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SCIENTISTS IN OLD GDANSK: 17th AND 18th CENTURIES

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1. The 17th century

Krüger's pupil was the 2nd most outstanding (after Copernicus) astronomer of the old Rzeczpospolita – Johann Hevelius (1611–1687). The Hevelke family he came from settled in Gdansk in the 15th century. The family house of the future scientist was in the Right City, on the corner of Straganiarska and Grobla IV (Dam IV) – in St. John's parish, where he was baptized. While still attending the Academic Gymnasium, he undertook his first astronomical observations.

In the years 1630–1634 he studied in Leyden and travelled around England and France. The contacts with the leading scientists, which were started then, were then maintained through all his life. In 1635 he got married and moved to the Old City. On the roofs of the houses in Korzenna street numbers 53–55 he organized an observatory, which started operating systematically in 1641. At that time Hevelius became the alderman, and two years later – the town councilor.

The money for scientific work came from the family brewing house and the salaries allocated by the kings: Louis XIV and Jan Sobieski. Since 1663 he was helped by his second wife, 36 years younger than he was, Elisabeth Koopman, the first in Poland woman-astronomer. It was her great energy that helped Hevelius to get over the results of the fire that in 1679 destroyed the observatory. She also published some of his works after his death. Among the output of the scientist there are: 19 works, 29 dissertations and 16 volumes of letters. *The Selenographia* published in 1647 includes precise descriptions and maps of the Moon. *Machina Coelestis* (Vol. I – 1673, Vol. II – 1679) presents the instruments, the difficulties and the achievements. Hevelius was the first person to use the micrometer screw to set the instruments and telescopes precisely. He was also the inventor of periscope, which he called a polemoscope. Under his guidance the first pendulum clocks were constructed. In 1644 he became the first foreign member of the Royal Scientific Society in London.

In 1679 Edmund Halley visited him in Gdansk. In 1687 The Stars Catalogue was published, in 1679 – Sobieski's Firmament with 56 maps of the sky, and Prodromus Astronomiae containing the positions of 1564 stars. The names of 9 constellations used till the present day, including the Shield (Sobieski's armorial bearings), come from Hevelius. After Krüger he continued the measurements of the magnetic declination, and discovered its secular changes. As a proof of the recognition he enjoyed we can give Ismael Bullialdi's assessment, expressed in 1648, when Hevelius had not even reached the middle of his career: *With "Selenographia" you gave the keystone to astronomy, since it is difficult to expect the human mind to go even higher*. King Jan Kazimierz, on learning about some intrigue against the scientist, expressed his highest surprise that the Council was unable to protect the master: *because this very man will be the ornament and the pride of Gdansk in the centuries to come*. The future generations confirmed this opinion.

Figure 1. Hevelius' bust presented to the City by the King Stanisław August

Hevelius was great light of his epoch. Probably because of his guidance the city doctor Israel Conradt (1634–1715) undertook the attempt to organize in Gdansk a scientific association modeled on Italian academies. In response to the appeal of the Royal Society from London, Conradt studied the influence of low temperatures on the density of substances. In the cycle of lectures from 1670 he reported the results. In his text published 7 years later he gave the first in the world description of over-cooling of liquids.

Taking advantage of the occasion, it is worth to mention here the achievements of Gdansk medicine. Since the beginning of the 15th century on the site of today's Railway Headquarters there was a city fever hospital with the pharmacy and a chapel. It admitted the infectious diseases, venereal patients, and the crazy ones. Since 1504 there existed the office of the city physician. In 1580 the first in Poland Chair of Anatomy was created at the Academic Gymnasium. Its second professor – Joachim Oelhaf (1570–1630) in 1613 performed the first in the Central Europe public dissection. The most outstanding Gdansk anatomist was Laurentius Eichstadt (1596–1660). In 1666 Johann Schmiedt (1624–1690)

was the third person in the world who started to use intravenous injections, and in 1665, together with another physician – Johann Scheffler (1605–1673) – he prepared the first in Poland Pharmacopoeia that was the official list of recipes for medicaments. Since 1597 the functioning of pharmacies was regulated by the Drugstore Act. In 1636 King Wladislaw IV ratified the opening of the Gdansk Medical College – the first in Poland Chamber of Physicians. In 1571 the city had 3 midwifes who also issued virginity certificates. Some doctors – Joachim and Nicolaus Oelhaf, Johann Placotomus, Laurentius Eichstadt and others – were successful in the field of botany, designed gardens, grew medicinal plants, published descriptions and herbariums. The development of medicine was also not stopped in the 18th century. In 1724 Emanuel Davisson (1692–1743) refuted the theory that considered plica to be an illness. A royal doctor and astronomer Matheus Wolff introduced in Gdansk the first inocculations against smallpox in 1776. Christian Sendel (1719–1788) was the pioneer of electroteraphy.

