SZEGEDI EGYETEMI TUDÁSTÁR 2.

The intellectual heritage of Albert Szent-Györgyi

Publishing Department – University of Szeged
2014

SZEGEDI EGYETEMI TUDÁSTÁR 2.

The intellectual heritage of Albert Szent-Györgyi

Edited by
Ilona Újszászi

University of Szeged – Compendium of Knowledge series

1. The intellectual heritage of Albert Szent-Györgyi (HUN)
2. The intellectual heritage of Albert Szent-Györgyi (ENG)
3. Albert Szent-Györgyi in the daily newspapers the Délmagyarország and the New York Times
4. Life sciences
5. Physical sciences
6. Humanities
7. Humanities and social sciences
8. The University's historical photo album

Series editors:
László Dux, István Hannus, József Pál, Ilona Újszászi

Contributor to the series:
Klebelsberg University Library of the University of Szeged

Assembled:
as commissioned by the University of Szeged within the framework of the tender:
"TÁMOP 4.2.3.-12/1/KONV – 2012-0035 on the acknowledgement and dissemination of scientific achievements at the University of Szeged"

SZEGEDI EGYETEMI TUDÁSTÁR 2.

The intellectual heritage of Albert Szent-Györgyi

Edited by
Ilona Újszászi

Publishing Department – University of Szeged
Szeged, 2014

Edited by
Ilona Újszászi

Contributors to the editing:
trainees at the Media Centre at the University of Szeged

Translated by: Eszter Asztalos-Zsembery, Éva Demeter, Éva Majos, Tamás Őszi, dr. Csilla Rápoltiné Keresztes, Ágnes Sebők, Klára Szabó, Márton Sztriha, Róbert Torkos, Vanda Varga, Gabriella Vecsei, Judit Zelena.

Responsible for publishing:
Head of the Publishing Department
University of Szeged

Cover design and technical editing:
László Losjak

Proofreading:
Balázs Sinkovics

Printing work:
Generál Nyomda Kft.

ISBN 978-963-306-347-7

Contents

Editorial introduction

Scientific life of Szeged in eight volumes

By launching the book series labelled *Compendium of Knowledge by the University of Szeged*, the editors embarked on a task with no historical antecedents and contemporary examples. In nearly two and a half thousand pages the completed eight volumes recall the images of the past of the University of Szeged, the intellectual heritage of its Nobel Prize laureate scientist: Albert Szent-Györgyi, the richness of the University's present, the quality of its current research activities and the University's international prospects. This enterprise complements the topic of a second set of publications. These publications, issued by the Publishing Department at the University of Szeged, look at the history of Szeged's higher education institution and its predecessors. The first volume, which explores the period between 1581 and 1872, was published in 2011 while efforts are currently made, under the guidance of the Committee on the History of the University, to issue the second volume in the series regarding the subject of.

The eight volumes in the Compendium of Knowledge by the University of Szeged follow the same editorial principles and have balanced length and similar typographical features. In line with the chronological order of the internal content, the volume numbering does not follow this order, the *illustrated book* is about historic space. It is about the buildings, and Szeged, the two towns where the *alma mater studiorum* has been operating for the past four hundred and thirty-three years linked with thousands of threads to the attributes of the geographical place and other institutions operating there. This illustrated book shows a lot of other things as well: famous professors, laboratories, libraries and diverse life situations. The Hungarian and English captions attached to the photos present only what is absolutely necessary.

In the 1920s and 1930s there was a real golden age in the life of the university in Szeged. Due to the supportive political environment, thanks primarily to Kunó Klebelsberg, and the level of work carried out here, all the scientific and artistic activities that took place on the banks of the river *Tisza* had received international attention. All that culminated in the work of Albert Szent-Györgyi. *Three volumes* are dedicated to him in the *Compendium of Knowledge by the University of Szeged* series. These volumes are all about *Albert Szent-Györgyi*. By publishing one by one those articles that are about Szent-Györgyi and appeared in the daily newspapers the *Délmagyarország* and the New York Times, we assume the role of a bridge that aims towards

top professionals and the world. While Szent-Györgyi's forward pointing significance in time and space that he achieved here is stressed by an all-round analysis of Szent-Györgyi's hardly known or unknown dimensions of operation that is far beyond biology and medical sciences. That is why, in the fall of 2012 at the 75th anniversary of the awarding of the Nobel Prize, we organized our free university series, the material of which is now printed here in Hungarian and English. In this way, the diplomat, the sportsman and the philosopher-poet all stand in front of us, a person who had contributed with his research to the development of our knowledge in the field of laser physics as well. So much so that as *Gábor Szabó* physicist, academician and the Rector of the University of Szeged has demonstrated in his study: the research carried out in this area by Szent-Györgyi should be rightly regarded as the scientific foundation for the big construction investment that is currently under way: the Extreme Light Infrastructure (ELI) ELI-ALPS Laser Research Centre.

Four volumes, half of the whole enterprise that is the *Compendium of Knowledge by the University of Szeged,* describe the present: *the ongoing scientific activities at the University of Szeged*. The common feature of these four volumes is the promotional aim: the directions of research and results presented here may well be understood without specific professional prior knowledge and provide very useful information in a variety of areas. In addition to the will of the editors and authors, the above-mentioned fact was a requirement for the TÁMOP dissemination tender that provided the financial background for this enterprise. In general, the international scientific world recognizes five major disciplines. Out of these five, the University of Szeged runs PhD training programmes in four in a total of nineteen schools. In order to give a more authentic presentation of the scientific research and its results, we relied on the heads of the doctoral schools and their most respected scientists. This is how the content of the four discipline-focused volumes was assembled.

Apart from the basic similarities, the various parts of the discipline-focused volumes in the Compendium of Knowledge by the University of Szeged were constructed using different editorial principles and methods. In the book of *life sciences*, the professors themselves provide an overview of the research topics available in their institutes and the main areas of their work. In the books of *physical sciences, humanities and social sciences*, the authors have approached the presentation task from a different aspect. In these sections, we can read studies that discuss, in a general way, timely issues that represent the topics of the university and formulate, in a popular manner, but satisfying the highest academic levels, those questions and answers that are most interesting for today's public. As editors, we do not think that via

the picture we present here on the work of the researchers at the University of Szeged, we are able to provide space for every important endeavour and achievement, nor do we think that there could not have been a more credible image on their professional realities. We ask the reader to look at what is included in the book and not what is missing due to reasons of size restrictions and selection criteria. We wanted to present content on the verge of what is no longer and what is to come with respect to the forerunners and looking forward to the successors.

Editors of the Compendium of Knowledge
by the University of Szeged

Greetings

"Far-sighted science – responsible answers for the future." In 2014 this is the motto of the Hungarian Science Festival when this Compendium of Knowledge by the University of Szeged, a snapshot of the University of Szeged, is published. It seems that the eight volumes that had been published in the past two years as a result of the USZ. UNIVERSITY OF SZEGED TÁMOP-supported dissemination tender by the Publishing Department at the University of Szeged were following this motto. The Compendium of Knowledge by the University of Szeged reflects on all areas of science that are cultivated in Szeged, puts into the spotlight the great achievements of the University and indicates its forward-looking responses to the challenges of the age.

It is not enough to be aware of the scientific responsibility nor is it sufficient to anticipate problems and be aware of the consequences of scientific work, it is also necessary that the scientists themselves and the results of their research serve society. Consequently, the dissemination of scientific achievements and, through this, the promotion of scientific research activities and the encouragement of the utilization of these results are also within the tasks of universities. *Albert Szent-Györgyi*, the Nobel laureate scientist of the University of Szeged, also shared this view. In his Rector's office inaugural speech, Szent-Györgyi stressed the following: "*Universities have triple missions. The oldest mission is to collect, distribute and enrich human knowledge. The second mission is to develop for the future a small number of scientists who will take over this profession from us. More recent in its origin, but no less sublime, is the third mission of universities: to educate citizens for the country who are equipped with the weapons of the intellect. (...) I may also add that our University has a fourth special mission that is to be the intellectual centre of the great Hungarian plain, the Alföld.*"

In this Compendium of Knowledge by the University of Szeged, a wide arsenal of the weapons of the intellect is revealed to the reader. The University's historical photo album helps the reader glance back into the past up to the time of the founder Prince *Báthory*. A volume that collects newspaper articles linked to our Nobel laureate scientist and the books in Hungarian and English that are based on the open university lectures held to celebrate the year of the 75th anniversary of this Prize illustrate that the University of Szeged is a worthy heir and successor of the spirit and research attitude of Szent-Györgyi. The discipline-focused volumes that concentrate on prominent research workshops and PhD schools in Szeged demonstrate that in Szeged

the distinct disciplines are close to each other. This is a determinant factor in modern science because today the focus is on problems and the competencies that are required to solve these problems. Achievements that are awarded with a Nobel Prize are born in the contact points of scientific disciplines.

Just like a good inventory, the Compendium of Knowledge by the University of Szeged may be seen as a take-off point: by summing up the results achieved so far, the Compendium points to the direction of continuance. With this quality, the Compendium of Knowledge by the University of Szeged may contribute to the fact that at the University of Szeged, time after time, we should be able to achieve scientific results at an international level and give responsible answers for the future.

10 November 2014, Szeged

Gábor Szabó
Rector
University of Szeged

László Dux

On the Basics of Biochemistry (An edited and shortened version of the presentation given on 12 September 2012 in the 10th semester of the Open University of Szeged)

Biochemistry is one of the relatively new fields in natural sciences. Biochemistry is the study of the structure of living organisms and their vital processes at the level of molecules, chemical compounds and their reactions. Justus Liebig was the first scientist to describe it first in the middle of the 19th century, and he wrote about the chemical properties of living organisms in two of his books.

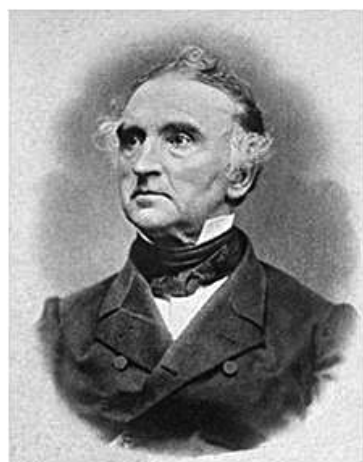


Figure 1. Justus von Liebig (1803–1873)

The first independent biochemistry departments, institutes and societies were founded and the first biochemistry journals launched in the first decades of the 20th century in German speaking countries followed by English speaking countries. There are two fields of sciences in the background of biochemistry: organic chemistry and physiology. Researchers in the field of organic chemistry working with macromolecules and biopolymers started to identify themselves as biochemists. Physiologists who tried to search down to the level of molecules when describing vital processes were also the forerunners of biochemists. Even nowadays, several universities have a department for molecular physiology and have the subject in the curriculum under this name.

It is an interesting issue what the development of biochemistry targets. Most probably it develops toward two further scientific fields, and they may take over the place of physiology in some generations.

Biophysics makes us possible to understand faster and more delicate changes of even smaller units with the development of the analytical approach. It is quite difficult even nowadays to draw a borderline between the two fields. "Omic" sciences will be the other option in further development due to their integrative approach and the technical development, especially in combinatorial chemistry. These sciences such as genomics, transcriptomics, proteomics, or metabolomics try to answer the essential questions of life by studying the complete DNA and RNA of the cells, tissues or the organism or studying their overall metabolic systems instead of characterizing a certain nucleic acid or protein. Processing and assessment of the unbelievable amount of data that can be gained by the new approach is possible only by the help of bioinformatics, and the systematization requires the methods of systems biology (systeomics).

During chemical, biochemical examinations of living organisms, nobody has been able to identify a compound or chemical process that could not be created or performed in non-living systems as well if the appropriate circumstances are given. Therefore, the apparent differences between living and non-living systems cannot be described by one or some chemical characteristics or substances. The essence of the difference can be found in the highly organized chemical processes and molecular systems, their regulation and adaptability.

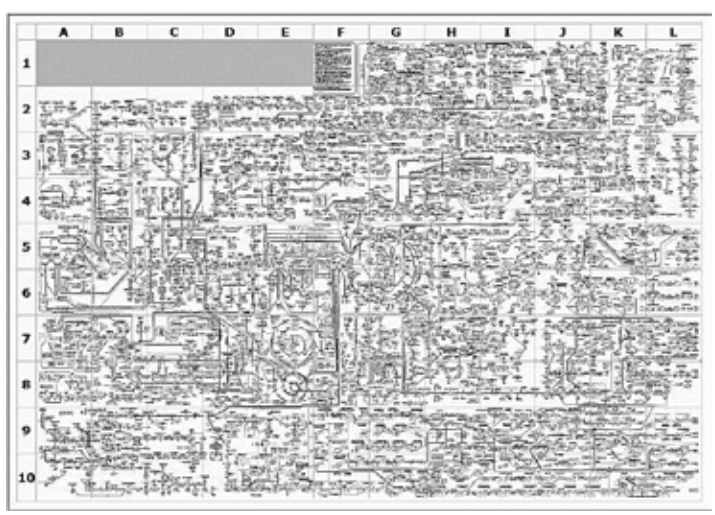


Figure 2. a) Organization of biochemical processes and metabolic pathways (http://biochemical-pathways.com)

b) The citrate cycle (http://biochemical-pathways.com)

Figure 2 presents in a simplified way the structural features of this network. It is a simplified presentation as it shows in a single plane, in two dimensions what happens in living systems based on strict structures in three dimensions. However, the role of the fourth dimension, time, should also be kept in mind as the system works differently in an infant, young adult or elderly subject, and it is different before breakfast, during meals or when doing sports. The regulation of biochemical systems are also expressed by our short and long term adaptability. An example for short term accommodation is that people in the room have their blood glucose level in the same range, except for diabetics, irrespective of the fact that they have had dinner or they will have it only after the lecture. Whereas long term accommodation refers to the different survival rate of certain groups and individuals, mainly related to the genetic variability among changing external circumstances, in the molecular-biological evolution process.

However wide and rich is the accommodation capacity of living systems, their limitations should also be considered. The amplitude or measure of the changes may exceed the limits of the survival range in case of any parameters, but the speed and frequency of the changes should not be underestimated either in determining the capacities of survival. One of the sources of risks in the modern societies is the acceleration of changes, which may reach or exceed the upper limit of the speed of accommodation capacities. Let us just remember the fact that our ancestors lived in the same cave for some ten thousand years, which covers at least 500 to 1000 generations compared to the fact that currently there are unbelievably huge changes even within the life

of 2 or 3 generations in energetics, informatics, transportation or chemicalization. These changes would be hardly tolerated by people who lived 36 or 37 generations ago in the age of the Landtaking in Hungary.

Two of the most important thermodynamic features of living systems are that on the one hand, they are open systems so there is constant material, energy and information interchange between them and their environment; on the other hand, they keep up a higher level of organization, i.e., a lower level of entropy. The higher level of organization in an open system can be maintained only by continuous energy input. The oxidation of reduced carbon atoms of nutrients provides the necessary energy source to it (and to all other life functions) in both human and animal organisms, and due to our oxidizing atmosphere, it is a spontaneous process. Most of the reduction of carbon atoms with high energy need is performed by the photosynthesizing green plants during which sugars, starch or even vegetable oils are performed from carbon dioxide by the help of light energy from fusion processes in the Sun.

