Constantin Carathéodory (September 13, 1873–February 2, 1950)

by HEINZ KLAUS STRICK, Germany

In 1994, the Greek postal service issued a double stamp devoted to two Greek mathematicians: CONSTANTIN CARATHÉODORY und THALES OF MILETUS. The name of the Greek scientist from antiquity (THALES was active in the sixth century B.C.E.) may sound familiar, for his name is forever linked with a famous theorem in geometry. But who was CARATHÉODORY?

CONSTANTIN CARATHÉODORY was born in 1873 in Berlin, the son of a diplomat of Greek origin serving in the Ottoman Empire's embassy in that city. At that time, a large portion of what is today the country of Greece was under the dominion of the Ottomans. After a temporary sojourn in Constantinople, the family moved to Brussels, where the father assumed the position of ambassador. After the death of CONSTANTIN's mother, his grandmother took over the care of the boy and his sister, LOULIA. A German servant girl was engaged so that in addition to French and their native Greek, the children would become fluent in German. CONSTANTIN attended primary school in Brussels, but he also spent part of the year in Berlin. The family spent winters on the Italian Riviera. It was during his secondary-school years that his interest in mathematics developed. He twice won the first prize of the *Concours généreaux*, the Belgian national mathematics competition for advanced secondary-school pupils.

CONSTANTIN CARATHÉODORY completed engineering studies at the *École Militaire de Belgique* and then worked as a civil engineer on Lesbos until the outbreak of the Greco-Turkish War in 1896. He solved the problem of conflicting loyalties as a Greek in the service of the Ottoman Empire by going to Egypt to work for a British firm in constructing a dam for regulation of the Nile. He travelled throughout the country, engaging in a number of activities including measuring the great pyramid of Giza and writing a book on the geography and history of Egypt, which appeared in 1901.

In his free time, however, he turned more and more to mathematics. He surprised his family by announcing his intention to study mathematics, and to do so at the place of his birth—Berlin. But he soon moved from Berlin to Göttingen, which at the time, enjoyed the reputation of being the capital of mathematical research. He was especially fascinated with the calculus of variations, a field established by JAKOB and JOHANN BERNOULLI through their solution of the brachistochrone problem and further developed by LEONHARD EULER, CARL GUSTAV JACOBI and ROWAN HAMILTON.

He generalized the solution of an apparently simple problem: *A lamp in the interior of a sphere projects points of the sphere onto a plane surface. Find a curve on the sphere of prescribed length such that its shadow is as short or as long as possible.*

In 1904, he received his doctorate with a thesis "*On discontinuous solutions in the calculus of variations*". His dissertation advisor was HERMANN MINKOWSKI, one of the founders of the special theory of relativity. His oral examination in applied mathematics was given by FELIX KLEIN, and the examination in astronomy by KARL SCHWARZSCHILD. As a way of keeping especially gifted mathematicians in Göttingen, he was allowed to submit his habilitation without the usual waiting period, which he did with a thesis "*On strong maxima and minima of simple integrals*".

(drawings: © Andreas Strick)

After a period as privatdozent at the University of Bonn, he accepted professorship in Hanover. In 1910, he was called to a professorship at the newly established Technical University of Breslau. In 1913, CARATHÉODORY was named as FELIX KLEIN's successor in Göttingen. He assumed the editorship of the journal *Mathematische Annalen* as well as of an Italian journal. With the outbreak of World War I, most of his Göttingen students and colleagues were called to military service, and he felt uneasy in Göttingen.
CARATHÉODORY had married a close relative in Constantinople in 1909; with his wife, EUPHROSYNE, he had two children.

In 1918, he was appointed to a chair in Berlin, and once again, he moved.

MAX PLANCK held the laudatory oration when in 1919, he was inducted into the *Prussian Academy of Sciences* together with ALBERT EINSTEIN. CARATHÉODORY had by that time maintained a correspondence with EINSTEIN for many years. In 1915, he gave EINSTEIN significant pointers on the use of the calculus of variations in the development of the general theory of relativity.

In 1917, Greece had joined the *Entente* powers with the particular goal of being able to enlarge the territory of Greece following a successful conclusion of the war. The treaty of Sèvres granted Thrace and region around Smyrna (today Izmir) to Greece.

CARATHÉODORY was then asked by the Greek government to establish a Greek university in Smyrna. He then travelled throughout Europe to secure an adequate supply of books for the university library. In the meantime, however, Greek forces attempted to alter the status quo by conquering the entire region up to Constantinople (Istanbul).

This military enterprise ended in catastrophe for Greece. The Turkish forces under the generalship of MUSTAFA KEMAL PASCHA (who later took the honorary title ATATÜRK) repelled the attacking forces and conquered Smyrna. The majority Greek population was driven out, many were killed, and the Greek quarter of the city was burned to the ground. CARATHÉODORY and his family were barely able to escape to the island of Samos, just off the coast of Smyrna.

CARATHÉODORY worked for a time at the University of Athens, and then in 1924, he became the successor to FERDINAND VON LINDEMANN in Munich (VON LINDEMANN is renowned for being the first to prove, in 1882, that π is a transcendental number). Till his retirement in 1938, CARATHÉODORY continued teaching and doing research in Munich, with some interruptions: in 1930, he was asked by the Greek government to advise it on reforms in the Universities of Athens and Thessaloniki. Guest lectureships in the United States led to offers from Harvard and Stanford Universities, both of which he declined, using, however, the offers to improve his position in Munich.

As a multifaceted and highly educated intellectual, CARATHÉODORY was valued internationally as a writer and lecturer, especially on account of his unusually strong mastery of languages. Indeed, in addition to his native Modern Greek, he was equally at home in French and German, and he was also well versed in English, Italian, Turkish, Latin, and Ancient Greek.

He was aghast at the political changes of 1933 and used his worldwide contacts to find new positions abroad for emigrating scientists and mathematicians. In 1938, following his retirement, he withdrew from university life. After the war, he published, among other things, those volumes of the *Collected works of LEONHARD EULER* dealing with the calculus of variations as well as an investigation of KEPLER's theory of planetary motion.

The focuses of his other publications was above all measure theory, the calculus of variations, and complex analysis. A number of his articles dealt with problems in both theoretical and applied physics, including a proof that no system of lenses and mirrors can exist that does not cause optical distortion. The transcriptions of his lectures are valued even today for their masterful structure and use of language. As OSKAR PERRON wrote in his 1950 eulogy of CARATHÉODORY following his death in 1950, "In fact, he did not publish many of his ideas; they are worked out in the publications of others … whom he initiated into the spirit and ways of scientific research."

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