We should now, however, come back to physics. Daniel Gabriel Fahrenheit was born in Gdansk on 24 May 1686. The date 14th, given sometimes, comes from the English sources and refers to the Julian calendar used in England in those times, while in Gdansk and in all Poland since 15 October 1582 the Gregorian calendar is used. After the tragic death of both parents 15-year-old Daniel was sent by his guardians to Amsterdam to learn to be a merchant. In 1706 the future scientist, who from sheer passion devoted most of his time to glass making and construction of science equipment, thermometers among others, started his journey to Germany, Denmark, and Sweden. The journey saved him from being deported to the Dutch Indies by his guardians, as punishment for a loan he took on account of his inheritance from his parents. In 1708/1709 he works together with Olef Römer in Copenhagen. He remains in touch with Gdansk where he sends his thermometer – still with the Florentine scale. In 1709 he returns to Gdansk and performs here the measurements of temperature and atmospheric pressure. After coming of age and receiving his part of the inheritance he tries his luck in trade. In the years 1712–1714 he co-operates with professor Paul Pater, the founder of the first technical school in Gdansk. In 1714 he finally gives up "business", goes to Berlin and Dresden. In Halle he gets in touch with Christian Wolff, who is impressed by his thermometers. Since 1717 he settles in Amsterdam, where he constructs instruments and gives private courses of physics and chemistry. In 1724 he presents his discoveries at the Royal Scientific Society in London and is accepted as its member. In 1736 he goes to The Hague because he received a warrant for his machine (a kind of turbine) *for removing stinking water from canals, for creating waterfalls and other water equipment*. He dies there on 16th September, after having settled his few possessions to go to his beloved sister and her son in Gdansk.

Among the greatest works of Fahrenheit is the construction of thermometers (since 1706/1707) of comparable readings. It was possible owing to the improvement in construction and calibrating with three constant points. In 1713 he used mercury as thermometer liquid. In 1714 he introduced his own scale which is still used in America. He measured the thermal expansion coefficient of different materials. Ha also discovered the dependence of boiling temperature on pressure. In 1729 he obtained the lowest temperature -40° by the use of a cooling mixture. He improved Newton's telescope, devised new types of densimeter and barometer. He was the first person to describe the properties of platinum. Each of his dissertations published in 1724 in the *Philosophical Transactions* introduced something

Figure 2. The Portal of Fahrenheits Birth House in Ogarna Street with the memory plate

Figure 3. Fahrenheit's Thermometer from Gdansk Hall (lost in last war)

new into the history of physics. In the notes to his Amsterdam lectures one can find many exploratory thoughts and modern viewpoints, for example the explanation of boiling of liquids basing on molecular theory.

On the 300th anniversary of Fahrenheit's birth on the family house of the scientist in 94 Ogarna Street a very original plate, in the shape of a thermometer, was placed.

2. The 18th century

Among the world pioneers in physics one should also mention Daniel Gralath (1708–1767). Already while studying in the Academic Gymnasium he showed the abilities and inclination for science. As a proof of this we can give the following dissertations published in 1729 (in Latin): *About Water Meteors, About the Origin of Springs, About Magnetism.* At that time their author already studied law and philosophy in Halle, then in Leyden

and Marburg. After coming back he married the daughter of the famous naturalist Jacob Theodor Klein. In 1754 he became the alderman, in 1758 the councilor, and in 1763 – the mayor.

Figure 4. Daniel Gralath

One of the greatest merits of Gralath was the creation of the Experimental Physics Society (Societas Physicae Experimentalis), later renamed Natural Scientific Society (Naturforschende Gesellschaft). The first organizing meeting took place on 7th November 1742, the first scientific meeting was called on 2nd January 1743. The aim of the Society was to practice and popularize science, among others through weekly public demonstrations of the most interesting experiments in physics. Since 1746 these took place in the Great Hall of the Green Gate. Among his particular interests was electrostatics. A novelty were the so-called Leyden bottle experiments, that is with a condenser prototype, discovered in 1745 by Ewald Kleist in Kamien Pomorski. Gralath performed the first successful experiments with the Kleist bottle on 5th March 1746, before a similar trial by Peter Musschenbrock in Leyden, which decided its later name. Gralath also put together the first in the world battery of such condensers and properly described their functioning. He also measured – 40 years earlier than Coulomb! – the forces between charged electrodes. Had he interpreted the results of his measurements properly we would be learning in today's schools about the Gralath's law. His most valuable publication is the first in the world *History of Electricity*, printed in the successive volumes of *Experiments and Dissertations of the Society* in the years 1747, 1754, 1756, and the two-part *Electric Library*.

