist).

The gravestone of R. Jhering is a high obelisk type. He is a founder of "historical law".

We passed by the cemetery office and proceeded about 100 m to the west, and entered the grave site of F. Wöhler's family (Fig. 128). His gravestone (Fig. 129) is a coffin type and

is not covered with ivy, and a “star” is in the middle of the stone plate. The writing shows that he was born in 1800 and died in 1882. The left side of Wöhler’s grave is his wife’s grave, which is covered with ivy. There are 5~6 gravestones in the family site including George Merkel (Fig. 130) who was the Mayor of Göttingen and was the husband of F. Wöhler’s daughter Sophie. Merkel’s gravestone is a high obelisk type. The graves of other members of Merkel’s family were in the site across the street. Just behind F. Wöhler’s grave identical shapes of H. Hübners grave (Fig. 131) covered with moss is there. Hübner was a pupil of Wöhler and successor of the laboratory.



Fig. 128 Family cemetery site of Wöhler s.

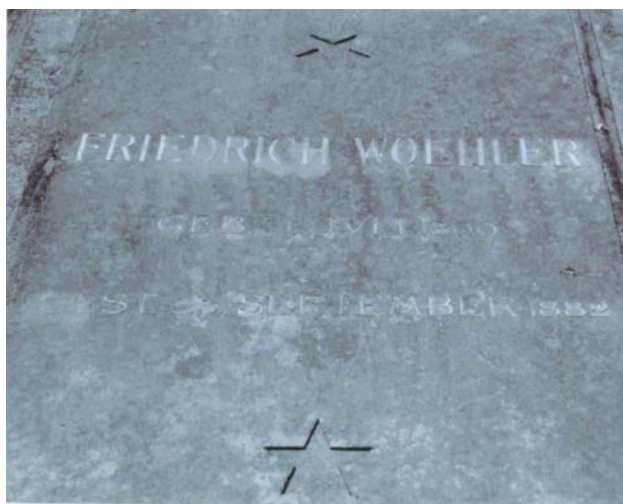


Fig. 129 Grave stone of F. Wöhler



Fig. 130 Obelisk type grave stone of Merker who is a son in law of Wöhler s daughter. Once he was a mayor of Göttingen (Fig. 130).

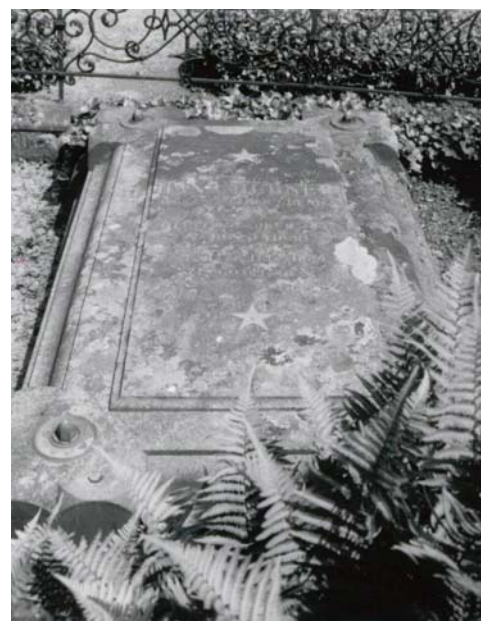


Fig. 131 When we stand facing to Wöhler s’ grave, H. Hubnlr’s grave is just back side. Hübner was the successor of Wöhler.

If we walked further we can find the main entrance of the Stadt Friedhof. The main entrance is open from morning to the late afternoon, somewhat longer than that of the north-east corner entrance.

We turn left (south) at the main gate, there is a Kapelle (Fig. 132). There are three famous scientist’s graves around the Kapelle (Fig. 132) (Map 3). The first grave is that of Otto Wallach (1847-1931, chemist) (Fig. 133), the next is that of Felix Klein (1849-1925, mathematician) (Fig. 134), and the third one is that of Karl Schwartzschild (1873-1916, astrophysicist) (Fig. 135),(Map 3).

