The Nobel Laureate
ALBERT SZENT-GYÖRGYI -
Scientist and Humanist

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To look at his picture as a whole,
a painter requires distance;
and to judge of the total scientific achievement of any age,
the standpoint of a succeeding age is desirable.

(John Tyndall)

This comment appears perfectly applicable for a consideration of the career of Albert Szent-Györgyi. He was born in 1893 in Budapest, Hungary, at that time composing an integral part of the Dual Monarchy of Austria-Hungary. He had an older brother, Paul, and a younger brother, Imre. His mother, Jozefa Lenhossék, was a member of a famous and influential medical family, which played an important role in Hungarian science for more than a century. His father, Miklós Szent-Györgyi von Nagyrapolt, was from an old Transylvanian land-owning family.

During his childhood, his parents lived separately, though they were not divorced. The acting head of the family was his uncle, Mihály Lenhossék, Professor of Anatomy at the Medical School of Pázmány Péter University in Budapest. Professor Lenhossék was a talented and intelligent, but rather rigorous man, who did not greatly respect the young Albert, who initially demonstrated little enthusiasm for learning. However, when Albert was 16 (as he later noted) something changed in his mind, and he started reading books and

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became interested in medicine. So much so that by the time of his final examinations he was an eminent student. (It should perhaps also be mentioned that his uncle meanwhile changed his opinion.)

After his final school examinations, at the age of 18, Szent-Györgyi was admitted to the Medical School at Pázmány Péter University, from which he graduated as an M.D. in June 1917. In the meantime, however, World War I broke out and Albert Szent-Györgyi, similarly to his contemporaries, joined his regiment. Experiencing the hell and senselessness of the war, he deliberately shot himself through the upper arm. During his recovery, he graduated, but was then ordered for medical duties to the Italian front, where he started to deal with malaria. While in Budapest for his recovery, he had married Kornélia Demény, and by the end of the war their daughter Kornélia (nicknamed Nelli) was born.

His scientific career started with his undergraduate research in the period 1911-13 in the Institute of Anatomy. At that time he dealt with the anatomy of the rectum, and his first paper appeared in the Anatomische Hefte ("*Zur Anatomie und Histologie des Teguments der Analöffnung und des Rectums*" in Anatomische Hefte, 1913; 49: 305-335). Later he joined the Institute of Physiology. This research was discontinued when World War I broke out. After the war and demilitarization, Szent-Györgyi applied for an academic position and became an assistant at the Institute of Pharmacology headed by Professor Mansfeld at the University of Pozsony on 1 January 1919. He remained in that position until 21 September 1919. While there, he had the opportunity to work with Carl Cori (Nobel Laureate in Physiology or Medicine, 1947), who moved to the USA in 1922. During this period, he learned much from Professor Mansfeld, who was full of ideas. Their cooperation resulted in publications (G. Mansfeld und A. Szent-Györgyi: "*Untersuchungen über die Ursachen des Herzschlages*" Pflüger's Archiv für die gesamte Physiologie des Menschen und der Tiere, 1919; 184: 236-264, and A. Szent-Györgyi: "*Über Herzmuskeltonus*", ibid 1919; 184: 266-271). However, as a consequence of World War I, conflict broke out between the newly-created Czechoslovakia and Hungary, and when peace was signed in Saint-Germain on 10 September 1919 the new regime ordered hundreds of thousands of Austrian-Hungarian citizens out of the territory that was now Czechoslovakia. However, like numerous other members of the intelligentsia, Szent-Györgyi could not find employ-

ment, and at the end of 1919 he therefore joined the exodus and left Hungary.

Szent-Györgyi worked in several places between 1919 and 1926. He first succeeded in returning to Czechoslovakia, where he studied electrophysiology under Professor Tschermak in Prague. Next, he moved to Berlin, where he worked with Professor Michaelis. When his financial position became difficult, Szent-Györgyi and his family moved on to Hamburg, where he spent two years studying tropical medicine at the Institute for Tropical Hygiene. He found these studies very difficult, and realized that he was not really interested in tropical medicine at all. Nevertheless, the financial pressure prevailed, and persisted. During this period he published a paper upon the Avogadro number ("*Eine Methode zur experimentellen Prüfung der Molakular-theorie und der Avogadro-Loschmidtschen Zahl*" Zeitschrift für physikalischen Chemie, 1920; 95: 247-250). In 1921, Szent-Györgyi was at last awarded a position in the Institute of Pharmacology at the University of Leiden, headed by Professor Storm van Leewen, but, after a personal conflict he moved on to Groningen, to the department of Professor Hamburger. There he undertook experiments on biological oxidation, and in 1924 and 1925 published a series of papers upon this topic in the Biochemische Zeitscrift ("*Studien über die biologische Oxydation*"). Biological oxidation was at the centre of interest at that time and two opposing theories had been put forward. It was postulated by Heinrich Otto Wieland (Nobel Laureate in Physiology or Medicine, 1927) that the basic process in biological oxidation was the dehydrogenation of substrates, during which oxygen interacted directly with the liberated hydrogen atoms. The alternative theory, proposed by Otto Warburg (Nobel Laureate in Physiology or Medicine, 1931), was that biological oxidation needed an enzyme that activated oxygen, and this enzyme had to contain iron. At this phase of the debate Szent-Györgyi joined in the work on this topic. The situation directed his attention to the adrenal glands. With the help of Professor Henry Hallett Dale (Nobel Laureate in Physiology or Medicine, 1936), he received a three-month invitation to the United Kingdom to carry out experiments in a search for evidence to support his suggestion concerning a substance present in the adrenal gland. However, he failed. To make matters worse, on his return to The Netherlands, he found the atmosphere in the laboratory greatly changed as Hamburger had died in the meantime. This made Szent-

Györgyi even more depressed, and he decided to send his family back to Hungary and then put an end to his life. Before doing so, however, he went to Stockholm to participate in a conference in 1926. And here his fortunes changed, for he met Professor Frederic Gawland Hopkins (Nobel Laureate in Physiology or Medicine, 1929), who invited him to Cambridge as a Rockefeller Fellow. Professor Hopkins became the mentor of Szent-Györgyi.