In the first decades of the 20th century, the basic question in bioenergetics was established about the activation that results in a reaction between the reduced carbon atom of living organisms and atmospheric oxygen. One of the positions was represented by a German biochemist, Heinrich Wieland, who considered the pre-activation of foodstuff molecules essential according to the hydrogen activation theory. Otto Warburg and his followers, however, favored the oxygen activation theory, which considered the development of a form of atmospheric oxygen with higher reactivity to be predominant.

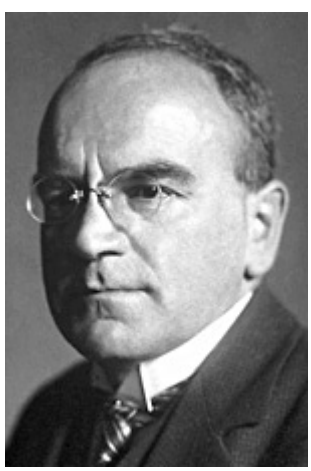


Figure 3. Heinrich Otto Wieland
(1883–1970)
Nobel Prize in Chemistry – 1927

Figure 4. Otto Heinrich Warburg
(1877–1957)
Nobel Prize in Physiology or Medicine – 1931

Figure 5. Albert Szent-Györgyi at the end of the 1920s

During this period of time, the young Albert Szent-Györgyi started travelling around Europe after leaving the University of Pozsony, which was taken from Hungary at the end of the war. First, he worked at the University of Leiden and then of Groningen, the Netherlands, where he revealed that the positions of the two disputing researchers (Warburg and Wieland, both of them are Nobel prize winners, too) are possible to be combined if the oxidation-reduction (redox) reaction is performed not in a single step, but being gradually performed from the more reduced carbon atom to the more oxidized form. To prove that his theory was right, he described the oxidation cycle of succinic, fumaric, malic, oxaloacetic acids, which was proven in a couple of years to be the second half of the citrate cycle. In 1937, Szent-Györgyi won the Nobel prize with special reference to the catalysis of fumaric acid.

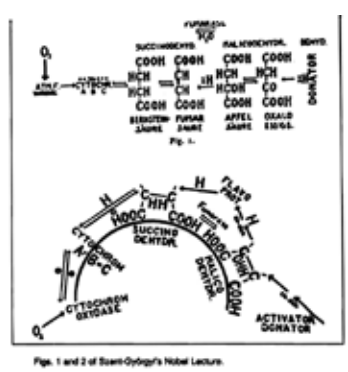


Figure 6. Figures 1 and 2 of Szent-Györgyi's Nobel Prize Lecture

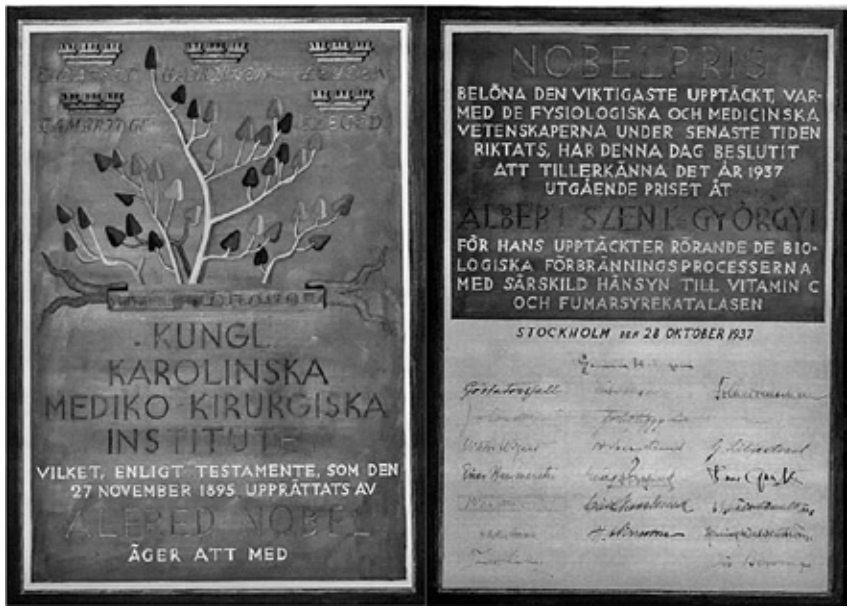


Figure 7. Certificate of the Nobel Prize in Physiology or Medicine - 28 October 1937

To show evidence for the cyclic feature of the complete citrate cycle, Hans Krebs, who was awarded by the Nobel Prize in 1953, also repeated Szent-Györgyi's fumaric acid catalysis experiment in the presence of malic acid that prevents the change of succinic acid and fumaric acid into both directions. Thus we do not make a mistake if we refer to the citrate cycle as the Szent-Györgyi–Krebs cycle at least in Szeged.

Figure 8. Sir Hans Adolf Krebs (1900–1981) Nobel Prize in Physiology or Medicine – 1953

Warburg's theory on oxygen activation was not incorrect as well. It is widely known that because of the specific electron shell structure of the oxygen molecule, especially in the presence of metals with variable valencies, it tends to produce so called oxygen free radicals, i.e., reactive oxygen derivatives, which may oxidize the reduced substances they get into contact with. It may cause the development of various diseases, or their progression, but it might be due to the normal aging process as well.

The other major reason why Szent-Györgyi was awarded the Nobel Prize has an interesting relation to oxygen activation. The discovery of vitamin C, as it is widely known, is a genuine explanation for the common observation that the cut or injured surface of the fruits and vegetables gets brownish or black. However, this discoloration develops slowly or not at all in certain crops. On the basis of this phenomenon, Szent-Györgyi suggested that the cause of the slower discoloration might be the presence of a strongly reductive agent that slowed or prevented the reaction developing in the presence of oxygen in the air. This reductive agent was identified as hexuronic acid, later renamed as ascorbic acid, and then described as vitamin C. These works are mostly related to Szeged and the paprika of Szeged.

Figure 9. The paprika of Szeged

Chemical processes in living structures are almost exclusively performed in catalysis with enzymes. Catalysis makes the development of biochemical reactions possible with appropriate intensity even at a relatively low temperature specific for warm-blooded animals. Catalysis enables the decrease in activation energy, the regulation of processes, their relation to structures, the distinction between energy releasing, spontaneous (exergonic) and energy needing (endergonic) processes, and their switch if necessary. The energy adaptability of living

organisms and the differentiation of energy storing and releasing processes in time and space may be due to the appearance of macroergic phosphate-binding nucleotides, primarily to adenosine triphosphate (ATP). The highly polarized phosphate group of these compounds is able to store the energy that is released during the breakdown of food. This process is the oxidative phosphorylation pathway in the mitochondria, which are the cells' miniature power plants, driven by the proton gradient power produced during respiration. The ATP energy gained in this process is utilized in chemical synthesis processes. We should also bear in mind (especially in winter time) the energy reserve that is not bound in ATP, which is responsible for the thermogenesis being essential in maintaining the constant body temperature. The biological catalysts, the enzymes are mainly proteins or protein derivatives, but it has been proven that ribonucleic acid may also employ biocatalytic mechanisms.

Living organisms are able to transform chemical energy into two other types of energy. One of them is the transport pump system playing a role in developing the unequal distribution of ions. Their mechanism is fundamental in the maintenance of electrochemical features of cells. It is the so called chemiosmotic energy transfer, which means that the gradients developed by the utilization of energy increase order in the system, and as a result they provide higher energy level and work capacity. The other type is the transformation of chemical energy to mechanical energy, which can be studied in its most developed form during muscle contraction.

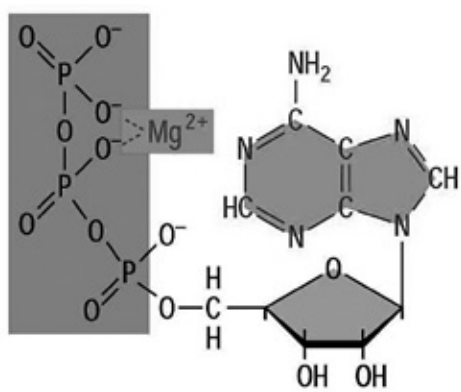


Figure 10. The molecular structure of ATP

The molecular features of it were also studied first in Szeged in the former Szent-Györgyi Institute. This research worth another Nobel Prize according to several researchers initiated the biochemical research on muscles in our

Institute. At the beginning of the 1940s, Szent-Györgyi and two of his outstanding students, Ilona Banga and Brunó F. Straub, described the explanation for the highly different behavior of the protein extracted from muscles (that they called myosin) depending on the timing of the extraction: right after the animal's death or only a couple of hours later.

While the solution of myosin A that can be obtained by fast extraction keeps its liquid form, the slowly extracted solution of myosin B becomes a gum like gel mass. The difference between the two solutions is explained by the fact that ATP present in the muscles is broken down during slow extraction, and in its absence, another protein being present permanently activates myosin. This protein was called actin, and it was first derived in its pure form by Brunó F. Straub in Szeged, in 1942. Actin is known as one of the most basic scaffold proteins in living creatures. The development of rigor mortis in the muscles can also be explained by the permanent actin-myosin interaction after the disintegration of ATP stores.

Figure 11.
Ilona Banga (1906–1998)

Figure 12.
Brunó F. Straub (1914–1996)

The last figure gives a summary of the chemistry of living organisms. One model for performing the processes with high energy uptake is that of the autotrophic organisms that are mainly green plants. They build up their simple organic compounds from basic, simple inorganic molecules such as carbon dioxide, water and minerals by the help of solar energy, and then the complex macromolecules and molecular systems are built up from them. The disintegrating processes are active even here, and part of the energy transferred during them is also utilized in the energy resources of the living organism.

The other model is the animal one, the heterotrophic metabolism, which is characteristic for the human body as well. The energy needed for build-up processes and other life functions is released by the uptake of small organic molecules and the oxidation of reduced carbon molecules in them. The living organism's energy resources are supplied by further energy release provided by the breakdown of previously built complex systems.

These systems would be able to balance the rate of oxidized and reduced forms of carbon atoms in the ecosystems. Unfortunately, this balance has been lost since the industrial revolution as a result of increased carbon dioxide emission. The reduced carbon atoms of fossil energy resources, which are also products of former photosynthesis themselves, are oxidized annually at a rate of normal reduction processes of 2000 years because of their use in the industry and transportation. The capacity of biological systems is by far not enough to reduce this amount of oxidation, especially considering that the rain forests are being destroyed, and erupting volcanoes also hinder the transfer of solar energy.

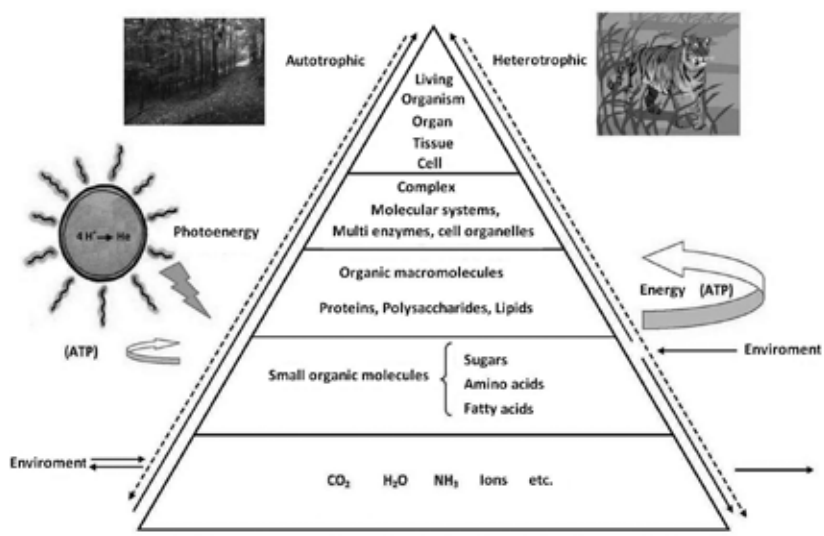


Figure 13. The pyramid model of substance and energy flow in living organisms

The end of metabolic, energy and information changes results in the death of living systems, i.e., the open thermodynamic feature of the systems are ceased, and they become isolated systems. After that no further build-up processes with high energy need are completed. However, breakdown processes are still performed. The main motive power of these processes is the entropy

difference between the space occupied by the former living organism and its surroundings, and the processes will be continued until the equilibrium is reached between the two systems. Entropy balance equation, the speed at which the chaotic level of the surroundings is reached, mainly depends on the surrounding factors. In a cremated dead body, this balance equation is fully reached at the high temperature in a couple of minutes. It might not be fully reached even in thousands of years at temperatures below freezing point, or under specific pressure, moisture, or chemical conditions, as it has been seen in recent years when corpses were found in glaciers or moorland.

János Wölfling

"Life through the eyes of a chemist"

On February 8, 1933, a lecture entitled "Life through the eyes of a chemist" was presented by Professor Albert Szent-Györgyi at an event organized by the Association of Friends of Ferenc József University. The next day's edition of *Délmagyarország* reported on the lecture, which was followed with great interest. The director of the Medical Chemistry Institute at the time stated, among others, that "there is no relation whatsoever between science and religion because what can be measured is science, and where there is nothing to measure is religion; science, therefore, may be at most a close neighbor of religion." He said, in addition, that "science investigates depths, it penetrates the tiniest of particles to reveal newer and newer secrets. Biochemistry reached this way the smallest constituent of the human body, the cell, and then the molecules and atoms. Thus, it learned that the amazing machinery we call living body is eighty percent water." He added, to the great amusement of the audience, that "it is so even if we speak of an honorable gentleman." His opinion was that "biochemists did not stop at the atom, they entered it, which was a more important event in world history than the Great War."

The present paper intends to demonstrate through examples how synthetic organic chemistry, a branch of chemistry, helps our everyday life.

Organic compounds

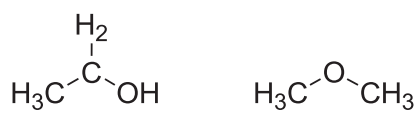
Organic chemistry is the chemistry of carbon compounds. Besides carbon, the molecules of organic compounds typically contain hydrogen, nitrogen, oxygen, sulfur or phosphorus. Their transformations into each other form the basis of the functioning of the living body. Organic chemical reactions were already performed in the antiquity (of course, not knowingly), and these included, for example, the production of wine or vinegar. The Middle Ages were dominated by alchemists and iatrochemists. As is well known, one of the main goals of alchemists was to produce gold. Iatrochemists were interested in medicine, the development of new treatments and medications. Although their efforts failed in many cases, an important recognition of theirs was that chemical substances may also be used for healing.

The experiments with organic chemical reactions were set back by "vitalism," a theory predominant until the beginning of the 19th century, according

to which it is not possible to produce an organic compound artificially, from an inorganic compound, because it requires "vital force," something possessed by living organisms only. This theory was disproved in 1828 by the German chemist Friedrich Wöhler, who synthesized, with heating, an organic compound, urea, from ammonium cyanate–which is an inorganic compound. Many questioned this discovery at the time but further experiments clearly confirmed the finding of Wöhler before long. The advance of organic chemistry gathered momentum after this.

What makes organic chemistry special within chemistry is that the carbon atoms that constitute the molecules of organic compounds may form chains of arbitrary length by binding to each other, and these chains may also contain forks → branches. Carbon atoms may form rings as well, in which carbon may also be replaced with another atom (oxygen, nitrogen, sulfur, etc.; a so-called heteroatom). Based on all of this, infinite kinds of organic compounds can be imagined in theory. In any case, the ones known today already number tens of millions.