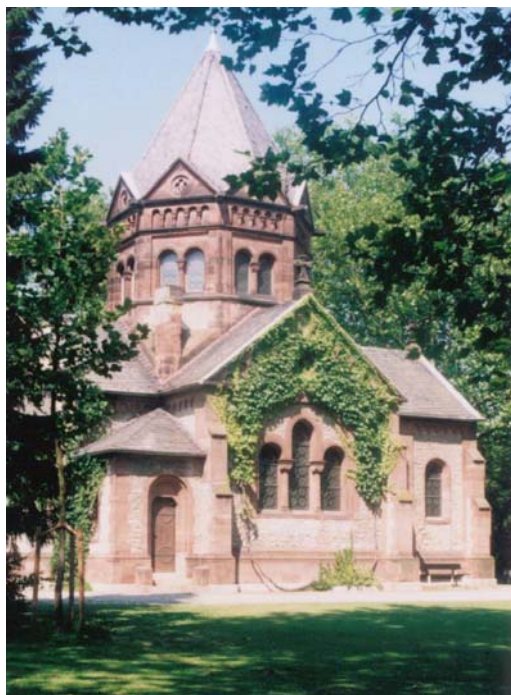
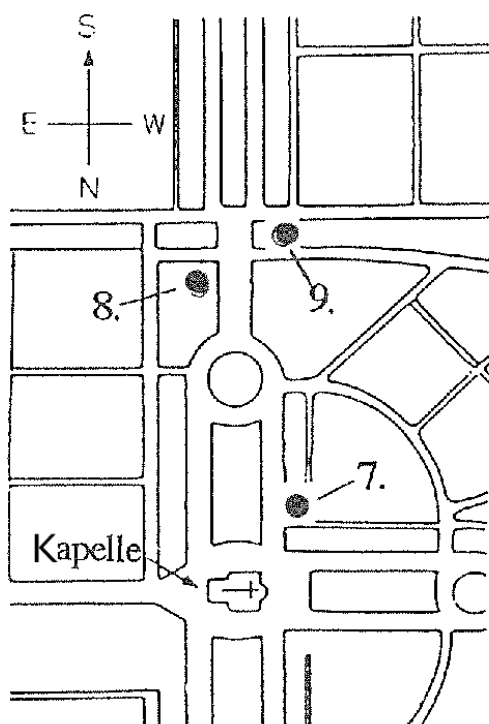


Fig. 132 A Kapelle is in the Stadt Friedhof.



Map 3. Stadtfriedhof Göttingen,

- 7. Felix Klein (Mathematician, 1849-1925).
- 8. Karl Schwarzschild (Astronomer, 1873-1916).
- 9. Otto Wallach (Chemist, 1847-1931).



Fig. 133 Grave stone of Otto Wallach (1847-1931, Chemist)

Felix Klein (Mathematician, 1849-1925), (Fig. 134).

When we proceed further to the south, we can find Felix Klein's gravestone, located south-west of the Kapelle. The gravestone is a thick light colored stone, and his name (Felix Klein) is engraved in large letters on the stone. Klein was a great mathematician in the field of geometry. Klein and Hilbert have been the mathematical leaders in the world at that time. In the lower part of the gravestone, there are three chrysanthemum like flowers.



Fig. 134 The grave of great mathematician Felix Klein is (1849-1925) in the bush.

Karl Schwarzschild (Astrophysicist, 1873-1916), (Fig. 135).

South-east of the small rotary and to the north of the Kapelle, there is a light colored gravestone of Karl Schwarzschild with a celestial globe on the top. He was born in Frankfurt am Main. He was a genius boy, and wrote an astronomical article when he was 16 years old. He studied in München under Hugo Seeliger (1849-1924) and he became a



Fig. 135 Grave stone of Karl Schwarzschild (1873-1916, Astrophysicist) is standing with a celestial globe on the top.

professor of astronomy in Göttingen, and also he became the head of the astronomical observatory of the University of Göttingen.

He volunteered for military service in the First World War, but returned from the front because of skin disease. His last two theoretical papers were written when he was still in the Russian front. He wrote papers on the general law of relativity, and discussed on the high gravitational field and he clarified the process for the formation of black hole. The Schwarzschild's radius came from his theoretical papers. If the star contract itself by gravity to some limit, the gravitational field is so strong that nothing (even light) can escape from the field. By the end of 20th century, several evidences for the existence of black hole had been observed, therefore supporting Schwarzschild's hypothesis.

His wife's name is Elise and she came from the

Rosenbach family. Agness Rosenbach's grave is located closely. Agness was probably a sister of Elise judging from her age. Close to Schwarzschild's grave, there is Friedrich Rosenbach's (Anatomist, 1842-1923) grave. In the city of Göttingen, there is Rosenbach-weg to commemorate the scholar's establishment.