From 1926-1931, Szent-Györgyi continued working on biological oxidation and discovered a new carbohydrate derivate, which became known as hexuronic acid (Szent-Györgyi later re-baptized this substance as ascorbic acid) or vitamin C. He received his Ph.D. in chemistry in Cambridge. During this period, he had the opportunity to visit the USA and spend time enthusiastically working on the adrenal glands at the Mayo Foundation in Rochester, Minnesota. The results of his observations at that time served as the basis for the citric acid cycle theory. For the full description of the tricarboxylic acid cycle, Hans Krebs, a colleague and friend of Szent-Györgyi, was awarded the Nobel Prize in 1953.

As Szent-Györgyi's scientific star ascended, his name became known in Hungary, too, and he was invited by the then Minister of Religion and Public Education, Kunó Klebelsberg, to return to Hungary as a professor of chemistry and biochemistry in Szeged. The family returned to their homeland in 1931, and Szent-Györgyi established a scientific school at the University of Szeged, a number of talented young students joining his group there. Financial support was provided in part by the Rockefeller Foundation. Those years saw the isolation of a large amount of ascorbic acid from Hungarian paprika and the initiation of muscle biochemistry in Hungary. Szent-Györgyi also noted the anti-scorbutic activity of vitamin C and additionally isolated vitamin P.

Outside his researches, he served as rector of the university. And these years brought changes in his private life: the Szent-Györgyi couple divorced, and his wife and their daughter moved to the USA. Szent-Györgyi later fell in love with the wife (Márta Borbíró) of his professorial colleague Miskolczy, and eventually they married.

In 1937, it became widely known that Professor Albert Szent-Györgyi had been awarded the Nobel Prize, and this aroused tremendous excitement in Hungary. It was regarded as a great honour, in particular since Szent-Györgyi was working in Hungary at the time

of the award. He was not the first Nobel Laureate of Hungarian origin, but he was the first, and so far the only, Hungarian to be honoured in this way while working in his homeland. (Fortunately, since then several other Hungarian-born scientists have been awarded Nobel Prizes.)

After the outbreak of World War II, scientific work became more difficult. Despite these circumstances, the members of the Szent-Györgyi school continued their activities, and made advances, particularly in muscle biochemistry. In parallel with these investigations, Szent-Györgyi published papers on the electronic basis of biological processes.

Szent-Györgyi was deeply shocked by the inhumanities of World War II and became an active anti-Nazi, joining those who sought a way out of the tragic position of Hungary. At that time the Hungarian government, headed by Miklós Kállay, decided to make contact with the Allied Powers, and Szent-Györgyi visited Turkey on a secret diplomatic mission in 1943. This was one of the reasons why the German secret state police (Gestapo) strived to capture him after Hungary was occupied by the German army. For this reason, Szent-Györgyi was forced to live underground until the end of the war.

In 1945, Szent-Györgyi became Professor of Biochemistry at Pázmány Péter University in Budapest, and held this position until 1947, when he emigrated from Hungary to the USA for political reasons. He finally settled down in Woods Hall, Massachusetts, where he worked for The Marine Biological Laboratory.

Initially, he continued research in the field of muscle biochemistry, particularly on myosin. He produced important publications on this subject and won the Albert Lasker award for the first workable theory of heart muscle contraction in 1954. His interest later turned to the thymus and cancer biology. Whether or not the death of his second wife from cancer played a role in this is not known. From the 1950s, he published in this field, and in the 1960s formulated the promine/retine theory of cell division in an attempt to explain cancer development. Moreover, his scientific intuition led him to describe a submolecular theory of life. Despite his scientific successes, he experienced difficulties in obtaining grants. Faced with this problem, he established a network of scientists working around the world under the aegis and financial support of the National Foundation for Cancer Research.

After the death of his second wife, he married on a further two occasions. He lost his only daughter, who also died of cancer. Despite his personal afflictions he did not despair and preserved his open-minded attitude toward the events of the world. His ethical approach fed his opposition to the Vietnam War.

He died at the age of 93 in Woods Hall, Massachusetts.

He was a member of several scientific societies and academies, among them the Hungarian Academy of Sciences.

His life may be summarized perhaps as the association of humanity with scientific commitment. He was a member of the large family of scientists who established biochemistry as a discipline, thereby enhancing our understanding of the elemental events of life.

"I always felt myself to belong to a great, international, spiritual family. Always and everywhere I found helping hands, friendship, cooperation and international solidarity. I owe solely to this spirit of our science ..."

(Albert Szent-Györgyi, Nobel Lecture, 11 December 1937)

"When I accepted the invitation to this Lecture, more than a year ago, I hoped to be able to finish it with a happy end, pulling out of my pocket a bottle of the synthetic product. This was not to be. The problem is the most difficult one I have ever met. Going was rough and slow. Perhaps I could have found, in my past, some more finished work to talk about, but Hopkins never stopped to delight himself in past achievements. He was always future-oriented. So if I only took you into my workshop, and leave you with more questions asked than answered, at least I have not acted contrary to the spirit of my beloved teacher."

(Albert Szent-Györgyi, The Fifth Hopkins Memorial Lecture, 1 April 1965)

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