In chemistry, the phenomenon where certain compounds have the same number and same kinds of elements (they have the same molecular formula) but differ in their structure is called isomerism. The figure shows an isomeric pair that also contains a heteroatom (oxygen)–ethyl alcohol and dimethyl ether, which have the same molecular formula, C_2H_6O.



etil-alkohol dimetil-éter

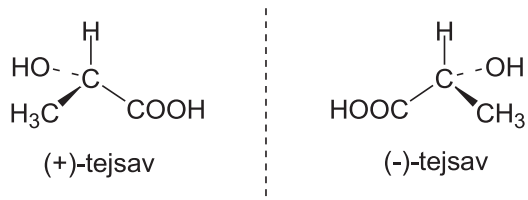
As the number of carbon atoms increases, there is an exponential growth in the number of possible isomers. For example, triacontane, the molecular formula of which is C30H62, has a theoretical 4,111,846,763 isomers, each of which is a different compound.

Identities and differences

In the beginning, organic compounds were labeled with so-called "trivial" names. These names could refer to the effect, source, etc. of the compound; e.g., morphine, barbituric acid. With the exponential increase in the number of known compounds came the need for creating a systematic nomenclature

to have a clear link between the structure and the name of the billions of real or yet imaginary compounds. The foundations of the so-called IUPAC (International Union of Pure and Applied Chemistry) nomenclature were laid down as early as 1896, and the rules of the nomenclature are still under constant development today.

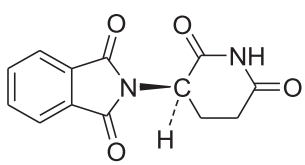
The structure of organic compounds with the same molecular formula may differ in several ways from each other and, based on this, different types of isomerism are distinguished. Out of these, optical isomerism is of marked importance. The carbon atom–because of its electron structure–has a valence of four in most of its compounds and, therefore, up to four different atoms or atomic groups may bind to it. In such case, the four valences of the carbon atom that is situated in the center of an imaginary tetrahedron are pointing at the four vertices of the tetrahedron, where the atoms or atomic groups are located. If these are different, the molecule cannot be superimposed on its mirror image, i.e., the compound has two isomers, which are called enantiomers. The figure shows the structural formulas of the enantiomers of lactic acid (the solid lines, the dashed line and the wedge bind the groups on the plane, behind the plane and in front of the plane of the paper, respectively, to the central carbon atom).



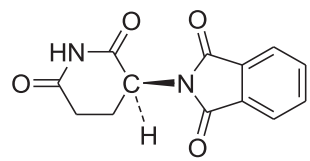
The relationship between the two compounds is like that of the right and the left hand, and therefore–based on the Greek word for "hand"–the phenomenon is called chirality. The label before the name of the compound indicates whether the solution of the given compound rotates the plane of polarized light clockwise or counterclockwise; this is where the term "optical" isomerism originates from. Enantiomers are the same in virtually all of their chemical and physical properties. This fact leads to a difficulty when we wish to separate the two isomers from each other. It is obvious that we should make use of some kind of a difference to achieve separation, but what if there is no difference? Why is it necessary anyway to separate the members of the enantiomeric pair? The main reason for this is that the systems of the living body are also chiral and, because of this, the substances administered into the body may lead to different responses. Thus, for example, if the molecules of an active

drug ingredient form an enantiomeric pair, it may happen that only one of the substances shows the desired effect, whereas the other one is harmful to the body. This phenomenon is similar to the situation when we are try to put the right-handed glove on our left hand. We will have little success; the same as when we are trying to put an unfitting enantiomer in the chiral "pocket" of an enzyme in the body. Why are enzymes chiral? Because their building blocks, the amino acids are mostly also chiral.

The pharmaceutical company Grünenthal put its drug Contergan, which contained thalidomide as the active ingredient, on the market in 1957. During its use, it was found that, out of the enantiomers shown on the figure, only the left one shows the desired sedative, painkilling effect, whereas the other one has a teratogenic effect, i.e., it is harmful to the fetus. In the late '50s and early '60s, more than 10,000 so-called Contergan babies with limb defects or without limbs were born in 46 countries around the world.



(+)-Thalidomide



(-)-Thalidomide

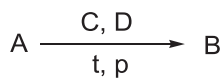
This event raised the attention to the following: if our active drug substance is chiral, the drug should ideally contain the required isomer only, or if the enantiomers cannot be separated in a reasonable way, the effect and destiny in the body of the other enantiomer must be thoroughly investigated. The peculiarity of thalidomide is that even if all of this had been known and the enantiomers had been separated from each other and only the suitable one had been used, it would not have been a solution. This is because in the body, the "good" isomer is able to transform into the "bad" isomer, i.e., it isomerizes, and therefore it would have exerted its harmful effect anyway. Another interesting thing is that thalidomide has recently found its way back into the pharmacological armamentarium because it shows a considerable antitumor effect and–naturally, taking its teratogenic effect into account–it may be used, e.g., in men.

Certain naturally occurring enantiomers differ even in their smell. (+)-carvone smells like caraway, whereas (–)-carvone smells like spearmint. (+)-limonene smells like orange, whereas (–)-limonene has a turpentine-like odor.

Separating enantiomers from each other or the targeted production of one of them is therefore a serious challenge and an important problem to be solved by the organic chemistry of today, and it can be achieved, even if often not easily, by using the principle provided by nature, that is, ensuring a chiral environment.

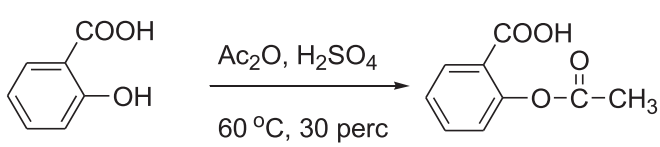
Equation of organic chemical reactions

Let's see now, in general, how to write the equation of an organic chemical reaction. We start from starting material "A," let's call the product to be produced "B," and an arrow is placed between them, on which the reagents (C, D) and the reaction conditions (t = reaction time, p = pressure, etc.) are usually given.



For a chemical reaction to occur, activation energy is required, which is usually communicated to the system in the form of heat. Instead of heat, we may also use activation by microwaves or light. If a catalyst is used, the activation energy needed for the reaction is lower, and therefore the reaction can occur under milder conditions and faster than without a catalyst. Enzymes are the catalysts of the living body. Reactions in the living body must be catalyzed so that the reactions that ensure the functioning of the body can occur at body temperature, i.e. at 36 to 37 °C in case of the human body.

I will demonstrate through the example of the production of acetylsalicylic acid, the active ingredient of aspirin, how an organic chemical reaction can be performed in the laboratory. "A" in this case is salicylic acid, whereas the resulting product, "B," is acetylsalicylic acid. Acetic anhydride is used as reagent and sulfuric acid as catalyst.



szalicilsav acetil-szalicilsav

The following recipe describes the steps of the transformation:

1.4 g (10 mmol) salicylic acid, 2.0 mL acetic anhydride and 3 drops of concentrated sulfuric acid are measured into a 50-mL round-bottom flask.

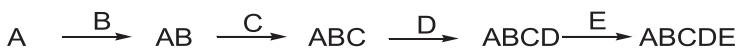
The mixture is heated over a water bath at 60 °C for 30 minutes, and it is shaken gently every now and then. After this, 20 mL water is added, and the mixture is cooled over an ice bath. The precipitation is filtered, and the raw product is recrystallized from water containing acetic acid.

Now, I wish to demonstrate how close the analogy between such a chemical transformation and one of the most important kitchen activities, cooking, is. If, for example, we wish to make chicken soup, chicken is the starting material (A) and chicken soup is the end result. The required materials are not called reaction partners or reagents here but ingredients. Temperature has an important role here as well. We cook in water, the temperature is therefore 100 °C, and the "reaction time" is about 3 hours. We also have a recipe here, which we may follow to the letter or modify, or we may create a new one, just like when performing reactions.

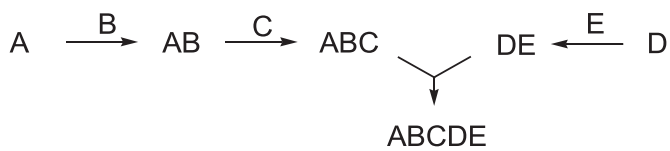
It is worth noticing that the equipment and the methods used in the kitchen and the synthetic organic chemistry laboratory are similar in many aspects. In the kitchen, we cook in pans and pots, whereas in the laboratory, flasks are used for the same purpose. We work in a broad temperature range both here and there, mixing may be necessary in both places, and the magnetic stirrer is the wooden spoon of the laboratory. In the kitchen, water is used as a solvent. Water may also be used for organic reactions but most often, various organic solvents are employed, mainly because most of the organic compounds are insoluble in water. Filtering is needed both here and there. Special gases may be found also in the kitchen, e.g., carbon dioxide or nitrous oxide; usually many types of special gases are used in the laboratory. Reactions requiring pressure may also be performed; in case of the kitchen, in a pressure cooker, whereas in case of the laboratory, in a pressure reactor. To speed up reactions, we may use a microwave oven, and a corresponding equipment can be found in the laboratory. Washing up is required both in the kitchen and the laboratory, and it is usually done manually in both places, but a dishwasher may also be used in either case. Of course, personal protective equipment must be available in both places. There is a considerable difference, however, between the two activities in that we have the opportunity to check the quality by tasting in the kitchen, whereas in the laboratory, we need to use a chemical-analytical method to this end. Another very important difference between the two activities is that in the kitchen, we usually need the end result in the form in which we cooked it, i.e., we need the meal itself. Contrarily, in the laboratory, we need the single substance that we wished to produce (the target compound), and therefore we must extract the desired product from the complex reaction mixture with a certain method after the reaction is

complete. In most cases, organic chemical reactions do not result in a 100% yield, i.e., after a reaction of A→B, unconverted A molecules may remain, or other products may be formed besides B, that is, selectivity issues may occur.

The term "synthesis" is also used in everyday life and it by and large means that from smaller parts, we create a larger one, which is qualitatively different from the sum of the small parts, and which is good or useful for something. In the case of organic chemical syntheses, a new or known organic compound is produced, usually from simple starting materials, with the help of chemical reactions. Syntheses usually consist of several, sometimes many, chemical reactions. Basically two kinds of synthesis strategies can be employed to implement the synthesis: in the case of linear synthesis strategy, we start from the first starting material, and build (in this case) the compound "ABCDE" step by step:



When the convergent synthesis strategy is used, we start with two (or more) pathways, and the smaller assembled units are combined with each other somewhere during the procedure.



Baskets, for example, may be made with the first strategy. During basket weaving, we take the first stave, we add the second one to it, and so forth until the basket is ready. An example for the second strategy may be car manufacturing, where the body of the car is assembled from different parts, in a sequential order. The engine is assembled separately, the piston, the cylinders, the spark plugs, etc. are installed in it, and then the body and the engine are assembled in the appropriate phase.

What can be the purposes of organic chemical syntheses? Several such purposes can be named, e.g.:

- Studying the reactivity of compounds,
- Expanding the application of new organic chemical methods and reactions,
- Producing new compounds to achieve different (physical, chemical or biological) research goals,

- Determining the structure of natural compounds. Organic syntheses were used to confirm the structure of compounds extracted from natural materials mainly in the past. At the time of Albert Szent-Györgyi, before that, and for a few decades even after that, the so-called chemical structure verification provided the means to solve this problem. During the "breakdown," the compound of unknown structure that had been extracted from a natural material was taken and was subjected to transformations with known effects. As a result of the reactions, smaller compounds with known structure were achieved, and then the structure of the compound of unknown structure was logically presumed based on the structure of these smaller compounds and the reactions conducted. After working out the structure this way, it was still an assumption only, and full certainty was achieved with the so-called total synthesis. It involved taking a commercially available small molecule, performing the synthesis of the target compound starting from it, and comparing the obtained target compound with the one isolated from nature. If the two compounds were identical, the structure gained final verification. Nowadays, it is much easier for synthetic organic chemists to verify a structure because many spectroscopic methods are available to complete this task. The use of these began to spread in the middle of the past century and for the organic chemist, the most important of them is nuclear magnetic resonance (NMR) spectroscopy. It is based on the same principle as the MRI equipment used in clinical practice. The results of spectroscopic measurements give a projection of the structure of the given compound, and if all relevant spectra are available, the same task that could have taken up to ten years a hundred years ago can be completed within a very short time, possibly a few hours.
- Organic chemical syntheses are quite commonly performed also for pharmacochemical purposes. It usually involves the need for producing a large number of compounds and investigating their effects to develop an effective and safe drug in the end. Efforts are not always accompanied by success but sometimes an active ingredient that can be used in a field different from the original is discovered during the research.

Digitoxigenin is an active ingredient improving heart muscle function, which is found, among others, in common foxglove and lily of the valley. Their infusion was used for this purpose in traditional medicine. However, there is a serious problem with the use of this active ingredient; namely, that there is only a small difference between the effective and the lethal dose and, therefore, it is very easy to overdose the drug. Synthetic organic chemists tried to modify

the structure of this compound with the purpose of widening this so-called therapeutic window, but their efforts were not crowned with success. Derivatives of the compound in which the oxygen atom in the ring of the molecules was replaced with nitrogen were also synthesized. Although the resulting abiraterone cannot be used as a cardiac drug, it is an outstanding treatment for benign prostate enlargement.

- Organic syntheses aimed at the production in large amounts of a compound that is scarce in nature but important from some (not only pharmacochemical) viewpoints are also often developed.

Imperial purple was used to dye the garments of senators and emperors in the antiquity. The dye was extracted from purple dye murex snails, obtaining a mere 1.5 grams of imperial purple by processing about 10,000 snails. The structure of the compound is quite simple, the synthesis of dibromoindigo was achieved already in the 1800s. The synthesis of textile dyes that provide a more lasting and better-looking result than imperial purple was also developed. The results are primarily associated with the name of Adolf von Baeyer.

Bombykol is an insect pheromone produced by female silkworm moths. Since mature female silkworm moths have a lifespan of about 3 to 5 days only, and they must mate and lay their eggs during this period, it is important to quickly encounter their male partners. Males can detect very low concentrations of bombykol from a great distance, even from kilometers away. In 1962, 3 mg bombykol was obtained from 31,000 moths, which was sufficient for the verification of its structure. Since the structure of the compound is relatively simple, synthetic chemists were able to achieve its synthesis in the same year. What is the benefit of being able to produce insect pheromones? These compounds may be used in environmentally friendly plant protection, e.g., by placing the attractant in traps. Another method is to contaminate a larger area with it, using very low concentrations but an amount that is enough to prevent the individuals of the opposite sex from meeting each other and, therefore, from mating.

At the time, vitamin C was called hexuronic acid by Albert Szent-Györgyi, who obtained the amount required for his experiments from paprika. This compound can be extracted from other natural sources as well, but it certainly would not be enough to satisfy the vitamin C needs of the world. Its synthesis was developed in the 1940s. The elegant syntheses starting from glucose and consisting of a few steps enable the efficient production of vitamin C.