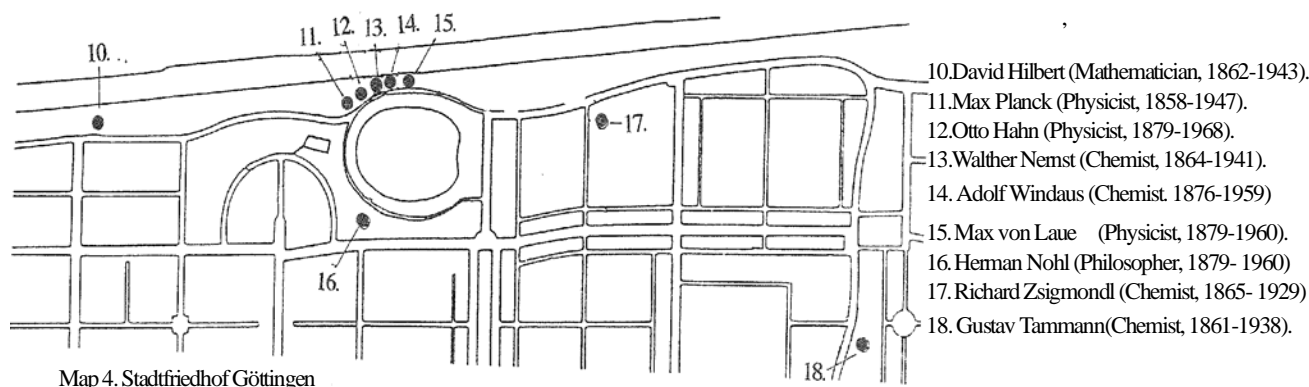
Otto Wallach (Chemist, 1847-1931), (Fig. 133).

South -west from the Schwarzschild's grave, there is the grave of the great organic chemist Otto Wallach in the shade of large trees. Wallach was born in Königsberg (now Kaliningrad) of east Prussen. He studied chemistry in Göttingen under Wöhler, and then moved to Bonn as an assistant of Kekule in 1870. At that time, Kekule thought that terpene chemistry was too complex to perform chemical research. However after becoming a professor of chemistry at Göttingen in 1889, Wallach initiated studies on terpene chemistry.

He separated and characterized many terpenes and studied their structures and established the foundation of terpene chemistry. Later, Vitamin A and D were shown to be derivatives of terpene, and Wallach was awarded the Nobel Prize Chemistry in 1910. In 1915, he retired from the position of the director of the Laboratory of General Chemistry of University of Göttingen.

Graves of famous persons in the south-east corner of the Stadtfriedhof (Map 4).

In the south-east corner of the Stadtfriedhof, there are many graves of great scientists. This area is a special territory in the cemetery. Lets start to visit the grave of the great Mathematician David Hilbert.



Map 4. Stadtfriedhof Göttingen

David Hilbert (Mathematician, 1862-1943), (Fig. 137, 138).

Hilbert was born in Königsberg, as Otto Wallach. He shows his genius ability in mathematics in his boys days. He became a professor of mathematics at the University of Göttingen at the age 28, and he studied various mathematical fields. In the year 1900, at the Second International Congress of Mathematics in Paris, Hilbert proposed 23 mathematical problems that mathematicians should solve in the future. In 1930 city of Göttingen offered honorary citizenship to Hilbert. His memorial lecture ended with the following words “Wir müssen wissen, wir werden wissen”. Hilbert’s famous words are engraved on the bottom of the gravestone. The simple words show his positive concern toward the unknown, and his belief that the unknown will be clarified.



Fig. 137 In the bottom of the gravestone of the great mathematician David Hilbert (1862-1943), there described the famous words “Wir müssen wissen wir werden wissen”.



Fig. 138 In the bottom of the gravestone. We can read David Hilbert’s famous words.

Max Planck (Physicist, 1858-1948), (Fig. 140).

Max Planck’s grave is similar to that of Hilbert’s in appearance and also in style. On the Planck’s gravestone, only his name was engraved, and the “Planck’s constant” is on the bottom. The Planks constant is the most fundamental physical constant which was found by Planck. Max Planck became a professor of the Berlin University, and he received the Nobel Prize of Physics in 1918, however he had hard time during the war, because he refused to cooperate with the Nazi.



Fig. 140 The gravestone of the great physicist Max Planck (1858-1947) is similar to that of David Hilbert. In the bottom of the gravestone, Planck’s constant is described.

Otto Hahn (Chemist, 1879-1968), (Fig. 141, 142).

On the upper part of the Otto Hahn’s gravestone, his name was engraved in a large letters, and the equation of nuclear fission of Uranium 235 by neutron irradiation was written on the bottom of the stone. The style of Otto Hahn’s grave is similar to D. Hilbert and M. Planck.

Otto Hahn is a pioneer of nuclear fission, however, during the discovery of the nuclear fission of Uranium 235, coworkers such as Lise Meitner (1878-1968) and Fritz Strassmann (1902-1980) were involved. Rather recently, Liese Meitner’s bust was put on the “Ehren Saar” of “Deutsches Museum”. Therefore, L. Meitner’s contribution in the finding of nuclear fission was recognized. Hahn and Strassmann received the Nobel Prize of Chemistry in 1944.