A remembrance of the learned mayor is the magnificent lime-tree alley between Gdansk and Wrzeszcz (Al. Zwyciestwa), which he has founded. Since 1901 in the alley stands his monument in the form of a boulder. After the last war a plate was mounted on it with the names of Polish scouts murdered by the Nazis. I think the scouts deserve their own monument, and the boulder should be given back to Gralath, who is really worth of it.

The co-founder of the Nature Society was among others Heinrich Kühn (1690–1769). Born in Königsberg, he studied at the Pedagogicum there, and then moved to Halle, where he wrote his doctor's thesis in law. Since 1717 he again studied in Königsberg – natural

Figure 5. The Natural Scientific Society's Emblem – orange trees and the motto: "with time and care"

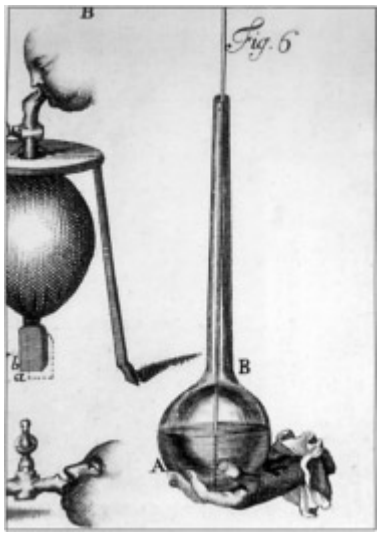

Figure 6. A so-called Leyden Bottle

science this time. In 1733 he settled in Gdansk. As mathematics professor at the Academic Gymnasium in the years 1735–1770 he published the calendar, which was distinguished by the high level of information and interesting content. Since the creation of the Society he was one of the most active members. Among the 5 treaties printed in 1747 in the *Experiments and Dissertations of the Society* the most important is the first one, containing the description of the prototype of analytical balance and the pioneer theory of scales and weighing. The other treaties concern such varied subjects as an apparatus for measuring the drop of the level of water in the rivers, sunspots, tails of comets and dissertations about density and transparency of air. The third volume of the Society's works includes the article about ocean tides. Kühn also dealt with the fashionable subject of the origin of springs. On the 300th anniversary of the Academic Gymnasium in 1758 he gave a brilliant lecture *About the Influence of Mathematics and Natural Sciences on the Worldly Happiness of Humankind*. His last work was *An Attempt of Precise Solution of Some Cubic Equations* published after his death. His most important achievement, however, was the *Considerations*

over Constructing Imaginary Quantities and Extracting Imaginary Roots from 1750/51, published 5 years later in *New Commentaries of the Petersburg Science Academy*, which awarded him with an honorary membership. In this work Kühn, as the first person in the history of mathematics, suggested geometric interpretation of complex numbers.

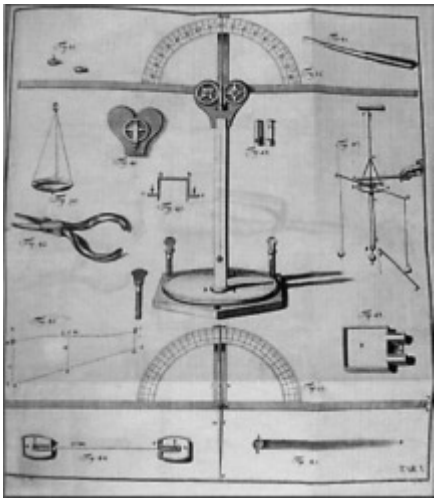

Figure 7. The Prototype of Analytic Scales by Heinrich Kühn

Science in the 18th century Gdansk was characterized by its high level and diversity of the fields of interest. There were also a lot of versatile scientists who tried to grasp the whole of the contemporary knowledge. There was one more person worth mentioning in the group of such polyhistors. This was one of the founders of the Natural Science Society – Michal Hanow (1695–1773). Born in Samborsk near Jastrow, he learnt in Gorzow Wielkopolski (Landsberg). In 1714 he moved to Gdansk avoiding to be enlisted into the Prussian Army. After finishing the Academic Gymnasium he started studying in Königsberg. After serious illness he lost his memory and started the studies from the beginning, this time in Wittenberg and Leipzig, where he attended lectures in philosophy, mathematics, medicine, natural sciences, history and law! In the years 1727–1771 he was the professor of mathematics and philosophy at the Academic Gymnasium in Gdansk. Apart from German, he also spoke French, English, Italian and Latin, and also knew some oriental languages.

