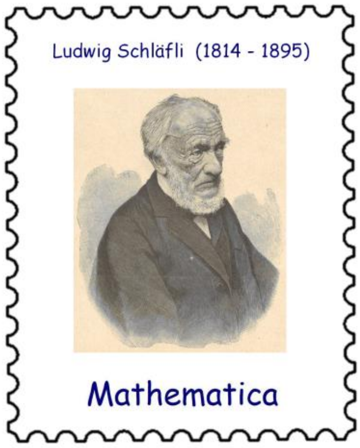
Ludwig Schläfli (January 15, 1814 – March 20, 1895)

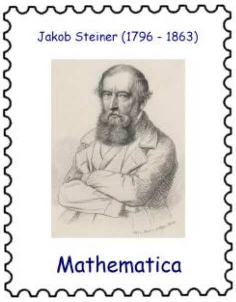
by Heinz Klaus Strick, Germany



"... [*he was*] *a rural mathematician from near Bern, an ass to the world, the most ingenious dolt I have ever met, but he learns languages like child's play* ...".

With these words Jakob Steiner praised his new acquaintance, the 29-year-old compatriot Ludwig Schläfli, to his colleagues Carl Gustav Jacob Jacobi, Peter Gustav Lejeune Dirichlet and Karl Wilhelm Borchardt as a companion for their stay in Italy.

In 1843, Jacobi, a professor of mathematics in Königsberg, was ill with diabetes. Thanks to the support of Alexander von Humboldt, an application to the Prussian king for a holiday in the mild climate of Italy had been approved and the Berlin mathematics professor Dirichlet was allowed to accompany Jacobi. During a stopover in Bern they met Steiner, who had just visited his old homeland and also met Schläfli.



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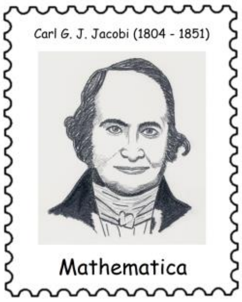
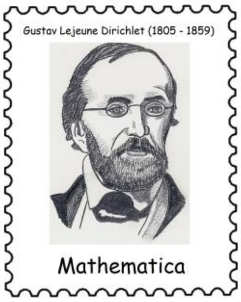




(Drawings © Andreas Strick)

Ludwig Schläfli was born as the eldest son of Johann Ludwig Schläfli and Magdalena Aebi in Grasswil in the canton of Bern (today belonging to the municipality of Seeberg). The family soon moved to neighbouring Burgdorf, where the father tried to support the growing family (four children) as a merchant. At primary school in Burgdorf it was already noticeable that Ludwig had a talent for mathematical tasks, while otherwise he was considered rather clumsy. When his father sent his 15-year-old son with a basket full of goods to peddle in neighbouring villages, it became clear that he was not a suitable successor for his trading business. Ludwig simply wasn't able to understand that you have to sell goods at a higher price than you paid for them yourself ...

So his father agreed to an offer that his son – thanks to a scholarship – could attend a grammar school in Bern. Ludwig had no problems with the demands of secondary school. In mathematics he worked through the volume *Mathematische Anfangsgründe der Analysis des Unendlichen* [Mathematical Foundations of the Analysis of the Infinite] by Göttingen professor Abraham Gotthelf Kästner (1719-1800) in addition to the current subject matter.

After attending school for two years, Ludwig Schläfli transferred to study theology at the *Bern Academy*, which was integrated into the University of Bern in 1834. In 1836 he passed his examination, which included a test sermon. However, he did not aspire to become a pastor, partly – as he confessed to his parents – *because he did not believe everything*.

For ten years he worked as a poorly paid teacher of mathematics and science at the *Progymnasium* in Thun.

One day a week he travelled to the University of Bern to expand his knowledge of the subject and he used every free minute for self-study, including learning foreign languages. In the meantime, he had mastered not only Latin, Greek and Hebrew, but also English, French and Italian. In 1843, just as he was thinking about travelling to Berlin to make contact with his compatriot JACOB STEINER, he learnt that the latter had come to Bern (ostensibly to recuperate, but more likely to sound out the chances of being appointed to the newly founded University of Bern). STEINER was impressed by SCHLÄFLI's expert knowledge and even more by his quick comprehension.

And when he learnt of SCHLÄFLI's language skills, the decision was made: SCHLÄFLI would serve as an interpreter for the small travel group (STEINER, DIRICHLET, JACOBI, BORCHARDT) in Italy.