The style of the gravestone of D. Hilbert, M. Planck and

Otto Hahn are unique and the average person could not use the style.



Fig. 141



Fig. 142 Otto Hahn is a pioneer of nuclear fission. In the bottom of his grave stone, equation of a nuclear fission using ^{235}U and neutron is engraved.

Walther Hermann Nernst (Physical Chemist, 1864-1941), (Fig. 143).

Nernst studied physics, and became an assistant of Wilhelm Ostwald (1853-1932) in 1887. He moved to Göttingen in 1891 as a professor of physical chemistry. He proposed new theories of thermodynamics of electric cell and chemical reactions, and he contributed to the development of physical chemistry. He became a professor of chemistry at Berlin University and he found third law of thermodynamics. Nernst received the Nobel Prize of Chemistry in 1920.



Fig. 143 Family Grave stone of physical chemist Walther Nernst (1864-1941).

Adolf Windaus (Chemist, 1876-1959), (Fig. 144).

Next to the gravestone of O. Hahn is the grave of Adolf Windaus. Windaus studied in Marburg and then engaged in research in Innsbruck. He became a professor of chemistry at Göttingen in 1915. He studied on the chemistry of Steroid, and is a pioneer of steroid chemistry. Windaus received the Noble Prize of Chemistry in 1928.



Fig. 144 Grave stone of organic chemist Adolf Windaus (1876-1959).

Max Theodor Felix Laue (Physicist, 1879-1960), (Fig. 145).

Laue was born in Koblenz by the river Rhein. He studied in Strasburg and then in Berlin under M. Planck. He moved to München in 1909 and studied X-ray. He irradiated X-ray to a crystal in 1912 and obtained interference patterns indicating that the X-ray is a short electromagnetic wave. He also found the way to clarify the crystal structure by using the interference pattern. He received the Nobel Prize of Physics in

1914. In the main building of the München University, large bronze plaque to celebrate the finding of “Laue’s sopt” was displayed on the wall of a Hof.. He became a professor of theoretical physics at the Berlin University in 1919, but he resigned his position in 1943 because of his political standpoint.



Fig. 145 Grave stone of physicist Max von Laue (1879-1960) who found diffraction of X-ray by using crystal.

Herman Nohl (Philosopher, 1879-1960). (Fig. 139).

He was a philosopher and pedagogist. He was born in Berlin. He became a professor in Göttingen in 1920. He was a Hegelian. I visited Nohl’s grave by the advice of my friend philosopher.



Fig. 139 Grave of Hermann Nohl who was a philosopher and pedagogist.

Richard Zsigmondy (Chemist, 1865-1929). (Fig. 146).

Richard Zsigmondy was born in Wien and studied there. He taught at Graz, then worked in a Glass Company in Jena, he studied colloid chemistry and he invented Supermicroscope. He became a professor of chemistry at Göttingen in 1908, and he received the Nobel Prize of Chemistry in 1925. His Supermicroscope contributed to the development of colloid chemistry, however because of the development of the electron microscope, his optical Supermicroscope gave up it’s dominant position to the more advanced electronic instrument.



Fig. 146 Grave stone of colloid chemist Richard Adolf Zsigmondy (1865-1929).

Gustav Tammann (Physical Chemist, 1861-1938). (Fig. 147).

On the other side of the cemetery (see Map), you can find Gustav Tammann’s grave. This is a family grave site and half a dozen similar gravestones are in this site. Gustav Tammann’s gravestone is 2nd from the right. Tammann was born in Petersburg (Russia) and studied in Germany. Tammann met with W. Ostwald, S. Arrhenius and W. Nemst and they became close friends. In the year 1902, the Laboratory of Inorganic Chemistry was established in Göttingen and Tammann became the professor of inorganic chemistry. He was a specialist of metals, and metal compounds. He also studied equilibrium in heterogeneous systems. Kotaro Honda (physicist, 1870-1954), who was also a metal specialist, studied at Tammann’s laboratory. Later Honda prepared a powerful magnetic steel (KS steel), and his plaque is displayed in the Kreutzberg Strasse with a plaque of Teiji Takagi (1875-1960). Honda and Takagi

are Japanese scholars.



Fig. 147 In the Tammann's family grave site, six gravestones are on the ground. Gustav Tammann's grave is 2nd from right.

Family grave site of Sartorius (Fig. 136).

Years ago, when I was walking around in the Stadtfriedhof, I passed by a large family grave site covered with beautiful flowers. I found out that this is the grave-site of the Sartorius family, the famous balance-maker. When I was a student (1950) the electric balance was a precious and convenient instrument. The Sartorius balance I used came from Göttingen a half century ago.