The last example to be mentioned is the case of taxol. Taxol is found in the bark of the Pacific yew tree, and it was extracted from there in the 1960s. It is excellent for the treatment of certain female cancers. This compound called

taxol is found in very low concentrations in the bark of the yew tree and, on average, the bark of three 100-year-old trees is required for the treatment of a single patient. The yew tree grows quite slowly, lives very long, for several hundreds or even a thousand years, and its wood is very hard, difficult to work on, and extremely durable. To prevent the eradication of the yew tree, synthetic organic chemists tried to perform the total synthesis of this compound. Six or seven research teams managed to do this, and their results were published in the 1990s. The rather complex total syntheses, however, consist of too many reaction steps, and therefore their industry-scale implementation is not economical. At the same time, an active ingredient that is a close structural relative of taxol was extracted from the leaf of the European yew, which is endogenous in Europe and, within it, Hungary, and with its so-called semisynthetic transformation, taxol can be obtained in relatively few steps and efficiently. In 2011, the yew was chosen as the tree of the year. The yew inspired writers and poets as well. It is worth knowing that every part of the yew, except for the aril around the seed, is poisonous, and thus this plant is usually associated with death and passing in the literary examples. An interesting thing is that in the Harry Potter books, the wand of Voldemort is made of yew.

Finally, the opinion of a few Nobel laureates on chemical syntheses:

R. B. Woodward: "There is excitement, adventure and challenge, and there can be great art in organic synthesis."

R. Hoffmann: "It is the making of such molecules–chemical synthesis–that I want to praise. → I want to praise chemical synthesis, the making of molecules."

E. J. Corey: "I believe that chemical synthesis will make enormous contributions to human progress in the next century especially when coupled to biology and medicine."

R. Noyori: "Chemistry has a central role in science, and synthesis has a central role in chemistry."

The thought of Albert Szent-Györgyi quoted earlier, according to which "science investigates depths, it penetrates the tiniest of particles to reveal newer and newer secrets" is completely true even today. Despite the fact that the researchers of today have, from many aspects, a simpler task than their predecessors, new and new questions arise with the expansion of knowledge, the answers to which will require the results of synthetic organic chemistry–among other disciplines–for a very long time to come.

References:

- Délmagyarország, February 1933 9.
- Wade, L. G. Jr., Organic Chemistry, 4th ed., Prentice Hall Int., Inc., 1999.
- McMurry, J. Organic Chemistry, 5th ed., Brooks/Cole, 2000.
- Felföldi, K., Wölfling, J., Szerves szintézisek [Organic syntheses], JATEPress, 2011.
- www.wikipedia.org

Gábor Tóth

From vitamins to peptides – Research topics in Szent-Györgyi's departments

Albert Szent-Györgyi is probably one of the most well-known Hungarian Nobel Laureates, and this is partly due to the fact that he was our only Nobel Laureate who after receiving the Nobel Prize returned to Hungary. However, his works are not very well-known and often it is believed that he received the Nobel Prize for the discovery of vitamin C, which is not entirely accurate. Below you can see the photo of an old article which was published in1932 about Szent-Györgyi's discovery that pepper around Szeged contains a lot of vitamin C.

Szent-Györgyi Albert professzor szenzációs felfedezése a szegedi paprikával kapcsolatban

A szegedi paprika négyszer több C vitamint tartalmaz, mint akár a narancs, akár a citrom — A felfedezéssel kapcsolatban nagy export lehetőségekre van kilátás

Szeged, december 3.

Ebben az évben ismét egy panasz hangzott el a szegedi paprikatermelők részéről. A néhány évvel ezelőtt virágzó paprikaexport az itteni az Ausztriával való vámháború miatt teljesen elakadt, s ezzel kiszámíthatatlan kár érte a szegedi termelőket. Pedig Szegeden közel 20 ezer embert érdekel a paprikatermelés, értékesítés és kikészítés.

A földmüvelésügyi minisztérium illetékes osztálya megpróbált segíteni a szegedi paprikatermelőkön, sajnos, azonban nem azzal az eredménnyel, amelyet a szegediek reméltek.

A különféle érdekeltségek szintén akcióba léptek a paprikatermelés érdekében, de nem lévén export, a jóindulatu támogatás nem jelentett kiadósabb anyagi hasznot. Állandó volt tehát a panasz a szegedi paprikások részéről. A vámháború és a külföldi lelketlen konkurrencia miatt az árak olyan mélyre estek, amelyek tovább folytatódva, föltételnül a paprikatermelés válságát idézték volna elő. Hogy ez mit jelentene az ország gazdasági életében, az csak most tünik ki,

Szent-Györgyi Albert professzornak, az egyetemi vegytani intézet igazgatójának szenzációs felfedezéséből,

amelyre nemcsak Magyarországon, nemcsak Európában, hanem az egész világon fel fognak figyelni s amelynek üzleti haszna, helyes megalapozással voha nem remélt arányokban bontakozhat ki.

Szent-Györgyi professzor buvárkodásának régebbi eredménye az egészségre annyira fontos C-vitamin. S a kiváló tudós állandóan kutat olyan növények után, amelyekben a C-Vitamin bőségesen fellelhető. Igy kezdett foglalkozni ez év októberében a szegedi termésü paradicsom-paprika vegyi összetételével, s néhány napi laboratóriumi munka után nagyszabásu felfedezésre jutott. Felfedezéséről a következőket mondotta el a **Szegedi Uj Nemzedék** munkatársának:

— Vitaminoknak nevezzük az anyagok egy csoportját, melyek táplálékunkban igen kis mennyiségben vannak jelen, azonban az élethez és egészséghez nélkülözhetetlenül szükségesek. Ezeknek a Vitaminoknak nagy teoretikus jelentőségük mellett igen nagy közegészségügyi és economiai jelentőségük van. A modern ember tápláléka nem felel meg a természetadta tápláléknak és így könnyen nélkülözi ezeknek az élettfontosságu Vitaminoknak egyikét, vagy másikát. Nem kell mást felhoznunk a Vitaminok fontossága bizonyitékául, mint egyes betegségeket, melyek szinte járványszerüen pusztitanak, amelyek lényege nem más, mint egyik vagy másik Vitamin hiánya, amilyen betegségek a beri-beri, az angolkór és scorbut.

Az én szegedi laboratóriumomnak jutott osztályrészül, hogy tisztázhassa egyik legfontosabb vitaminnak, az ugynevezett Vitamin C.-nek a chémiai természetét.

Ez a Vitamin C. csakis friss gyümölcsökben, vagy növényekben található. A Vitamin C. hiánya által okozott betegség vagy gyengeség könnyen sujt olyanokat,

Both the article and the discovery are true. However, when Szent-Györgyi received the Nobel Prize in Physiology in 1937, on the same day two other gentlemen, namely Sir Walter Norman Haworth and Paul Karrer, also received the Nobel Prize for research in connection with vitamin C. Furthermore, Haworth received this high-rank award for the investigations he carried out on the structure of carbohydrates and vitamin C.

Sir Walter Norman Haworth
(1883–1950)

Paul Karrer
(1889–1971)

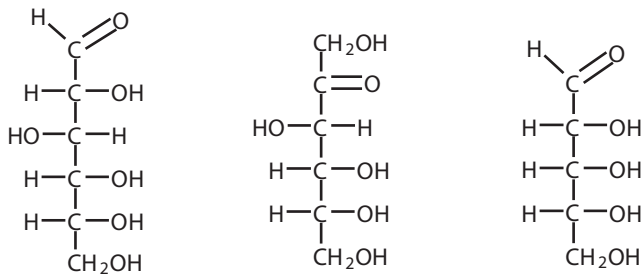
The components of nutrients

Now let's see what these so-called vitamins are and why they are so interesting that so many Nobel Prizes have been awarded on this topic.

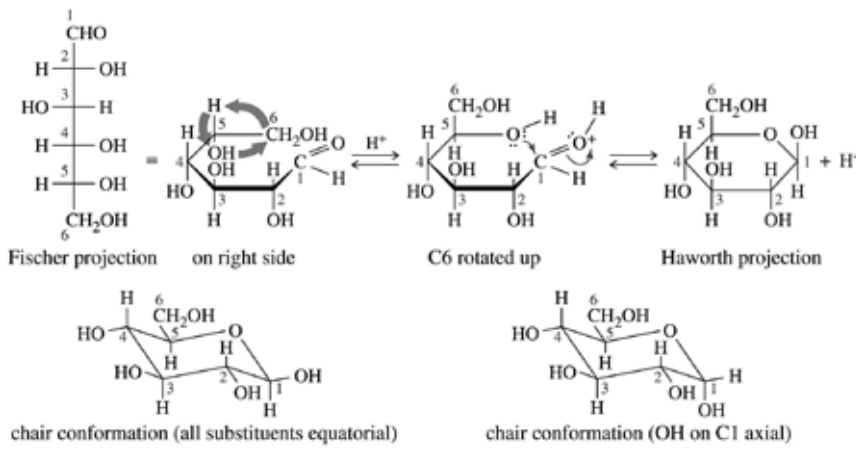
By the end of the 19th and the beginning of the 20th century, chemical structure research was advanced enough to determine what kind of chemicals are in nutrients. During this, 3 main components were distinguished. Nutrients are predominantly made up of carbohydrates, which, according to chemical definitions, are polyhydroxy-oxo compounds, containing an oxo group and some alcoholic hydroxyl groups.

In the following pictures, the formula of some important, well-known and simple carbohydrates can be seen. Carbohydrates have an interesting characteristic, namely, that they are like a snake biting its own tail when they form a cycle between the oxo group and one of the hydroxyl groups. At the end of this cycle the interesting, ring-like structure of the carbohydrates develop, which includes a new hydroxyl group. This has a different reactivity than normal hydroxyl groups because of its surroundings, which makes it possible for

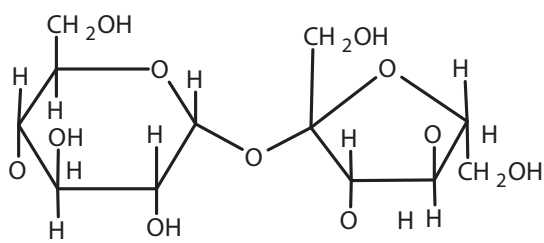
carbohydrates to form long chains together. After this process, carbohydrates are able to connect with each other, not just two of them but a lot of molecules and if these molecules are made up of glucose units, we end up with starch, cellulose or glycogen. These are one of the important components of our nutrients.



The structure of D-ribose, D-fructose and D-glucose

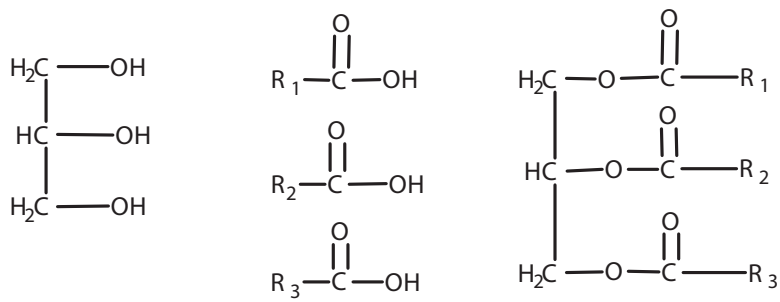


The ring structure of D-glucose and the spatial structure of the ring



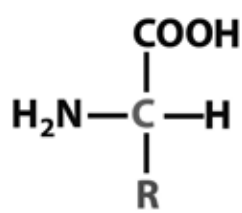
The structure of sucrose made up of D-fructose and D-glucose

The next group is constituted by fats and oils. These are made up of tri-alcohol, glycerol and some fatty acids. This triester is called triglyceride, which is commonly known as vegetable oil or animal fat, depending on the type of fatty acids involved and their level of saturation.



The general structure of triglycerides

Last, but not least, the third group of nutrients is proteins. Proteins consist of amino acids, which are organic compounds having a carboxyl and an amino group with a side-chain attached to them. In case of protein-forming amino acids the amino and the carboxyl groups can be found on the same, alpha-carbon atom. Amino acids are able to combine with the help of the so-called peptide bond between the amino and the carboxyl groups. If 100, 150 or 200 amino acids combine, the resulting molecule is called protein. The importance of proteins is proven by the fact that amino acid or its components constitute approximately half of the dry matter content of living cells.



The general formula of an alpha-amino acid

So these are the components of nutrients. After isolating these substances in a pure form, laboratory animals were given these as nutrients. Within a short period of time, these animals got sick and died. This led to the realization that there are substances which are necessary for a living organism but can be found in nutrients only in a small amount. These substances are called vitamins.

Water- and fat-soluble vitamins

The term vitamin was compiled in 1912 by a Polish biochemist, Kazimierz Funk, who put an "amin" suffix after the Latin word "vita", meaning life, since he thought that vitamins are such amines which are essential to life. Today we know that he was only partially right because there are some vitamins which are not amines, e.g. vitamin C. The proper definition of vitamins is that they are organic compounds essential to life, usually relatively small molecules. From a chemical point of view, they are quite diverse, this is why they are divided into two subcategories, that of water-soluble and fat-soluble vitamins. We don't know the exact number of vitamins, the literature is inconsistent; however, on this picture 13 can be seen. Later on, depending on the author, other compounds were named as vitamins too; but what we consider as a vitamin also partially depends on the way we consider this term. For example, we call vitamin C a vitamin, since our organism cannot produce it; however, for lions it is not, since they can synthetize vitamin C. So we can say that lions don't need to consume fresh fruit to avoid scurvy.

Water-soluble vitamins:
vitamin B1 (thiamine, aneurin)
vitamin B2 (riboflavin)
vitamin B3 (nicotinic acid)
vitamin B5 (pantothenic acid)
vitamin B6 (pyridoxine)
vitamin B7 (biotin)
vitamin B9 (folic acid)
vitamin B12 (cobalamin)
vitamin C (ascorbic acid)

Fat-soluble vitamins:
vitamin A (retinol)
vitamin D (calciferol)
vitamin E (tocopherol)
vitamin K (phylloquinone)

Why are vitamins important? Below you can see a table summarizing vitamins. In the first column different water- and fat-soluble vitamins are listed.

We can ask why it is relevant that a vitamin is fat-soluble or water-soluble. The reason is that if a vitamin is water-soluble, it is quickly excreted from

the body. On the other hand, if a vitamin is fat-soluble, it can accumulate in the body, thus it is not necessary to intake a fresh vitamin dose daily. In the next column we can see enzyme functions which require the given vitamin for their proper functioning. It provides an explanation for the importance of vitamins. If there is no vitamin, certain enzymes are not able to function properly, thus leading to certain disorders. These vitamin deficiency diseases can be seen in the next column. They include a wide variety of disorders ranging from coagulopathy to haematopoietic disorders, skin diseases, visual complaints, osteogenesis and its disorders, etc. At first sight, it does not seem to be something serious if someone has a skin disease, we are sure that the person is going to be cured, no big deal. However, when it comes to these vitamin deficiency diseases, if they are no treated, most of them are fatal.