After SCHLÄFLI had appointed a substitute at the school (which he had to pay for himself), he travelled with STEINER to Rome, where they met the others. Every day he received a private lecture on *number theory* from DIRICHLET and he translated treatises by STEINER and JACOBI into Italian. During the expert discussions with the Italian scientists, SCHLÄFLI was valued as a full member of the travel group.

When SCHLÄFLI returned to Thun after six months, he felt even more uncomfortable as a teacher than before. His application for a part-time professorship in physics, mathematics and astronomy at the University of Bern was accepted in 1847 – but at first he was only given the *prospect* of an honorarium.

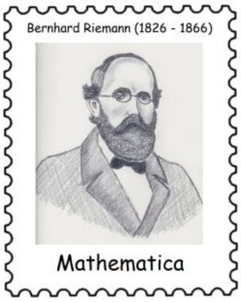
From 1848 onwards he received an annual salary of 400 francs as a *Private Lecturer*, which he could barely live on. Friends arranged for him to give private lessons so that he does not have to go hungry, and he also worked for an insurance company. When he renounced a small inheritance from his parents in favour of his mentally handicapped sister, the good-natured scholar did not object to the fact that he nevertheless had to pay a higher tax.

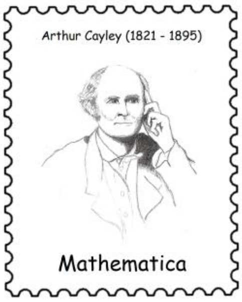
It was not until 1853, when he was appointed *Associate Professor*, that his annual salary was increased to 1200 francs, from which he was finally able to support himself. He owed subsequent salary increases (to 2000 francs after his appointment as full professor and up to 4000 francs in 1879) to the commitment of his colleagues and his students, who appreciated his work at the university more than those responsible in the government.

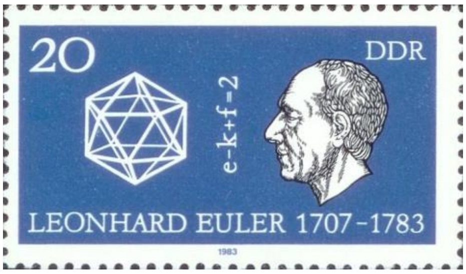
SCHLÄFLI was very popular as a university teacher and he prepared his lectures meticulously. He was extremely devoted to his students, especially his twelve doctoral students, six of whom later became professors. It is only because of STEINER's persistence that the University of Bern awarded him an honorary doctorate in 1863. SCHLÄFLI continued his successful teaching career until his retirement in 1891 (by then he was already 77 years old).

After that, he concentrated on linguistic research and thanks to his special talent, he also learned Modern Persian, Arabic, Coptic, Polish, Russian, Swedish and Turkish over the years, as well as Vedic and Sanskrit. He was unable to complete the planned translation of the *Rigveda*, one of the most important Hindu scriptures. Although he was awarded the STEINER Prize of the *Berlin Academy of Sciences* in 1870 and was a corresponding member of the scientific academies in Göttingen, Rome and Milan, not all his treatises received the attention they deserved – in some respects he was ahead of his time.

The publication of his main work, the *Theory of Multiple Continuity*, written in the early 1850s, was rejected by the academies in Vienna and Berlin (partly because of its size). ARTHUR CAYLEY translated parts of it into English in 1860 and the complete version was published posthumously in 1901. With his main work SCHLÄFLI – together with CAYLEY and BERNHARD RIEMANN – laid the foundations of multidimensional geometry.







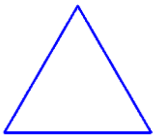
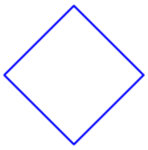
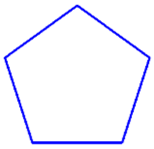
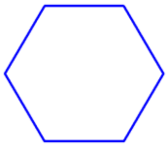
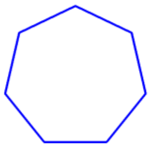
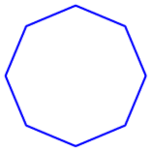
He generalised the terms *polygon* in the 2-dimensional and *polyhedron* in the 3-dimensional cases to *polyschema* (today: *polytope*) in the *n*-dimensional case.

He also found the generalisation of EULER's polyhedron theorem
$v - e + f = 2$ (*number of vertices – number of edges* + *number of faces* = 2)

to $\sum_{i=0}^{n-1} (-1)^i \cdot k_i = 2$, where k_i denotes the number of *i*-dimensional boundary elements.