Fig. 136 Accidentally I pass by the family grave site of Sartorius who are famous for the production of balances and other instruments. Beautiful flowers are in bloom.

Plaques for Scientists in Göttingen (Fig. 148-163, Map 5).

Memorial plates are called "plaque" in English, which is French in origin, and it is called "Gedenktafel" in German. We find many plaques of famous people in European cities, by which we can get various information where they were born, lived, worked and died. It is also true in Germany, especially in the university cities. The display of plaque in the city came from the citizens' love and respect to the person, and the feelings crystallized to make a plaque in the city.

German people love to systematize or to arrange various facts or things in order. They love to make dictionary,

encyclopedia and handbooks. Publications of the "Beilstein's Handbook", "Gmelins Handbook" and "Landolt-Bornstein's Physicochemical Tables" were typical cases in the field of natural sciences in Germany. The plaques displaying in the city were reflections of this German character.

It seems that the number of plaques in the university cities are larger than that of non-university cities. Exact number of plaques in Göttingen is unknown at the present time. It was said that the number of plaque after the 2nd World War was about 220. After then, plaques were added and also removed, and now the total number of plaques in Göttingen is probably about 250. Let's think about the case of city of Jena. Jena has been a famous university city since 1558. Now populated about 100,000. The numbers of plaques in the city of Jena are more than 300 according to a guidebook. I saw a house in Jena displaying so many plaques, that the house looked like a large travel trunk with many travel labels pasted on.

In order to display a plaque for some person, a responsible citizen must propose a plan to the city committee which qualifies the proposal by going through the proper channel. This process was carried out in strict way, and sometime the proposal was not approved.

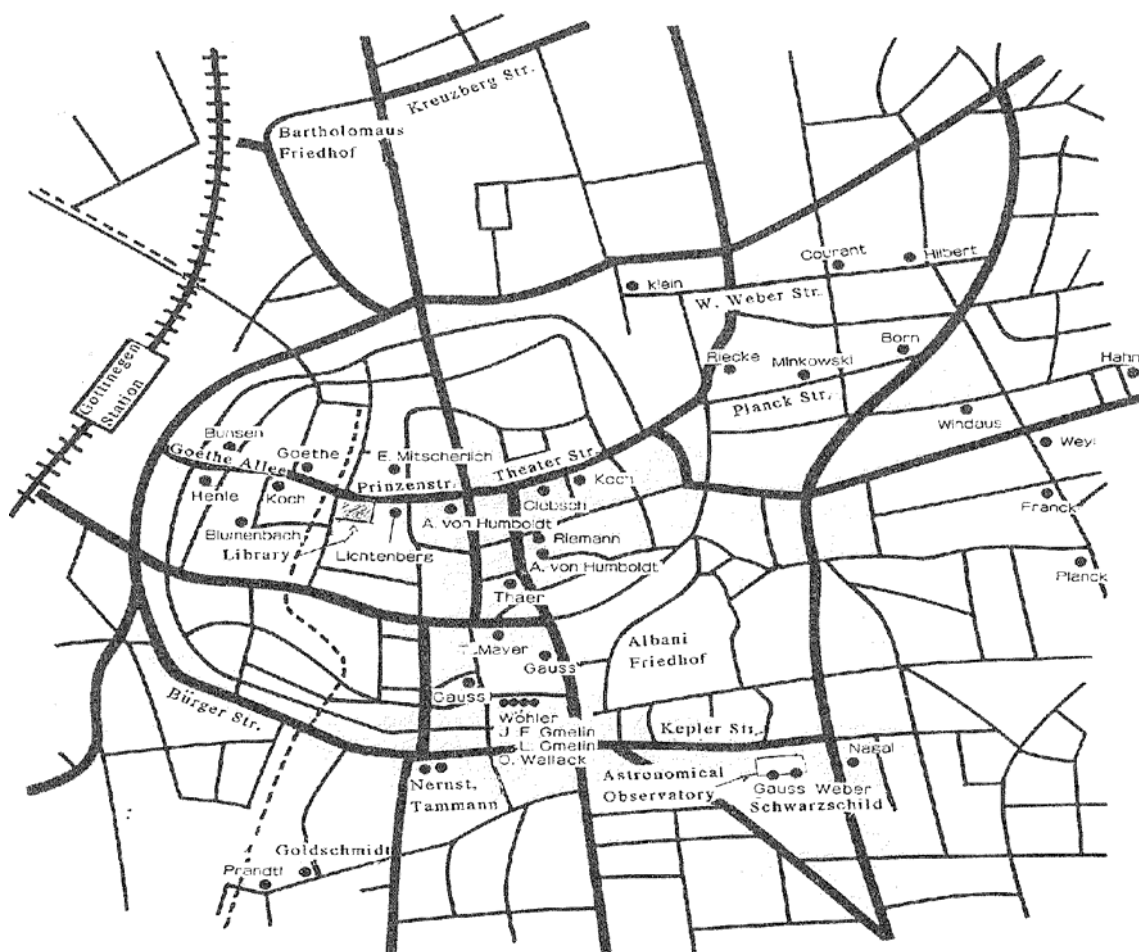
All of the plaques in Göttingen were made of white marble, except that of Felix Kleins one (red brown color), (Fig. 158) as far as I know. The size of old marble plate was said to be 35 cm x 48 cm, but were not necessarily the same. An interesting process is going on slowly that is the replacement of the old plaque with new one. The letters on the old plate are written in old German style, and the new plaque is written in contemporary style and the size of the plate is a little larger than the old one. You can see the old and new plaques for Robert Bunsen (chemist) in the Goethe Allee (Fig. 149-152).

