Constantin Carathéodory: Mathematics and Politics in Turbulent Times. By Maria Georgiadou. Springer, Berlin, 2004, xviii + 651 pp. Cloth: ISBN 3-540-44258-8, $99. Paper: ISBN 3-540-20352-4, $49.95.

Reviewed by **Loukas Grafakos**

A Greek born in Germany, Constantin Carathéodory (1873-1950) lived during a tempestuous period in the history of both Europe and mathematics. In her book *Constantin Carathéodory: Mathematics and Politics in Turbulent Times*, Maria Georgiadou paints a thought-provoking picture of a man caught between two cultures whose personal motivations cannot always be easily understood. In a story with amazing breadth and depth, Georgiadou provides both an excellent historical reference and a compelling account of one of the foremost mathematicians of the twentieth century.

Carathéodory's life encompassed interests in science, history, politics, and the arts, but above all an enchantment with mathematics. He was born in 1873 in Berlin, where his father Stephanos Carathéodory was serving as the first secretary of the Ottoman legation. He became a successful engineer who worked in Egypt on the building of the Assiut dam but then gave up his job to study mathematics, against the advice of his powerful Greek friends and his family. He studied first in Berlin under H. A. Schwartz but then went to Göttingen, where he received a doctoral degree in 1904 on the subject of calculus of variations. He worked in Bonn, Hanover, and Breslau before returning to Göttingen as a full professor in 1913, and he spent the year 1918-1919 in Berlin.

In the fall of 1919, Carathéodory accepted a mandate by the prime minister of Greece, Eleftherios Venizelos, to organize a new university in Smyrna.[1] This emotional decision provided Carathéodory with an opportunity to escape from war-torn Berlin and return to his family's roots in Asia Minor. He spent the period 1919–1923 between Smyrna and Athens working toward the difficult goal of recruiting talented people to build a new university. But the political climate in that region, the tragic events in Asia Minor of that period, and the fall of Venizelos in 1920 doomed this noble enterprise from its very outset. A disappointed Carathéodory returned to Germany, where he was appointed professor of mathematics at Munich University in 1924.

[1]Smyrna (now Izmir in Turkey) was under Greek control from 1919 to 1922.

Remarkably enough, during his turbulent stay in Asia Minor, Carathéodory did not lose contact with research but continued to produce quality work.

After his return to Germany, Carathéodory's career took off. He received many international recognitions, including the editorship of *Mathematische Annalen* and a full membership in the Academy of Athens in 1926. In 1928 he became the first Visiting Lecturer of the American Mathematical Society. He lectured at many American universities and was offered a permanent position at Stanford in 1929, which he used to negotiate better conditions for remaining in Munich. During this time, Carathéodory's research branched out to areas such as quantum mechanics, control theory, and certain aspects of partial differential equations.

Part of Georgiadou's biography is devoted to a short history of several prominent scientists in Germany during the difficult period 1933-1939. The solidarity displayed within the scientific community was significant, but it could barely resist the racial discrimination the Nazis forcibly imposed on the German academic world starting in 1933. Carathéodory himself avoided persecution and expulsion from Germany through a series of carefully calculated maneuvers. The same cannot be said, however, about many of his friends, some of whom were very distinguished scientists, who found themselves compelled to give up their professorships and go into exile. The tragic racial policies in Germany during the period before World War II had devastating consequences for science in Europe but simultaneously benefitted countries that accepted exiled scientists, including nations as diverse as the United States and Turkey. Historical evidence indicates that Carathéodory had the opportunity to leave Germany for a post in the USA during that period but that he rejected this idea. This choice may be the most difficult aspect of his career to explain; it could have been a stubborn decision based on the feeling that, despite the political situation, Germany remained the center of science at that time.

Carathéodory considered himself a servant of science and pretended to ignore his political connections. His basic concern in the Nazi era was to find a balance between an accommodation with the regime and the autonomy of his profession. Nevertheless, his aversion for the Nazis did not remain unmanifested. His decision that his daughter Despina should interrupt her law studies in Munich and continue in Athens was probably due to his wish to remove her from the pro-Nazi student culture. For the same reason, he forbade his children to speak German at home, and when confronted with positive remarks about the regime, he often expressed vehement opposition.

During the war, Carathéodory tried, for the most part unsuccessfully, to help colleagues outside Germany who were not only losing their academic positions and personal property but were also in danger for their lives. It is not clear if Carathéodory was aware of the Holocaust, or what his reaction was to the German occupation of Greece.

Carathéodory's connection with Greece continued throughout his active career. Important meetings with leaders of the academic community and even with the prime ministers of the country revolved around his role of evaluating conditions at Greek universities and finding ways to improve them. He wrote the entry for mathematics for the *Great Greek Encyclopedia* of 1931. There he made the claim that ancient Greek geometry had a great influence on the general progress of European peoples. Carathéodory believed that the most significant mathematical success during the sixty-year period centered around the turn of the twentieth century was the reestablishment of the exactness of the works of ancient Greek mathematicians in terms of modern mathematical means of thought. This period of time included Cantor's axiomatic set theory and the exploration of geometric axioms. Mathematical science, according to Carathéodory, exhibited two main tendencies: to continue discovering new logical arguments and to organize known theories.

After the end of World War II, Carathéodory seemed to have been more concerned with the relocation of his mathematical friends and the restructuring of mathematics in Germany than with the general fate of the country. His opinion and advice in matters of university policies was again solicited and always respected. The task of rebuilding German mathematics occupied him until 1947, when he lost his wife Euphrosyne and was stricken by prostate disease that kept him in bed for several months. An operation and recovery gave him hope again for a life full of mathematics. At the beginning of 1950 he felt that he still had a long life ahead of him and wrote to Zermelo announcing a lecture for the summer. This may have been his last letter, for he died on the second day of February in 1950. Carathéodory was mourned by mathematicians all over the world but especially by the academic and intellectual communities of the Greek and German nations, both of which counted him among their best representatives.

Maria Georgiadou has put a significant effort into collecting mathematical correspondence and other historical materials and memorabilia that illuminate aspects of Carathéodory's life. Her well-organized and detail-oriented book presents his personal and mathematical life within a broader historical and cultural context that is needed to understand many striking details.

For instance, Carathéodory's marriage with his aunt Euphrosyne might have been an odd union by German standards, but it was a perfectly acceptable intermarriage within his privileged social class, the Greek aristocracy of the Ottoman empire. Carathéodory's struggle to maintain a delicate balance between the forces and traditions of his two cultures is a focal point of the book.

Carathéodory was a bridge between Hilbert and the younger generation of Hellinger, Weyl, Haar, Courant, Hecke, and Funk. Devoted to Hilbert's mathematical vision, he pursued the goal of developing and promoting Hilbert's agenda in a way that complemented his own program. He attacked a wide range of complex problems ranging from foundational issues to concrete applications. His engineering background engendered a deep concern with areas of applications of mathematics such as geometric optics, mechanics, planetary motion, and thermodynamics, but he also regarded proofs as expressions of beauty, elegance, and charm. His daughter has reported that he viewed mathematics as a Bach composition full of dynamics and harmony and that he compared the structure of a mathematical proof with a fugue for several voices.

A true mathematical sentimentalist belonging to a memorable generation of great thinkers and lovers of science, Constantin Carathéodory still appears as an important figure in the world of mathematics. This biography brings him to life and presents a fitting tribute to his accomplishments.

University of Missouri, Columbia, MO, 65211
loukas@math.missouri.edu