Hanow's scientific output comprises over 100 dissertations about statics, meteorology, law, philosophy, and history. He published a collection of Chelmno (Culm) law with a commentary (in the years 1745–1771), source materials for the Prussian history (1747–1750), a treaty about the history of printing in Gdansk (1740), a study of the rules of economy, philosophy and physics according to Christian Wolff's system (1755–1768), and many others. Since 1739 he published the first in Poland popularized scientific magazines *Gdansk Experiments* and *Nature's Curiosities Explained*, and since 1747 – *The Prussian Collection* devoted to the past of the East Pomerania. In the *Experiments and Dissertations* of the Nature Society we can find as many as 13 articles written by him on such different subjects as: Gdansk measures and scales, freezing of liquids, corn scales, putting down fires by explosion, organizing fire protection, and so on. Apart from that Hanow systematically collected and published meteorological data (since 1739) and the statistics of population

Figure 8. Michal Hanow's Portrait

migration. He can be considered the forerunner of demography. His counting of the density of population in Gdansk since 1601 is, with small corrections, feasible also today.

Jacob Theodor Klein (1685–1759) – an outstanding naturalist was also connected with the Gdansk Natural Scientific Society. In his native Königsberg ha studied law, history, mathematics, and was also interested in the natural sciences, music and poetry. After the "obligatory" trip around Europe he settled shortly in Germany. Since 1712 he lived in Gdansk, a year later he became a secretary of the Council. In the years 1714–1716 he was Gdansk resident in Dresden and Warsaw. In 1718 he founded the famous botanical garden in Dlugie Ogrody (Long Gardens), where among others he grew fruit bearing coffee trees and pineapples. By the garden there was also a nature study with a rich collection of animals, fish, birds, shells and minerals – including amber. The recapitulation of Klein's work were the multi-volume works, for example *Natural History of Fish* (1740–1749), *History of Birds* (1750), or the basics of mineralogy bearing an original title *An Underground Study by the Light of a Lamp* (1758). Zoological systematics, prepared by Klein independently of Linneus, enjoyed considerable popularity. The proof of the recognition of the scientist in the world was the membership in scientific societies in London, Bologna, Jena and Petersburg.

Outside the Nature Society worked the greatest historian of old Gdansk – Gotfryd Lengnich (1689–1774). At the age of 13 he was sent to Gniew to broaden his knowledge of Polish language, then returned to Gdansk, graduated from St. Mary's School, and since 1707 he studied at the Academic Gymnasium. In 1710 he went to Halle to study law and history: *[…] I listened to some of the famous professors there, yet as I studied mainly for myself, I expected to obtain more from staying with scientists and using their libraries than from listening to lectures*. He also co-operated with the "learned" monthly magazine *New Hallenic Library* (*Neue Hallische Bibliothek*). In 1712 he obtained the title of licentiate, in 1713 the doctor's title, and decided "to look for his luck" at the king's court in Warsaw. On his way there he visited Gdansk… and remained here till the end of his life. At first he was jobless, so he used the time to learn as much as possible about the history and constitutional law of Poland, Prussia and Gdansk. In 1721 the Council asked him to continue the 16th century History of Prussia by Casper Schütz. In 1729 Lengnich became the professor of the

Figure 9. Jacob Theodor Klein's Portrait

Academic Gymnasium, in 1738 – an honorary member of the Petersburg Science Academy, in 1740 – the court councilor for the king August III, and finally in 1750 – the syndic of the City of Gdansk. In this office he showed an incredible ability in approaching difficult or delicate matters. Among all these duties he did not neglect science. In the years 1722–1753 he published his fundamental, 9-volume History of Royal Prussia. As a tutor of the sons of voivode Poniatowski, including the future king Stanislaw August, he wrote for them the *History of Poland since the Times of Lech till the Death of August II*, which was published twice (in 1740 and 1750) and also translated into German. It is worth mentioning here that the first known handbook of Polish history entitled *Polish Flower* (*Florus Polonicus*) appeared in 1641 in Leyden. It was written by Joachim Hirtenberg-Pastorius (1611–1681) – the Academic Gymnasium professor (since 1655), St. Mary's vicar (since 1678) and the Kujawian bishop's official.