Four plaques are displayed on the "Wöhler Haus" at the Hospital-strasse, and the plaques show the history of the chemistry department in Göttingen from 18th to 20th century (Fig. 148). The plaques are for Johann Friedrich Gmelin (1748-1804), Leopold Gmelin (1788-1853), Friedrich Wöhler (1800-1802) and Otto Wallach (1847-1931). The old wooden building (Wöhler Haus) is now used for the Institute for metal physics.

Famous chemist Hermann Adolf Wilhelm Kolbe (1818-1884) was born in a parsonage at Eliehausen near Göttingen (Fig. 153). Kolbe studied in Göttingen and worked under Bunsen at Marburg. He was promoted to a professor of chemistry at

Marburg in 1852. He moved to the University of Leipzig in 1865. He was famous for his "Type Theory" and for "Kolbe Reaction" to synthesize salicylic acid from phenol and carbon

dioxide. He was also famous as a controversialist in the chemical theories. Kolbe's plaque (Fig. 154) is displayed above the entrance of the building.



Map 5. Some Plaques of Scientists in Göttingen.



Fig. 148 On the wall of "Wöhler Haus" four new plaques were displayed. These are J. F. Gmelin, L. Gmelin, F. Wöhler and O. Wallach (see black arrows). They are all chemists.



Fig. 149



Fig. 150

Fig. 149, 150 Old(Fig. 149) and new (Fig. 150) plaques for R. W. Bunsen at Goetheallee 22.



Fig. 151



Fig. 152

Fig. 152 Old (Fig. 151) and new (fig. 152) plaques of four persons (Humboldt, Tieck, von Stein and Migue



Fig. 153



Fig. 154

Fig. 153, 154 Fig. 153 is a parsonage in Eliehausen near Göttingen where chemist Hermann Adolf Wilhelm Kolbe (1818-1884) was born. You can see a plaque (Fig. 154) pointed by arrow in Fig. 153



Fig. 155 Carl Friedrich Gauss
stayed here
1808-1816

Mathematician, Physicist (in modern style)



Fig. 157 Karl Schwarzschild
stayed here
1901-1909

Astrophysicist



Fig. 159 Robert Koch
stayed here
1862-1866

Physician



Fig. 156 C. F. Gauss
stayed here
1796-1799

Ledwig Harms 1828-1830(inold style)



Fig. 158 Felix Klein
stayed here 1901-1909

Mathematician

Kleine's plaque is red brown in color



Fig. 160 Max Planck
stayed here
1945-1947

Physicist



Fig. 161 James Franck
stayed here
1921-1933
Physicist



Fig. 162 Max von Laue
stayed here
1946-1951
Physicist



Fig. 163 Otto Hahn
stayed here
1953-1968
Chemist, Physicist

Some of the plaques of scientists in Göttingen were photographed by the author, and these are shown from Fig. 155-163 and also in Map 5.

Table 1. Some plaques of Scientists in Göttingen

Scientists	period stayed	Specialty	Fig
Carl F. Gauss	1808-1816	Mathematician	155
	1796-1798	Mathematician	156
Karl Schwarzschild	1901-1909	Astrophysicist	157
Hermann Kolbe	1818-1826	Chemist	154
Felix Klein	1901-1909	Mathematician	158
Robert Koch	1862-1866	Physician	159
Max Planck	1945-1947	Physicist	160
James Frank	1921-1933	Physicist	161
Max von Laue	1946-1951	Physicist	162
Otto Hahn	1953-1968	Chemist	163

A few years ago, a new plaque was displayed at the Judenstrasse in Göttingen. The plaque is for William Smith Clark, 1826-1886, who is an American scholar famous in Japan for his saying "Boys be ambitious". He was originally a chemist who received his Ph D degree by his analytical work of iron meteorites under Friedrich Wöhler. He is probably the first American student in the chemistry department in Göttingen. He wrote his Ph D thesis in English. His interest changed from chemistry to agriculture and he came to Japan. He contributed to Japan as an educator. One problem is that a word "Geochemist" (地球化学者) is described on the plaque in Japanese. The plaque is displayed for German citizen not for Japanese. I am wondering why such a Japanese word was engraved on the plaque, and what is his contribution to science?