Name of the vitamin	Chemical name	Solubility	Deficiency disease	Overdose	Recommended daily intake
Vitamin A	Retinol	fat	Night-blindness, Keratomalacia	25,000 IUs	620µg
Vitamin B1	Thiamine	water	Beriberi	n/d	1mg
Vitamin B2 (G)	Riboflavin	water	Ariboflavinosis	n/d	1.1mg
Vitamin B3 (PP)	Niacin	water	Pellagra	2,500 mg	12mg
Vitamin B5	Pantothenic acid	water	Paraesthesia	n/d	
Vitamin B6	Pyridoxine	water	n/a	400 mg	1.1 mg
Vitamin B7 (H)	Biotin	water	n/a	n/a	30 µg
Vitamin B9 (M)	Folic acid	water	[3]	1,000 µg	320 µg
Vitamin B12	Cyanocobalamin	water	Megaloblastic anaemia	n/d	2 µg
Vitamin C	Ascorbic acid	water	Scurvy	n/d	75 mg
Vitamin D1-D4	Lamisterol, Ergocalciferol, Calciferol, Dihydrotachysterol, 7-ehydrositosterol	fat	Rickets	50,000 IU	2 µg for all Vitamin D
Vitamin E	Tocopherol	fat	n/a	50,000 IU	12 mg
Vitamin K	Naphthoquinon	fat	n/a	n/d	75 µg

The name of vitamins, their deficiency diseases and their recommended daily intake

The classification of enzymes		
Main divisions	*Subclasses*	*Reaction catalysed*
Hydrolases	Lipases Nucleases Proteases	ester hydrolysis phosphate hydrolysis amide hydrolysis
Isomerases	Epimerases	isomerisation of the stereogenic centre
Ligases	Carboxylases Synthetases	addition of CO_2 formation of new bonds
Lyases	Decarboxylases Dehydrases	CO_2 reduction H_2O reduction
Oxidoreductases	Dehydrogenases Oxidases Reductases	formation of double bond by reducing H_2 Oxidation Reduction
Transferases	Kinases Transaminases	phosphate group transfer amino group transfer

Enzyme functions

On the figure above we can see different enzyme groups, their subgroups and what these enzymes can do. We can see that in a living organism there are three groups which can break down different things (e.g. nucleic acids, fats or proteins) with the help of hydrolysis. Other enzymes can change the spatial structure of compounds, form new chemical bonds and break down compounds, in other words, they can remove carbon dioxide or water from molecules, reduce molecules or transfer amino or phosphate groups to molecules. It is clear that in these processes the majority of organic chemistry is present, thus our enzyme system and its functioning is vitally important to maintain our health.

From micrograms to milligrams

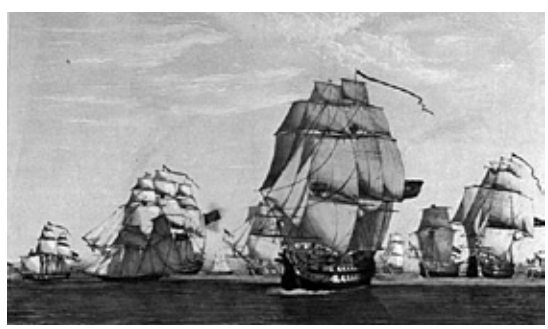
How much vitamin is necessary? The amount can range from a couple of micrograms to a couple of milligrams. For example for an adult, 75 milligrams is the daily recommendation from vitamin C, which is needed in the largest amount.

Vitamin C is important for us because there is a disease, namely scurvy, which caused serious problems to mankind in the past. Back in the age of discoveries, sailors departed on long journeys on their ships without having fresh food. It was quite common to see these sailors go down with scurvy after a couple of days or weeks. At the beginning, scurvy just caused unpleasant symptoms, however later on it often proved to be fatal, thus we can say that scurvy killed

ten times more sailors than sea battles. The first major discovery in connection with this disease was made by James Lind, a Scottish physician, who served on a battleship in the 1750s. There was an outbreak of scurvy on his vessel and for the first time in history, he formed a control group in which patients were not treated with anything, while other patients were divided into smaller groups receiving different substances as a treatment. One of the groups was treated with apple cider vinegar, which proved to be mildly effective. However, the patients of another group who were treated with lemon juice showed dramatic improvement. All the other groups showed signs of dramatic deterioration.

James Lind (1716–1794)

At that era it was not easy to introduce new things, so people questioned Lind's methods. However, by the end of the 18th century, it became a common practice required in the British Navy to give sailors on battleships a set amount of lemon juice every day. Their enemies often made fun of the British Navy by calling them lemon juice ships, though this did not prevent England from becoming the ruler of the seas.



18th century sailing vessels

Actually we can say that vitamin C was discovered in certain aspects earlier, however, back then people did not know what was in lemon juice which made it effective. Albert Szent-Györgyi, who for a long timed worked in the building on Dóm Square, joined this research for vitamins many years later.

Szent-Györgyi's departments on Dóm square

Szent-Györgyi and the research for vitamins

Albert Szent-Györgyi was born in 1893 as a member of a landowning family as Albert Szent-Györgyi de Nagyrápolt. From his mother's side, he came from a medical dynasty, that of the Lenhossék family. He completed his high school studies at the Lónyai Street Calvinist High School and received his degree at the Faculty of Medicine of the University of Budapest in 1917. During his studies, he also served in the army and fought on two front lines in the World War. After the war he got a job in Bratislava; the farmer hungarian capital, Porzsony however, soon he was fired because the Czech government did not want to have any Hungarian researchers in a research institute in Bratislava. After this, Szent-Györgyi went on a trip around the world including Prague, Berlin, Leiden, Groningen and Cambridge. He worked for years in Groningen and Cambridge and started to do his researches there for which he later received the Nobel Prize. This is why the University of Groningen considers him as its own Nobel Laureate, since he worked there for years.

In 1928 he accepted the invitation of Kuno Klebelsberg, the Minister of Education, to take up a position and he became a professor at the Department of Medical Chemistry of the University of Szeged, which was called Ferencz József University back then. In 1935, when Tibor Széki moved to Budapest, he became a professor at

the Department of Organic and Pharmaceutical Chemistry. He served as the Head of both departments until 1940, when he resigned from one of his positions as he became the Rector of the University. In 1945 he went to Budapest and after two years he emigrated. He died in emigration in Woods Hole, USA in 1986.

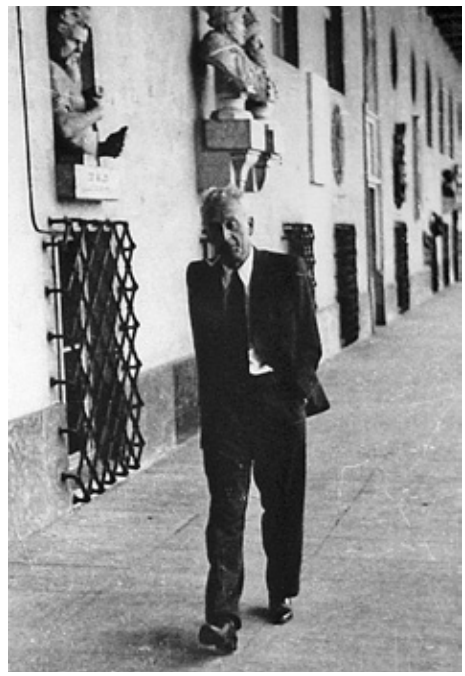
Over the years he received several recognitions. He was awarded the Nobel Prize in 1937. He received the Corvin Wreath and became the Member of the Hungarian Academy of Sciences. He was the Honorary Citizen of Szeged and served as the first Rector of the newly founded Horthy Miklós University in Szeged. After the German occupation he was forced to hide in secret.

Albert Szent-Györgyi

Albert Szent-Györgyi receiving the Nobel Prize. Below you can find the appraisal: "Professor A.E. Lindh of the University of Uppsala addressed the laureate:

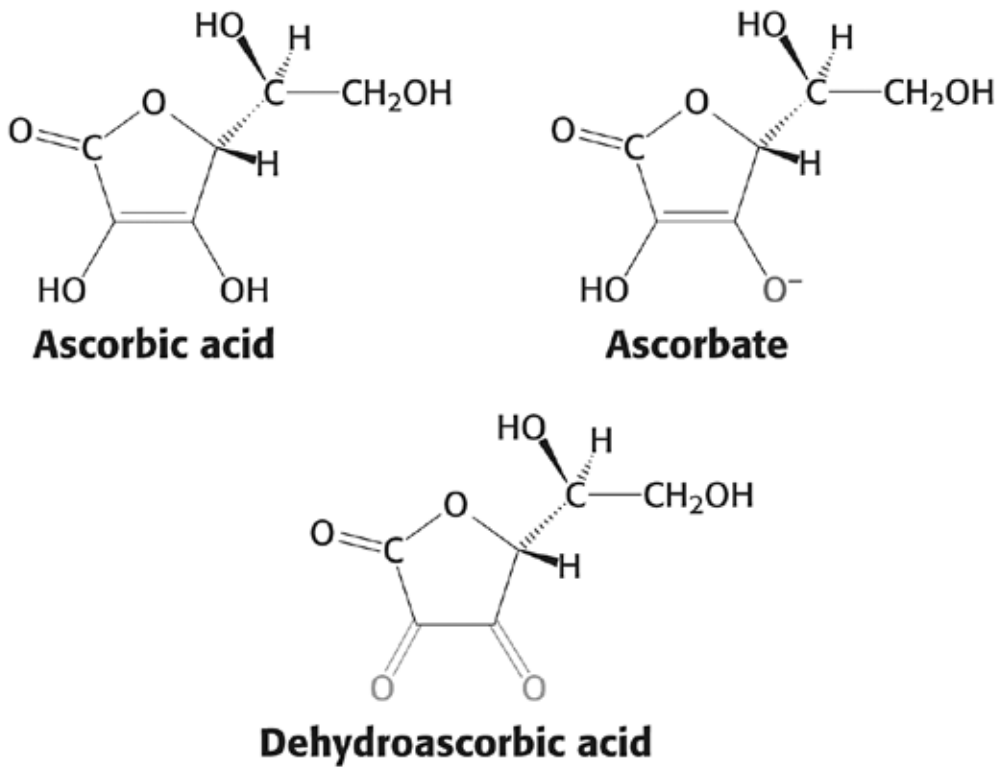
The name of Haworth and Karrer are, via Vitamin C, in close connection with the name of Albert von Szent-György, this year's Nobel Prize laureate in Physiology and Medicine, the ingenious and indefatigable scientist. Kindly accept our greetings, Albert von Szent-György, and at the same time accept our expressions of sincere admiration for the untiring energy you have hitherto shown, and for the extraordinary results you have obtained in your research work despite the difficulties you have, and have had to overcome. Your investigations into oxidation in living cells enabled you to crystallize Vitamin C, a discovery of vital importance to medical science. Your discovery of the Fumaric Acid Catalysis, and your ingenious penetration of its complicated mechanism has opened the way to undreamt of paths within the sphere of medical science and its practical work in the service of suffering humanity. We congratulate you and participate in your happiness in connection with the reward you have gained for your great scientific work, a work of research which has aroused the sincere admiration of the scientific world and in whose continuation we place our highest hopes."

Bálint Hóman giving a speech at the Opening Ceremony of the University in 1940, next to him, Rector Albert Szent-Györgyi.



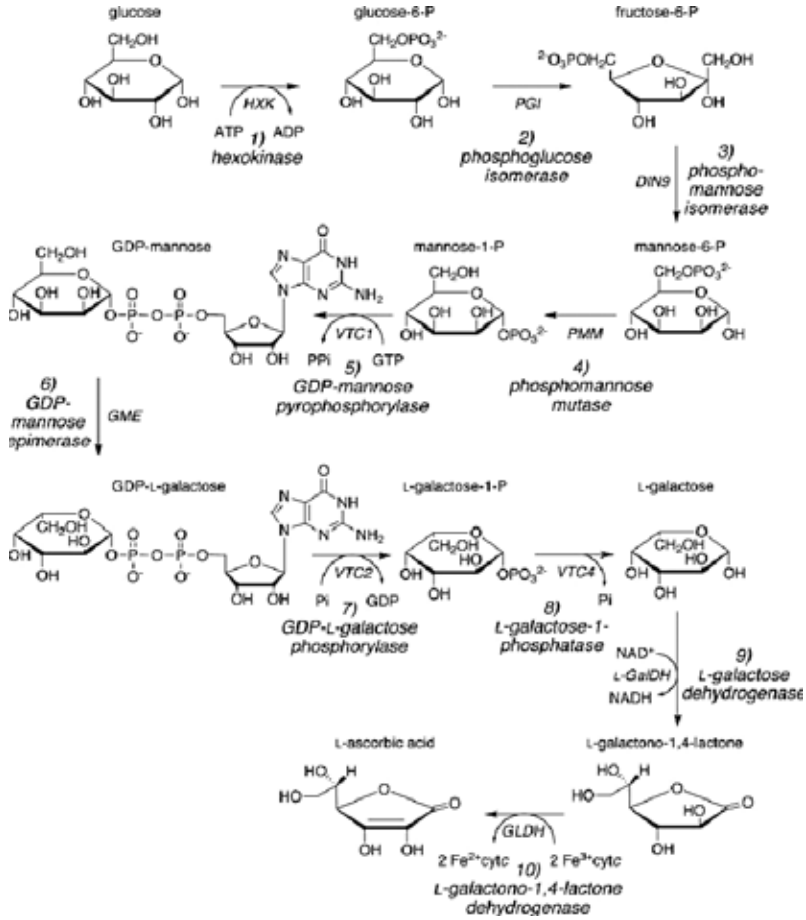
Albert Szent-Györgyi under the arcade in Dóm square and in front of the entrance of his departments

What researches were carried out in these two departments? The most well-known research was concerning vitamin C, the molecule of which can be seen on the following diagram. It also shows its other name, ascorbic acid, and this name originates from the fact that this is the substance which prevents scurvy and has acidic properties.



Ascorbic acid and the results of its two important alterations

For years it was only known that ascorbic acid prevents scurvy and has acidic properties. Then Szent-Györgyi named it hexuronic acid, which is an acid with six carbon atoms. Another important characteristic feature of ascorbic acid is that it easily oxidizes into dehydroascorbic acid. This is a redox process implying that ascorbic acid by itself is a quite good reducing agent. This is a central feature which guarantees that our organism does not get into an overly oxidized state. If we focus on enzyme functions we can state that ascorbic acid is essential for the functioning of certain hydrolase enzymes and collagen synthesis.



The biosynthesis of vitamin C. The last step is blocked in primates.

What contains vitamin C? The popular belief that lemon, as well as pepper, contains lots of vitamin C is true. However, it can also be found in other things like, for example, fresh meat, this is why the Eskimos did not get scurvy though they were eating only small amounts of vegetables for centuries.

Szent-Györgyi realised that it was quite difficult to find vitamin C for researches. They tried to isolate vitamin C from left-overs, adrenal glands from abattoirs. The purity of this was not satisfactory and only a small amount of vitamin C could be gained this way. Szent-Györgyi managed to isolate vitamin C from pepper in great quantities and with the required purity, which was then used for structural analysis and function tests. During these function tests Szent-Györgyi made significant discoveries, for example, how succinic acid

is transformed in several steps into malic acid. If we consume the nutrient, after many steps, what happens to it? We live on it, gain energy and build up the molecules of our body. Eventually a significant proportion of nutrients is transformed into carbon dioxide and water. How is carbon dioxide transformed into lard? People did not know the answer for that for many years and Szent-Györgyi managed to find the answer to these questions through his researches.