He could prove that there are only six different regular polytopes in 4-dimensions, in higher dimensions there are only three each. For polygons, polyhedra, etc. he introduced a notation, the so-called SCHLÄFLI symbols:

Regular *n*-gons are denoted by {*n*}, regular star-polygons, where the *n* vertices are each connected to the *k*-nearest vertices, by {*n/k*}. Regular polyhedra are characterised by {*p, q*}, where *q* is the number of regular polygons with *p* vertices meeting at the vertices of the solid.

 {3}	 {4}	 {5}	 {6}	 {7}	 {8}
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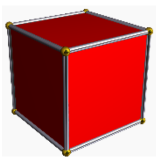
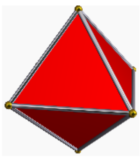
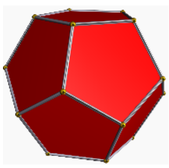
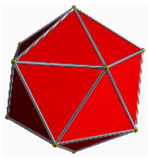
 {3,3}	 {4,3}	 {3,4}	 {5,3}	 {3,5}	Images of the Platonic solids © Tomruen/Wiki with Robert Webb's Stella software

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https://www.spektrum.de/wissen/ludwig-schlaefli-ein-genialer-toelpel/1911970

Translated 2021 by John O'Connor, University of St Andrews

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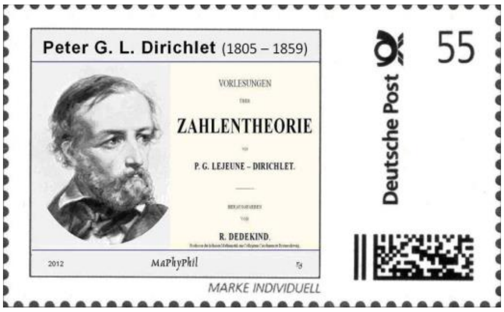

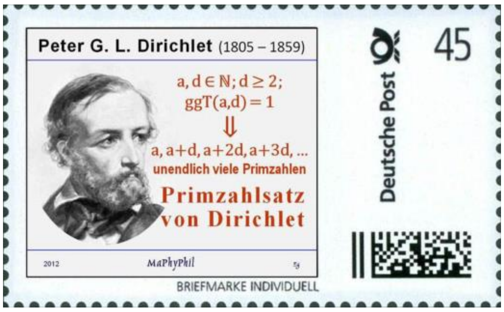

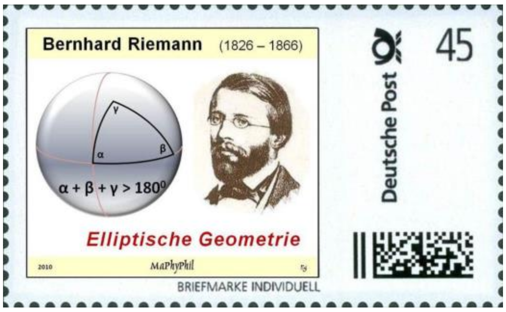

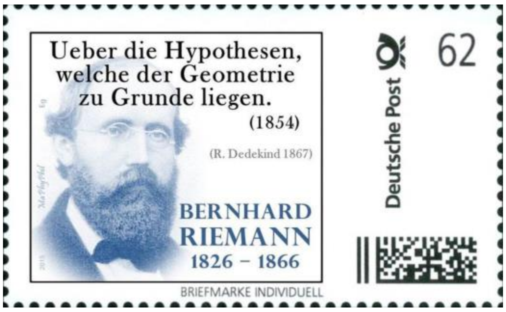

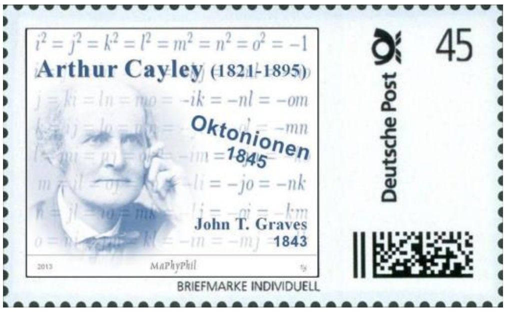

And here two new individual stamps …

… published on the occasion of the rescue of the gravestone of Ludwig Schläfli through the initiative of BARBARA KUMMER from Utzenstorf.

(“I have moved once again”)

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