Street names came from famous scientists

Most of the street names of Göttingen came from the names of famous persons. They are poet, philosopher, scientist mathematician, musician, physicist, historian, artist and jurist. Some photographs of the street name plates came from famous scientists are shown in Fig. 164-177 and also summarized in Table 2.

I hope the reader of the article may take a short time to make a walk trip to visit individual plaque and street-name plate in the city. It would be an interesting trip historically, scientifically and of course good for your health.



Fig. 164 Bunsenstr.
Robert Bunsen
born - died
1811 - 1899
Chemist



Fig. 166 Gaussstrasse
Friedrich Gauss
born - died
1777 - 1855
Mathematician,
Physicist

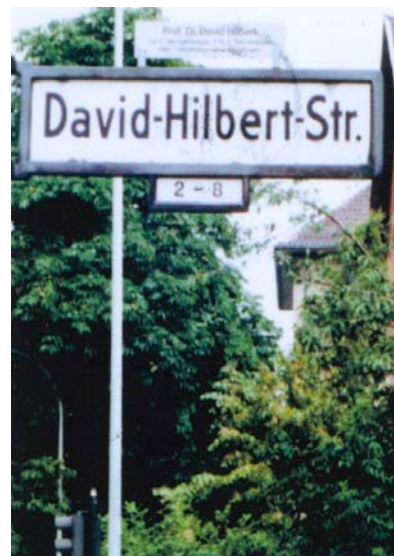


Fig. 168 David-Hilbert-Str.
David Hilbert
1862-1943
Mathematician

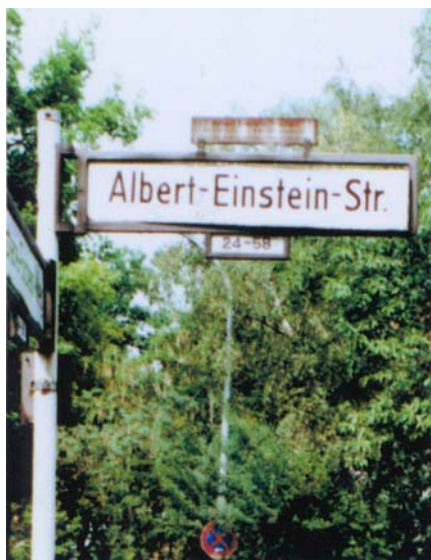


Fig. 165 Albert Einstein-Str.
Albert Einstein
born - died
1879 - 1955
Physicist



Fig. 167 Humboldtallee
Alexander v. Humboldt
1769-1859
Naturalist



Fig. 169 Felix-Klein-Str.
Felix Klein
1849-1925
Mathematician



Fig. 170 Immanuel-Kant-Str.

Immanuel Kant
1724-1804
Philosopher



Fig. 172 Walter-Nernst-Weg

Walther Nernst
1864-1941
Chemist



Fig. 174 Otto-Wallach-Weg

Otto Wallach
1847-1931
Chemist



Fig. 171 Lilienthalstr.