Lengnich also published a very valuable study of the law of Poland, Polish (Royal) Prussia and the outstanding Public Law of the City of Gdansk, which was published only in 1900. Among the many collections of treaties and speeches a permanent value keeps the 1749 edition of the Chronicles of Kadlubek and Gall Anonim.

In 1718 Lengnich started publishing the first in Poland science magazine *Polish Library* (*Polnische Bibliothek*) devoted to the history of Poland. Tannenberg (Stębark) was mentioned as the place of publication, where Jagiello defeated the Teutonic Knights. His aim was to clear the history of his Fatherland (original "Vaterland") of the obvious lies and present it in the true light. He was also the founder of the first in Poland Learned Society (Societas Literaria), which worked in the years 1720–1727.

Let us mention one more name from among the 18th century Gdansk scientists who gained worldwide fame. It is the name of Johann Reinhold Forster (1729–1798) and his son Johann Georg (1754–1794). The Forster family came from the Scottish Forresters. The older Forster was born in Tczew. After finishing theological studies he became a parson in Mokry Dwor near Gdansk. He was interested in mathematics, philosophy, geography and languages, of which he knew 17. In 1765, following the order of Russian Empress Catherine, he studied the conditions of life of German settlers in the Saratowsk province. In the years

Figure 10. Gotfryd Lengnich's Portrait

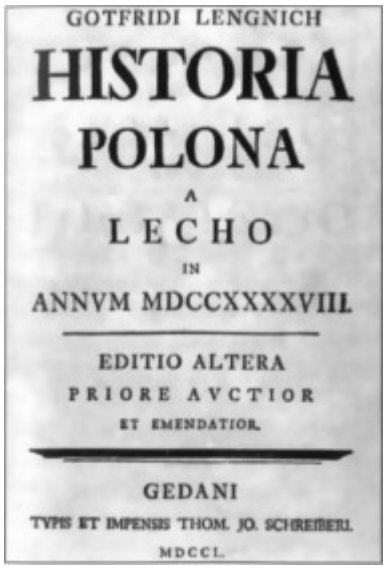

Figure 11. The Title Page of Historia Polona by Lengnich

1766–1772 he moved with his family to England, working as "natural history" professor in Warrington. In 1772, as scientific supervisor, he with his son took part in Cook's second expedition around the world. After coming back he and his son published a description of the plants they had seen and discovered during that voyage. Acknowledging his merits the Gdansk Natural Society presented him with the title of an honorary member, and the Oxford University presented him with the title of a doctor. After having some problems here (he was, for example, imprisoned for debts) he moved to Halle, where he was natural history professor since 1780. In 1794 he published the history of polar expeditions.

Johann Georg Forster was born in Mokry Dwor (Nassenhuben). He was educated by his father. At the age of 17 he accompanied his father in his voyage to Russia, helped him collect materials and compile the results. In England he helped to support the family, studying languages at the same time and translating the reports from research expeditions. As a participant of Cook's expedition he helped his father, learned to navigate, studied geography and ethnography, described and sketched everything they met on their way, measured the depth of waters. The description of their expedition *Voyage around the World*, published in 1775 still raises admiration by the beauty of the language and the mastery of the sketches.

Figure 12. Johann Reinhold and Johann Georg Forsters – Cook's Expedition Participants

Since 1779 Georg Forster was a professor in Kassel, where he gained fame as an outstanding lecturer. In the years 1784–1787 he stayed in Wilno, where, among other things, he gave the first in Poland lectures in paleontology. Several dozen of years before Darwin he propagated the evolution theory. In 1778 he moved to Mogunce, and after the French Revolution – to Paris, where he died prematurely.

In spite of the outstanding output, Johann Georg Forster is a scientist without a native country. A Scotsman from origin, a Pole by birth, a cosmopolite by character – he never stayed long anywhere. The Poles could not forget the malicious saying – "polnische Wirtschaft", the Germans couldn't overlook the fact that he supported joining the Rhine region to France, the English people – the fact that he was a republican, and the French always considered him a foreigner. Yet he surely deserves a prominent position in the Pantheon of Gdansk science.

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