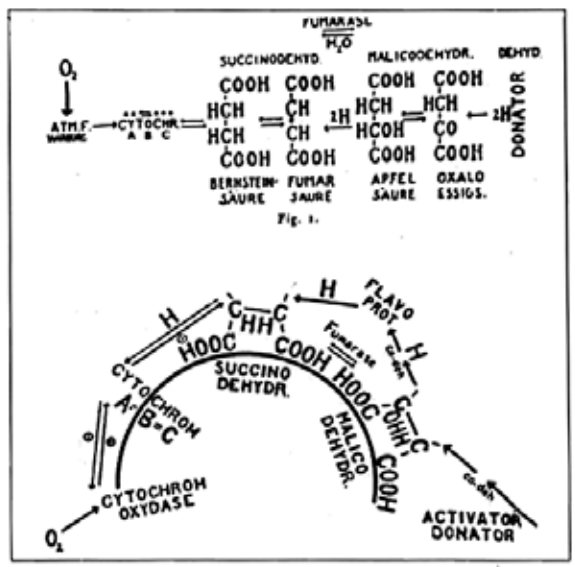
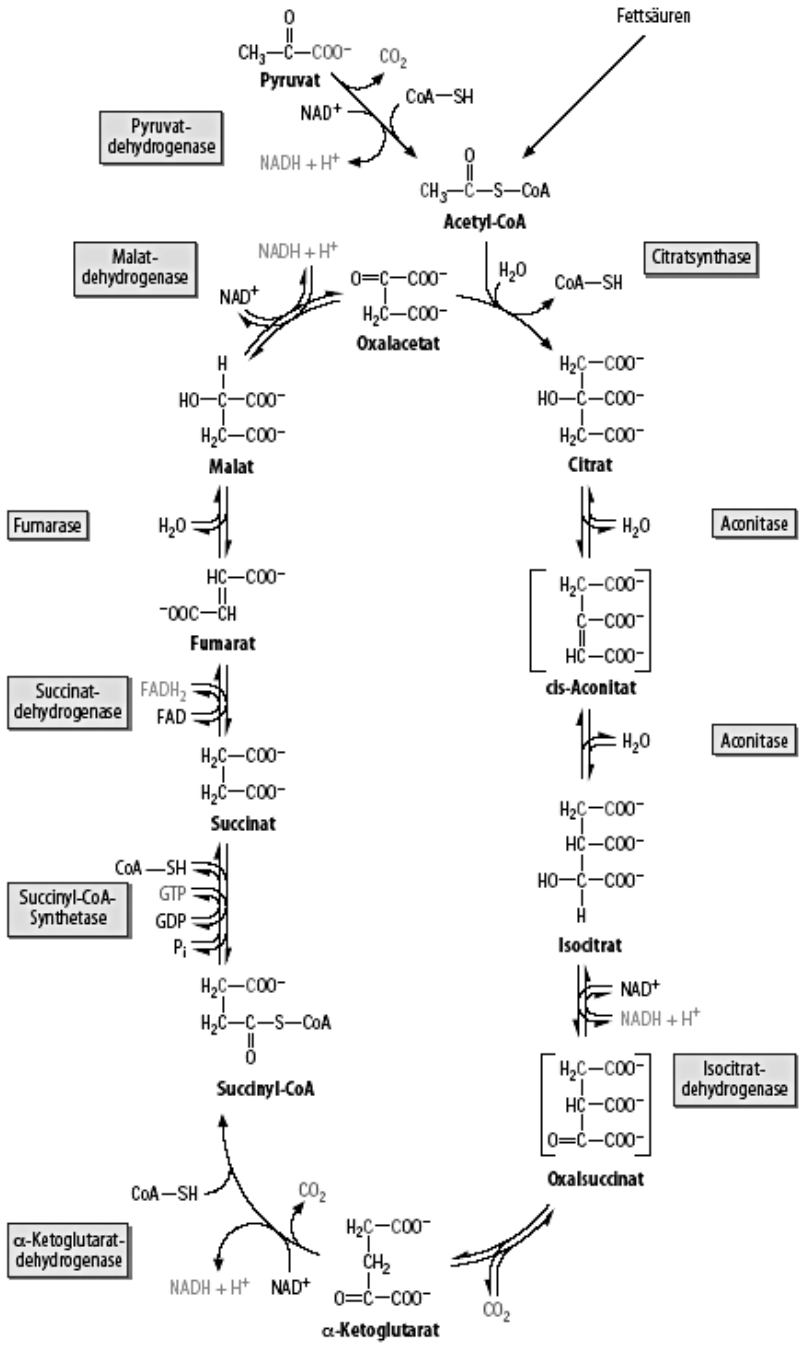


Figure 6. Figs. 1 and 2 of Szent-Györgyi's Nobel Lecture.

Szent-Györgyi's lecture in Szeged



The Krebs cycle (also known as Szent-Györgyi – Krebs cycle).
The metabolic pathway of fatty acids.

Sir Hans Adolf Krebs (1900 – 1981)

In the picture above we can see how fatty acid enters the cycle and how through several steps this acetic acid part is oxidized by losing two carbon dioxides, thus these carboxylic acids are broken down to their original form. There is a carboxylic acid in our organism containing four carbon atoms which with the help of an acetic acid part containing two carbon atoms is transformed into citric acid containing six carbon atoms. Then in several steps, we regain the original carboxylic acid containing four carbon atoms from the citric acid while two carbon atoms are transformed into carbon dioxide during which process we gain energy. The full cycle was described by Krebs, who was Szent-Györgyi's friend.

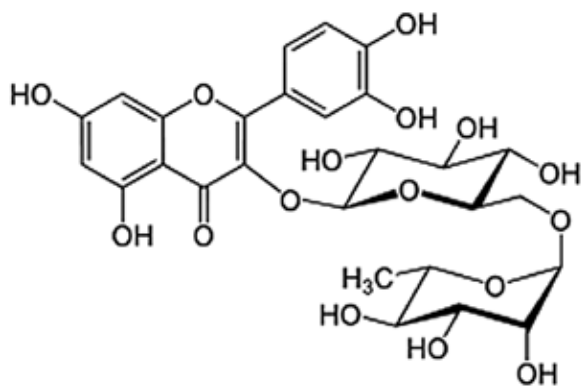
Albert Szent-Györgyi received the Nobel Prize for "the results of his research on biological oxidation processes, especially for clarifying the catalysis of fumaric acid and the importance of vitamin C". This was one of the fundamental questions of biochemistry back then, resolving the contradiction between the oxygen activation theory of Warburg and the proton or hydrogen activation theory of Wieland. By setting up the steps of the oxidation process of dicarboxylic acid containing four carbon atoms, one half of the citrate cycle was discovered.

Our title was from vitamins to peptides and so far we covered only one vitamin. Szent-Györgyi discovered with István Rusznyák that with the pure form of vitamin C which he synthetized, he was not able to carry out things which were possible with the less pure form of this compound. He discovered

that the less pure form contained something else, a biologically active substance.

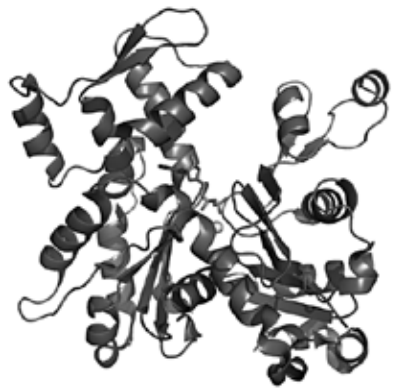
Beneficial effects

From a chemical point of view, these substances were polyphenols, belonging to the group of flavones. They can be found in great concentration in citruses, tea and wine. These are not real vitamins but they have significant physiological effects. Szent-Györgyi called it vitamin P; they have many beneficial effects that is why we drink tea, eat fruits and those who like it, drink red wine.



One of the flavonoids, rutin, which Szent-Györgyi called vitamin P

There was one more thing with which Szent-Györgyi dealt with in Szeged, the foundation of muscle biochemistry. Back then it was not well-known how muscles work. It was known that there is a protein complex, the actin-myosin complex, from which the myosin part was already described. The actin part was discovered by the department which Szent-Györgyi led.



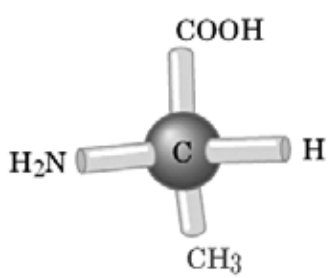
The model of the actin-myosin complex

On Dóm square, Szent-Györgyi has a bust under which there is a bronze plaque, which was put up by the American Chemical Society. They only put up a plaque where a great discovery was made in chemistry. This is an English-Hungarian plaque appraising Szent-Györgyi's discovery, and we have to mention that there are only a few of such plaques outside the USA.

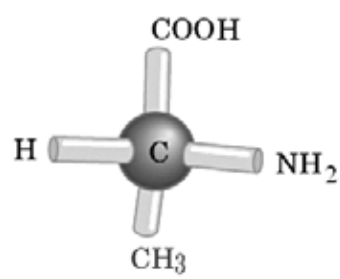
Iványovics György
(11th June, 1904 –1st September, 1980)

Bruckner Győző
(1st November, 1900 – 8th March, 1980)

Now I would like to talk about Győző Bruckner, who was one of the outstanding and dominant figures of Hungarian organic chemistry. Back then he was Szent-Györgyi's employee and later he became his successor. Bruckner made a great discovery in which Szent-Györgyi was not involved directly; however, this discovery was made in Szent-Györgyi's department. This discovery was on amino acids, more precisely, on proteins. Amino acids always contain at least one carboxyl group and an amino group. In case of amino acids which constitute proteins, both groups can be found on the same carbon atom. If four different substituents are attached to a single carbon atom, the carbon atom has chiral form and the compound has enantiomer forms.

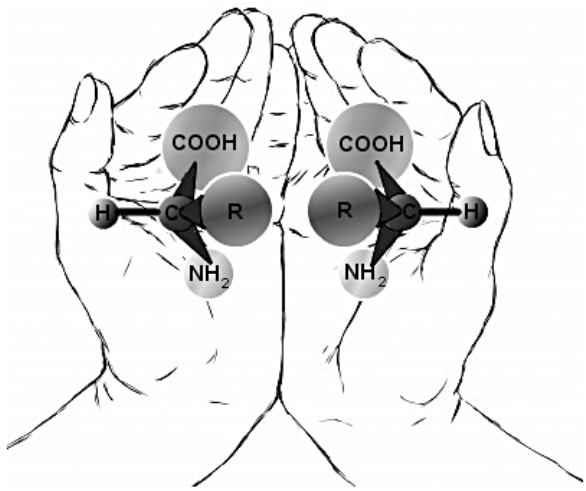


L-Alanine



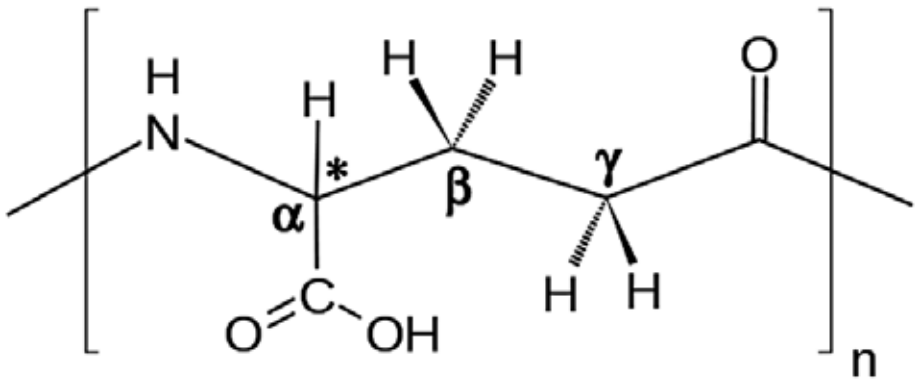
D-Alanine

If four different substituents are attached to a single carbon atom, the carbon atom has chiral form and the compound has enantiomer forms.



The link between the different versions of amino acids and the left and right hand

When they started to examine the structure of proteins it was discovered that different amino acids constitute proteins and almost all of these amino acids are alpha-amino acids. It also turned out that one of them is slightly different than the rest since it contains two hydrogen atoms, thus they are not mirror-image versions of each other. All the other 19 amino acids have two mirror-image versions and proteins are solely built up of one of these versions, the L-alpha-amino acids. This was a scientific doctrine; however, there was an interesting observation which challenged this theory. There is a fatal disease which is caused by the anthrax bacillus. Normally, if an animal got sick and died, its body was buried and underground its proteins decomposed the same way as the pathogens. However, the bodies of animals which died because of anthrax were found to be infectious even after decades. This went against all knowledge of the era.



The polypeptide structure of anthrax

In 1937, Győző Bruckner and György Ivánovics published that the capsular material of anthrax has a very unique structure in many ways. Firstly, a normal protein contains 20 different L-alpha-amino acids, in different sequences. On the other hand, the capsular material of the anthrax pathogen consists of only glutamic acid, so it can be considered as a polyglutamic acid. What is more, it is a polyglutamic acid in which the alpha-amino and the gamma carboxyl groups take part in the peptide bond formation. Thus it is not a substrate of proteolytic enzymes. It also turned out that this is also a chiral, hand-like molecule, just like the constituting amino acids. After this realisation Bruckner and Ivánovics published that the capsular material of anthrax is a poly-gamma-glutamic acid. However, they realised later on that they made a mistake and rectified it by saying that though it is a poly-gamma-glutamic acid, more precisely, it is a poly-gamma D-glutamic acid, explaining why it is so resistant to proteases. This might be the reason why they continued their research on anthrax as they might have suspected its great potential as a biological warfare agent. Anyhow, this discovery, which happened exactly at the time when Szent-Györgyi received the Nobel Prize, can also be considered as the birthday of Hungarian protein research.

To sum up, we can say that Hungarian vitamin and muscle research were founded in Szent-Györgyi's departments. After his departure, these departments started to undertake new projects.

Moreover, at the University of Szeged there are four departments which regard themselves as the successors of Szent-Györgyi, though he was the Head of only two of these departments. The reason for this is that after the war,

the Department of Organic and Pharmaceutical Chemistry was broken up into the Department of Pharmaceutical Chemistry and the Department of Organic Chemistry. At the beginning of the 1960s, the Department of Medical Chemistry was separated to the Department of Biochemistry, where muscle biochemical researches are still carried out today. Currently at the Department of Medical Chemistry peptide research is conducted, which cannot be connected to Szent-Györgyi directly, but to his department.

István Hannus

The Analysis of Vitamin C in Szeged

Albert Szent-Györgyi was awarded the Noble prize at the age of 44 in 1937. On the front side of the Noble medal, which is made of 23-carat gold and weighs approximately 200 grams, you can see the portrait of Alfred Nobel, while on the reverse side you can find a symbolic image: a woman is healing another woman with the water of life springing from a piece of rock. The medal, which has a rather adventurous past, is now in the Hungarian National Museum in Budapest. There is a copy of the medal in the Szent-Györgyi memorial room at 103. Tisza Lajos Street, Szeged. *(Illustration 1. The Nobel medal)*

Illustration 1. The Noble Prize

Leaves of the „pepper tree"

The justification on the Nobel Diploma written in sophisticated Swedish language says "for the discoveries in the field of biological burning processes, in particular vitamin C and fumaric acid catalysis". As previous presenters, László Dux, János Wölfling and Gábor Tóth also emphasized, the discovery is about biological oxidation. As Professor Dux described, Albert Szent-Györgyi was the first to suspect the existence of the citric acid cycle (which was discovered and described by Krebs) and the role of four-carbon-atom carbonic acids, including fumaric acid, in the oxidation cycle. In his presentation at

the Nobel award gala Szent-Györgyi illustrated the process as a half circle. He suspected that there was a cycle, which is known today as Krebs' cycle, therefore in Hungary and Szeged we can rightly call it Szent-Györgyi - Krebs cycle.