Otto Lillienthal
1848-1896
Inventor



Fig. 173 Riemannstrasse

Bernhard Riemann
1826-1866
Mathematician



Fig. 175 Wöhler strasse

Friedrich Wöhler
1800-1882
Chemist



Fig. 176 Zeppelinstrasse
Ferdinand Graf von Zeppelin
1838-1917
Inventor



Fig. 177 Richard Zsigmondi-Weg
Richard Zsigmondy
1865-1929
Chemist

Table. 2, Street Names in Göttingen Employing Name of Scientists

Street Name	Name of Scientist	Field	Birth	Death
Albert-Einstein-Strasse	Albert Einstein	Physicist	1879—1955	
Albert-Schweitzer-Strasse	Albert Schweitzer	Physicist, Musician	1875—1965	
Albrecht-Thaer-Weg	Albrecht Danier Thaer	Agronomist	1752—1828	
Albrecht-von Haller -Strasse	Albrecht von Haller	Naturalist	1708—1797	
Benzstrasse	Carl Friedrich Benz	Industrialist	1844—1929	
Blumenbachstrasse	Johann Friedrich Blumenbach	Physician	1752—1840	
Bunsenstrasse	Wihelm Robert Bunsen	Chemist	1811—1899	
Carl-Zeiss-Strasse	Carl Zeiss	Industrialist	1816—1888	
Daimlerstrasse	Gotlieb Wilhelm Daimler	Inventor	1834—1900	
David-Hillbert-Strasse	David Hillbert	Mathematician	1862—1943	
Enrico-Fermi-Strasse	Enrico Fermi	Physicist	1901—1954	
Ernst-Abbe-Strasse	Ernst Abbe	Physicist	1840—1905	
Felix-Klein-Strasse	Felix Klein	Mathematician	1849—1925	
Fridtjof-Nansen-Weg	Fridtjof Nansen	Geologist	1861—1930	
Gaussstrasse	Johann Carl Freindrich Gauss	Mathematician	1777—1855	
Goethe-Allee	Johann Wolfgang von Goethe	Poet, Naturalist	1749—1832	
Goldschmidtstrasse	Victor Moritz Goldschmidt	Geo-chemist	1888—1947	
Gustav-Hertz-Ecke	Gustav Hertz	Physicist	1887—1975	
Gutenbergstrasse	Johannes Gutenberg	Inventor	1397—1468	
Hermann-Kolbe-Strasse	Hermann Kolbe	Chemist	1818—1884	
Hermann-Weyl-Stieg	Hermann Weyl	Mathematician	1858—1955	
Humboldtallee	Alexander Freiherr von Humboldt	Naturalist	1769—1859	
Immanuel-Kant -Strasse	Immanuel Kant	Philosopher	1724—1804	
James-Franck-Ring	James Franck	Astronomer	1882—1964	
Karl-Schwarzschild-Weg	Karl Schwarzschildt	Astronomer	1873—1916	
Keplerstrasse	Johannes Kepler	Astronomer	1571—1630	
Kopernikusstrasse	Nikolaus Kopernikus	Astronomer	1473—1543	
Leibnizstrasse	Gottfried Wilhelm Freiherr von Leibniz	Philosopher Mathematician	1646—1716	
Lichtenbergstrasse	Georg Christoph Lichtenberg	Physicist	1742—1799	
Lilienthalstrasse	Otto Lilienthal	Inventor	1848—1896	
Ludwig-Prandtl-Strasse	Ludwig Prandtl	Physicist	1875—1953	

Street Name	Name of Scientist	Field	Birth	Death
Maria-Goppert-Weg	Maria Goppert	Physicist	1906—1972	
Max-Born-Ring	Max Born	Physicist	1882—1870	
Max-von-Laue-Weg	Max von Laue	Physicist	1879—1960	
Minkowskiweg	Hermann Minkowski	Mathematician	1964—1909	
Otto-Hahn-Strasse	Otto Hahn	Physical Chemist	1879—1968	
Otto-Wallach-Weg	Otto Wallach	Chemist	1847—1931	
Richard-Zsigmondy-Weg	Richard Zsigmondy	Physical Chemist	1865—1929	
Riemannstrasse	Bernhard Riemann	Mathematician	1826—1866	
Robert-Koch-Strasse	Robert Koch	Bacteriologist	1843—1910	
Rosenbachweg	Friedrich Julius Rosenbach	Bacteriologist	1842—1923	
Rudolf-Diesel-Strasse	Rudolf Diesel	Inventor	1858—1913	
Sternstrasse	Moritz Abraham Stern	Mathematician	1807—1894	
Tammannstrasse	Gustav Tammann	Physical Chemist	1861—1938	
von Siebold-Strasse	Karl Kasper Jakob von Siebold	Physicist	1801—1861	
Walther-Nernst-Weg	Walther Nernst	Physical Chemist	1864—1941	
Werner-Heisenberg-Platz	Werner Heisenberg	Physicist	1901—1976	
Werner-von Siemens-Strasse	Werner von Siemens	Industrialist	1816—1892	
Wilhelm-Weber-Strasse	Wilhelm Weber	Physicist	1804—1891	
Wöhler platz	Friedrich Wöhler	Chemist	1800—1882	
Wöhler strasse				
Wolfgang-Pauli-Weg	Wolfgang Pauli	Physicist	1900—1958	
Zeppelinstrasse	Fredinand Graf von Zeppelin	Inventor	1838—1917	

Acknowledgment

I would like to thank Dr. Günther Beer of the University of Göttingen for his kind supply of many valuable informations to write the article. I am also appreciated to Dr. Kazuo Harada of Tokyo Gakugei University for his efforts to improve the article. Thanks are extended to Ms. Hiroko Eto for her editing work of this article.

All photographs appeared in this article were taken by the author Kaoru Harada.