The Swedish graphic designer of the Nobel Diploma drew a slightly strange image of the pepper plant and it looks like a "pepper tree". He also created images of cities that played an important role in Szent-Györgyi's career: Budapest, where he was born and where he studied; the Dutch cities of Groningen and Leiden; Cambridge in England and, of course, Szeged. (*Illustration 2. The Nobel Diploma*)

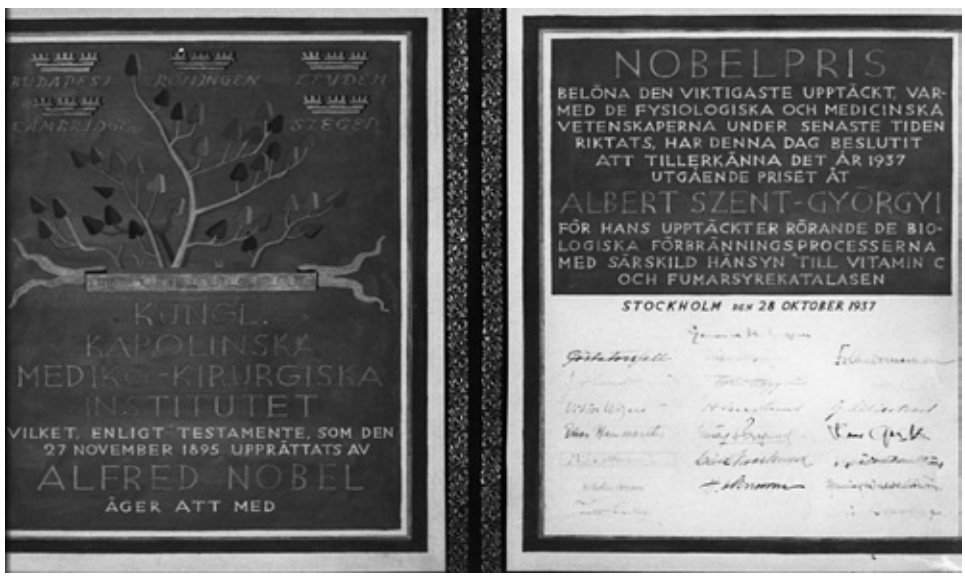


Illustration 2. The Noble Diploma

Before I move on to the topic of vitamin C research in Szeged, I will outline the important milestones in Szent-Györgyi's life. He was attending the medical university in Budapest, when World War I broke out and he was ordered to the Ukrainian front. Because of his tremendous physical and mental sufferings he was desperate to come home. He deliberately wounded himself by shooting into his own arm. Self-mutilation is a capital offence in the military, but his action remained unveiled and he was sent back to Hungary for medical treatment. He could complete his medical studies, he was awarded his diploma and he got married. However, the war had not ended by then and he was sent to the Italian front where he survived the terrors of the Isonzo-Piave swamps before the war ended and he could return home.

The years after the war were turbulent for the whole country, including the Szent-Györgyi family. He had many jobs, he took his family to Hamburg, then he received a job in Leiden, the Netherlands. The next milestone is Groningen, where he focused on biological oxidation. His research settled the dispute between Wartburg and Wieland, an important scientific controversy of that time, as it was described by László Dux in his presentation about the basics of biochemistry. Interestingly, following the principle of "Nomen est omen", O. Wartburg said that active oxygen (O) plays an important role in oxidation, whereas H. Wieland said it was active hydrogen (H). Then came Albert Szent-Györgyi, a young scientist, who conducted experiments using potato and found that both of them are right: they examined two different sides of the same process, in which active oxygen oxidises active hydrogen. Szent-Györgyi published a series of five articles on the topic bringing him international reputation in the field of biological oxidation.

At the end of 1920s in Groningen he used the adrenal cortex to isolate a highly reactive anti-oxidant, similar to the substance found in citrus fruits, orange, lemon, as well as pickled cabbage. Then he moved to Cambridge, the town he later considered as his scientific home. We, chemists are proud of the fact that in 1927 he was awarded his PhD title in the field of chemistry. By that time he was able to isolate one gram of clear crystallic substance from the adrenal cortex. His doctoral thesis described the results of these experiments.

In order to obtain their PhD titles, researchers were also required to publish articles, although not as many as today, and describe their results. The interesting anti-oxidant Szent-Györgyi discovered was simply called "Szent-Györgyi's substance" by his colleagues in Cambridge, but this name was not suitable for publication. Having analysed the substance they found that it was a sugar-like substance, an acidic carbohydrate whose formula was $C_6H_8O_6$.

They wondered what name to give to the substance. Szent-Györgyi recommended Ignose (unknown sugar), based on the Latin word 'ignosco', 'do not know' and the ending '–ose' which refers to the fact that it is a kind of sugar. The editor of the journal did not have a good sense of humour, neither was he so poetic as Szent-Györgyi, so he refused the name. Then Szent-Györgyi came up with 'Godnose' (God knows what kind of sugar). The editor did not like this name either, and because the substance contained six carbon atoms and it was acidic, he called it hexuronic acid. From then on Szent-Györgyi's substance, which later was found to be vitamin C itself, was called hexuronic acid.

Key components: the place, the colleague, the guinea pig

In 1928, when Szent-Györgyi had already gained international reputation, Minister of Education, Kuno Klebelsberg invited him to Szeged to fill the vacant post of Chairman of the Department of Medical Chemistry. Szent-Györgyi accepted the invitation, but since the construction of the university was still in progress, he asked for and received a two-year unpaid holiday to work at the Mayo Clinic in the USA. It took one year to isolate 25 grams of hexuronic acid from adrenal glands of cows from a slaughterhouse near Chicago. He sent 10 grams of hexuronic acid to Professor Haworth in Birmingham, who was an acknowledged researcher of carbohydrates, so that he could determine the structure of the new substance. He brought the rest of the substance to Szeged.

He started to work in Szeged as a professor in 1930. He had a flat and a lab on Kálvária Square. Although he was not even 40 years old when he came to Szeged, he was internationally acknowledged due to his research into biological oxidation. The common belief that Szent-Györgyi is the only Hungarian scientist to be awarded the Nobel prize for research conducted in Hungary is not entirely true. Even so I would not like to dismiss his merits, I am too much of a Szent-Györgyi fan.

Illustration 3. The building with Szent-Györgyi's first laboratory in Szeged

Where is *the building* in which vitamin C research was conducted? It is situated on Kálvária Square and today it houses Miksa Déri Technical Secondary School. The building, which was originally designed to be a school building, was completed in 1914. When World War I broke out the building which had wide corridors and large windows was found to be ideal for military hospital. After the war it gave shelter to refugees from Transylvania. In 1921 when the University of Kolozsvár moved to Szeged, university hospitals, including the department of surgery, were also moved to the building. The building was also home to various academic departments, such as the Department of Medical Chemistry where Szent-Györgyi worked. In the side wing there were flats for the academic staff, including the Szent-Györgyi family: his wife, his daughter and his mother, Jozefina Lenhossék. *(Illustration 4. Female family members*)

Illustration 4. Female family members

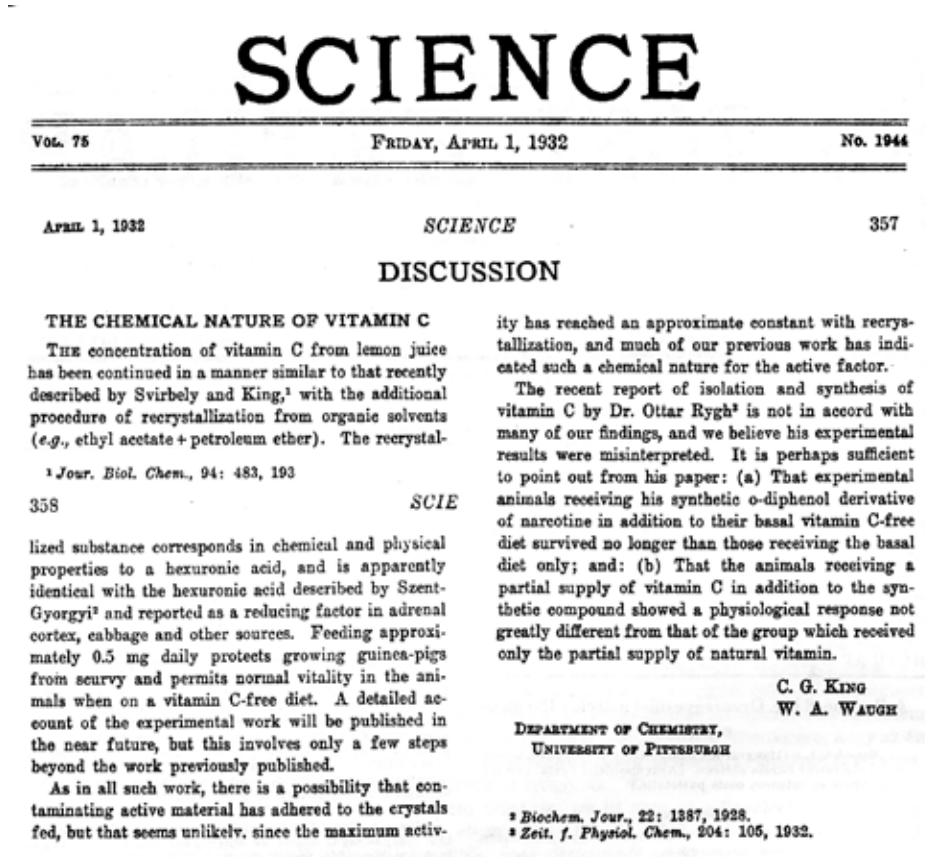
The second key component of vitamin C research was the colleague. In the autumn of 1931 Joseph Svirbely, a young American scientist of Hungarian origin, came to Szeged with the intention to work with Szent-Györgyi. His parents were Hungarian, and after obtaining his doctoral title he felt obliged to visit his parents' home country. He visited the most well-known biochemist, Szent-Györgyi. Szent-Györgyi asked him what he was involved in and what

he was good at. He explained that he had been involved in vitamin C research with Professor King and with the help of guinea pig tests he was able to tell if a substance was effective against scurvy, that is it has the properties of vitamin C. (Similarly to man, guinea pigs are not able to synthetise vitamin C, they should take it with food. That is why they are suitable for research.) Szent-Györgyi gave him a few grams of the substance he brought from America. He explained him that in his opinion it was vitamin C. He told the young man to conduct the guinea pig experiment using the substance. So the third key component of vitamin C research was the guinea pig.

Priority debate

It had been known for a long time that there was a substance that could prevent scurvy and researchers called it vitamin C. However, researchers had not been able to tell exactly what this substance was until the early 1930s. József Svirbely came to Szeged in the autumn of 1931 and in the winter of 1931-32 he conducted a successful experiment. He was euphoric to tell Szent-Györgyi "Sir, your substance, hexuronic acid is vitamin C indeed". They were enthusiastic, however, they were aware of the fact that the experiment was not entirely accurate (they used few animals and fed them differently than described in literature) and one experiment was not enough, it should be repeated. The second experiment proved to be successful. József Svirbely then asked Szent-Györgyi if he could write to Professor King in Pittsburgh and tell him that they had identified vitamin C, it was hexuronic acid. Szent-Györgyi answered that "if you had been working with me and you had found something we had been searching for working with some one else and you had not report this fact to me, I would say you are a lousy, lousy fellow. Of course, you should write to Professor King."

Svirbely sent a letter to Pittsburg by sea. At the same time Professor King sent a letter to him saying that they had failed to identify vitamin C. The two letters crossed each other. When Professor King received Svirbely's letter, they quickly published an article on the discovery of vitamin C in Science, America's leading scientific journal, which started a priority debate between King and Szent-Györgyi. King and his colleagues published the article on April 1. In their article they described that they continued the experiment they had started with Svirbely and through crystalisation they managed to produce the same substance from lemon as Szent-Györgyi from adrenal cortex, namely hexuronic acid. *(Illustration 5. The article in Science magazine)*



SCIENCE

VOL. 75 — FRIDAY, APRIL 1, 1932 — No. 1944

APRIL 1, 1932 — SCIENCE — 357

DISCUSSION

THE CHEMICAL NATURE OF VITAMIN C

THE concentration of vitamin C from lemon juice has been continued in a manner similar to that recently described by Svirbely and King,[1] with the additional procedure of recrystallization from organic solvents (*e.g.*, ethyl acetate + petroleum ether). The recrystal-

[1] *Jour. Biol. Chem.*, 94: 483, 193

358 — SCIE

lized substance corresponds in chemical and physical properties to a hexuronic acid, and is apparently identical with the hexuronic acid described by Szent-Gyorgyi[2] and reported as a reducing factor in adrenal cortex, cabbage and other sources. Feeding approximately 0.5 mg daily protects growing guinea-pigs from scurvy and permits normal vitality in the animals when on a vitamin C-free diet. A detailed account of the experimental work will be published in the near future, but this involves only a few steps beyond the work previously published.

As in all such work, there is a possibility that contaminating active material has adhered to the crystals fed, but that seems unlikely, since the maximum activity has reached an approximate constant with recrystallization, and much of our previous work has indicated such a chemical nature for the active factor.

The recent report of isolation and synthesis of vitamin C by Dr. Ottar Rygh[3] is not in accord with many of our findings, and we believe his experimental results were misinterpreted. It is perhaps sufficient to point out from his paper: (a) That experimental animals receiving his synthetic o-diphenol derivative of narcotine in addition to their basal vitamin C-free diet survived no longer than those receiving the basal diet only; and: (b) That the animals receiving a partial supply of vitamin C in addition to the synthetic compound showed a physiological response not greatly different from that of the group which received only the partial supply of natural vitamin.

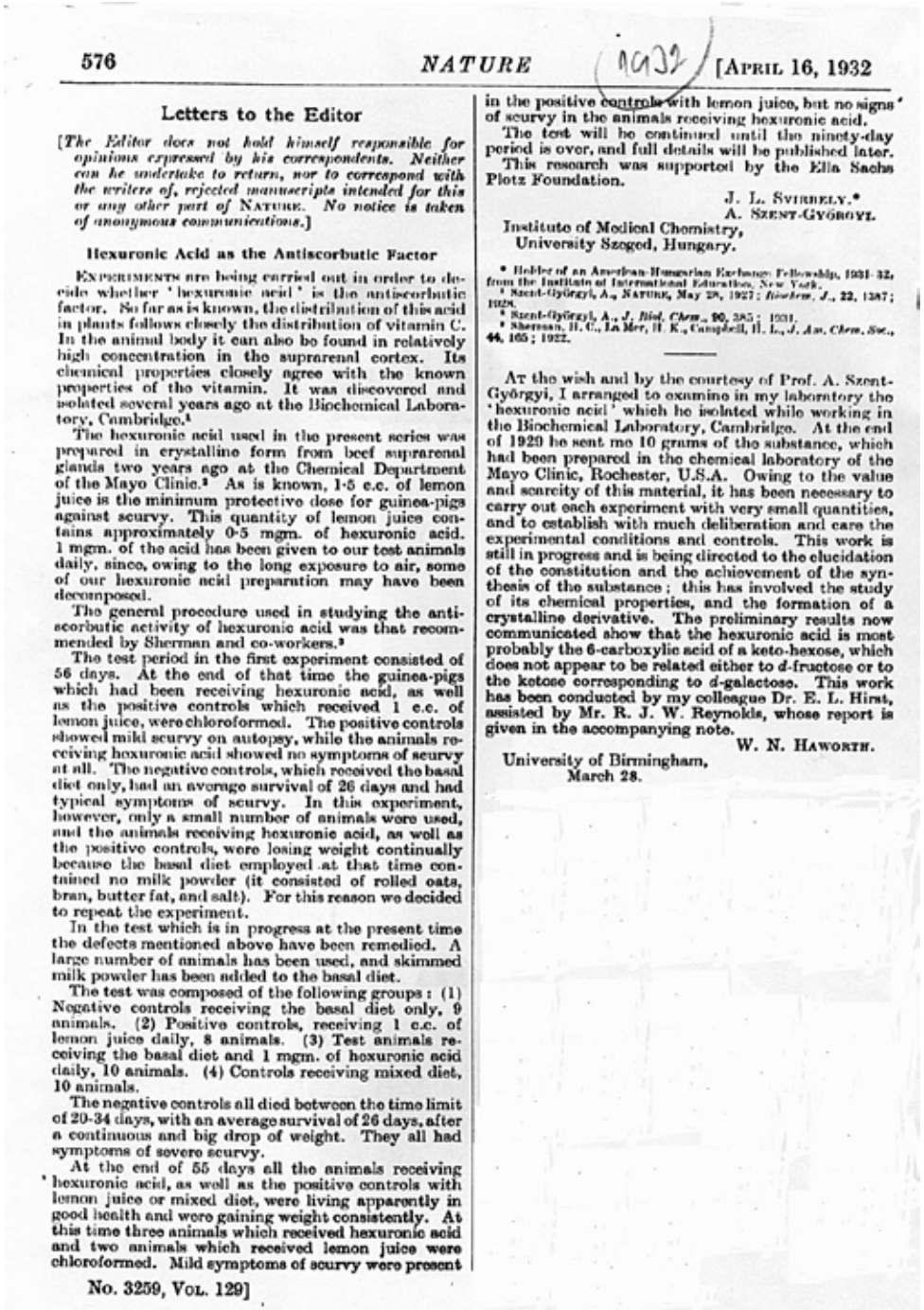
C. G. KING
W. A. WAUGH

DEPARTMENT OF CHEMISTRY,
UNIVERSITY OF PITTSBURGH

[2] *Biochem. Jour.*, 22: 1387, 1928.
[3] *Zeit. f. Physiol. Chem.*, 204: 105, 1932.

Illustration 5. King's article in Science magazine

After completing the animal tests Szent-Györgyi published their article in Nature magazine, Europe's leading scientific journal, on April 16 only. In the article they described the experiment in detail. Each group included 8-10 subjects. The diet of the control group included powdered milk, rye flakes, bran, cream and salt. Animals in the control group had a mean survival rate of 26 days, they were losing weight steadily and finally died of scurvy. Animals in the positive control group were also administered 1.5 ml of lemon juice, whereas the test animals received 1 mg of hexuronic acid. They were still alive after 56 days without developing any symptoms of scurvy. So they published their article and added that they will continue the experiment until day 90. There was another article in Nature by Haworth in Birmingham describing that they were still working on determining the structure of vitamin C using the substance they had been given by Szent-Györgyi. *(Illustration 6. The article in Nature magazine)*



576 NATURE [APRIL 16, 1932

Letters to the Editor

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, nor to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. No notice is taken of anonymous communications.]

Hexuronic Acid as the Antiscorbutic Factor

EXPERIMENTS are being carried out in order to decide whether 'hexuronic acid' is the antiscorbutic factor. So far as is known, the distribution of this acid in plants follows closely the distribution of vitamin C. In the animal body it can also be found in relatively high concentration in the suprarenal cortex. Its chemical properties closely agree with the known properties of the vitamin. It was discovered and isolated several years ago at the Biochemical Laboratory, Cambridge.[1]

The hexuronic acid used in the present series was prepared in crystalline form from beef suprarenal glands two years ago at the Chemical Department of the Mayo Clinic.[2] As is known, 1·5 c.c. of lemon juice is the minimum protective dose for guinea-pigs against scurvy. This quantity of lemon juice contains approximately 0·5 mgm. of hexuronic acid. 1 mgm. of the acid has been given to our test animals daily, since, owing to the long exposure to air, some of our hexuronic acid preparation may have been decomposed.

The general procedure used in studying the antiscorbutic activity of hexuronic acid was that recommended by Sherman and co-workers.[3]

The test period in the first experiment consisted of 56 days. At the end of that time the guinea-pigs which had been receiving hexuronic acid, as well as the positive controls which received 1 c.c. of lemon juice, were chloroformed. The positive controls showed mild scurvy on autopsy, while the animals receiving hexuronic acid showed no symptoms of scurvy at all. The negative controls, which received the basal diet only, had an average survival of 26 days and had typical symptoms of scurvy. In this experiment, however, only a small number of animals were used, and the animals receiving hexuronic acid, as well as the positive controls, were losing weight continually because the basal diet employed at that time contained no milk powder (it consisted of rolled oats, bran, butter fat, and salt). For this reason we decided to repeat the experiment.

In the test which is in progress at the present time the defects mentioned above have been remedied. A large number of animals has been used, and skimmed milk powder has been added to the basal diet.

The test was composed of the following groups: (1) Negative controls receiving the basal diet only, 9 animals. (2) Positive controls, receiving 1 c.c. of lemon juice daily, 8 animals. (3) Test animals receiving the basal diet and 1 mgm. of hexuronic acid daily, 10 animals. (4) Controls receiving mixed diet, 10 animals.

The negative controls all died between the time limit of 20-34 days, with an average survival of 26 days, after a continuous and big drop of weight. They all had symptoms of severe scurvy.

At the end of 55 days all the animals receiving hexuronic acid, as well as the positive controls with lemon juice or mixed diet, were living apparently in good health and were gaining weight consistently. At this time three animals which received hexuronic acid and two animals which received lemon juice were chloroformed. Mild symptoms of scurvy were present in the positive controls with lemon juice, but no signs of scurvy in the animals receiving hexuronic acid.

The test will be continued until the ninety-day period is over, and full details will be published later.

This research was supported by the Ella Sachs Plotz Foundation.

J. L. SVIRBELY.*
A. SZENT-GYÖRGYI.
Institute of Medical Chemistry,
University Szeged, Hungary.

* Holder of an American-Hungarian Exchange Fellowship, 1931-32, from the Institute of International Education, New York.

[1] Szent-Györgyi, A., NATURE, May 28, 1927; *Biochem. J.*, **22**, 1387; 1928.

[2] Szent-Györgyi, A., *J. Biol. Chem.*, **90**, 385; 1931.

[3] Sherman, H. C., La Mer, H. K., Campbell, H. L., *J. Am. Chem. Soc.*, **44**, 165; 1922.

AT the wish and by the courtesy of Prof. A. Szent-Györgyi, I arranged to examine in my laboratory the 'hexuronic acid' which he isolated while working in the Biochemical Laboratory, Cambridge. At the end of 1929 he sent me 10 grams of the substance, which had been prepared in the chemical laboratory of the Mayo Clinic, Rochester, U.S.A. Owing to the value and scarcity of this material, it has been necessary to carry out each experiment with very small quantities, and to establish with much deliberation and care the experimental conditions and controls. This work is still in progress and is being directed to the elucidation of the constitution and the achievement of the synthesis of the substance; this has involved the study of its chemical properties, and the formation of a crystalline derivative. The preliminary results now communicated show that the hexuronic acid is most probably the 6-carboxylic acid of a keto-hexose, which does not appear to be related either to *d*-fructose or to the ketose corresponding to *d*-galactose. This work has been conducted by my colleague Dr. E. L. Hirst, assisted by Mr. R. J. W. Reynolds, whose report is given in the accompanying note.

W. N. HAWORTH.
University of Birmingham,
March 28.

Illustration 6. The article in Nature magazine

What was the result of the priority debate? Historians of science have found out that Szent-Györgyi and his colleagues should be given priority. Szent-Györgyi announced their results at a conference in Budapest and the discovery was published in an article in Hungarian in the Hungarian Medical Weekly on March 26. This article was adopted and published in a German journal in March. So it was as early as March that Szent-Györgyi announced that hexuronic acid is identical to vitamin C. When the 90-day experiment was over, they published another article in Nature in May, announcing that the animals had not developed scurvy. The animals who survived were euthanized and dissected to see if they had signs of scurvy in their internal organs. All results were normal proving that hexuronic acid could prevent scurvy. In the same article Szent-Györgyi hinted at the fact that King failed to give detailed description of the experiment and analysis of hexuronic acid, and until they did this it was not proved that they had produced vitamin C. Later, in a figure included in an article published in Biochemical Journal in 1933, we can see that the animals in the control group who did not receive vitamin C lost weight and died within a short period of time, whereas the animals who were given lemon juice or ascorbic acid (as vitamin C was called by that time) lived happily until they died natural death. Then they performed other experiments with various derivatives and found out that acetone derivatives, for example, were less effective than clear substance. So Szent-Györgyi and his colleagues published detailed description of their experiments they conducted in spring 1932. *(Illustration 7. The article in Biochemical Journal)*

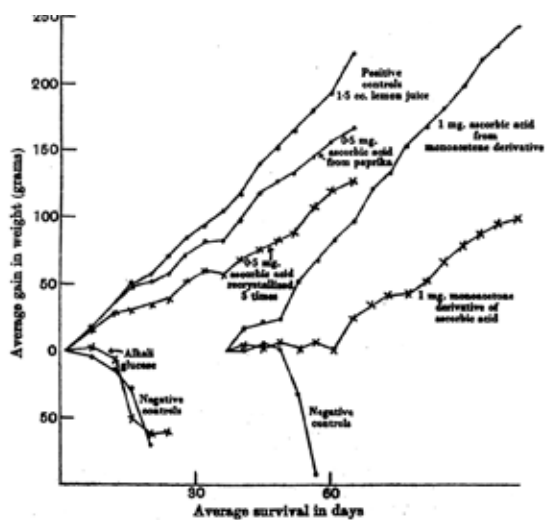


Illustration 7.
The article in Biochemical Journal: The effect of vitamin C on the weight of guinea pigs

The fortune of the cowardly husband: pepper

A real breakthrough was achieved on the first days of October 1932, when great amounts of pepper was available. They could extract one and a half kilograms within one week. Earlier they only had a maximum of 25 grams. Szent-Györgyi recalled the story and it has entered the history of science as *a husband's cowardice resulted in revolutionary discovery*. The story is as follows: Szent-Györgyi invited a new colleague to his home in the Déry Miksa building. His wife served cold dinner with pepper. Szent-Györgyi did not like pepper, but he did not have the courage to tell it to his wife. Instead he said that he had not examined pepper to see if it contained vitamin C and he should do it right away. With this he left behind the guest, which was rather impolite of him, and went to his laboratory to do the test. Soon he discovered that pepper was "the fountain of vitamin C", as he called it. From this huge amount he could send further samples to Birmingham, where they managed to determine the structure of vitamin C. He sent samples to other researchers all over the world who were involved in vitamin C research. He sent it to everyone so that they could carry on further tests. That is how he became the moral winner of the priority debate.

The amount they had was enough for detailed chemical analysis. Haworth and Szent-Györgyi decided to change the name hexuronic acid to ascorbic acid and they announced it in an article in Nature stating that ascorbic acid is an anti-scurvy factor. So they had discovered a substance against scurvy.

In 1937 two Nobel prizes were awarded for research into vitamin C. Szent-Györgyi was awarded the medical Nobel prize, while Norman Haworth and Paul Karrer received a joint Nobel prize in Chemistry for vitamin research. Haworth's prize was awarded for vitamin C research. *(Illustration 8. The structure and reaction of vitamin C)*

The formula is the former and contemporary illustration of the ring structure. We could learn from János Wölfling's presentation that a carbon atom with four different substituents forms a chiral carbon atom which has two optically active isomers. This is the case with ascorbic acid, and L-ascorbic acid is vitamin C itself. The chemical equation at the bottom represents the antioxidant reaction of vitamin C. Szent-Györgyi noticed that when certain fruits are cut into pieces, the cutting surface turns brownish, while with other fruits this process is less prominent. They contain a substance that prevents oxidisation. Vitamin C can prevent oxidation of its environment, because it can easily oxidise. The two hydroxyl groups on the covalent bonds turn into two ketone groups by releasing two hydrogens. The process is easily reversible. Due to heavy oxidation vitamin C yields to oxalic acid and threonic acid.

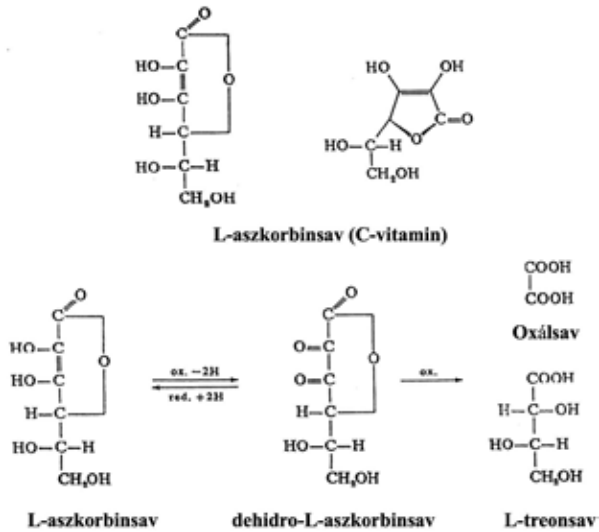


Illustration 8. The structure of vitamin C

Returning to the place, in this photo you can see the inner courtyard of Déri Miksa building. There was the entrance of Szent-Györgyi's flat and he took these stairs to get to his laboratory, where he examined the pepper for vitamin content. Today these stairs are called Szent-Györgyi stairs. *(Illustration 9. The Szent-Györgyi stairs)*

Illustration 9. The „Szent-Györgyi stairs" in Déri Miksa building

Several photos were taken at that time. This arch still exists today. The volleyball court where he and his colleagues played volleyball was situated in this courtyard. The woman next to Szent-Györgyi is clearly identified as his nearest colleague, Ilona Banga. *(Illustration 10. Albert Szent-Györgyi and his colleagues)*

Illustration 10. Albert Szent-Györgyi and his colleagues.

In the next photo you can see the famous pepper spin, which was used to extract the juice from the plant. The floor tiles are still there in the Déri Miksa building, so we can say without doubt that the equipment was used here. *(Illustration 11. Albert Szent-Györgyi and Brunó F. Straub with the pepper spin)*

Illustration 11. Albert Szent-Györgyi és Brunó Straub F. with the pepper spin

The question arises: what kind of pepper did Szent-Györgyi use to extract vitamin C? An article in the December 4, 1932 issue of Új Nemzedék (New Generation), a newspaper in Szeged, says that "Albert Szent-Györgyi has been looking for plants that contain plenty of vitamin C. Therefore in October this year he started determining the chemical composition of a special fleshy sweet pepper grown around Szeged." From this article it is clear that it was the so called 'tomato pepper'. I found another clue in Ralph Moss' book on Szent-Györgyi, which is the best biography of the researcher, that "Szent-Györgyi sent students to the market for 'tomato pepper' because tests revealed that it contained five-six times as much vitamin C as orange juice." These sources confirm that first they tried to acquire large amounts of this pepper. However, they could not have enough of it, so they tried other types of pepper, including hot spice peppers. It has also been described that Szent-Györgyi hired women to process spice pepper, and when the seeds of the hot spice pepper got into someone's eyes, he used his medical knowledge to give first aid. The first type he tested, the one he received for dinner, was probably 'tomato pepper', and later they used various types as well.

Publications show that the key figure was József Svirbely. He became a tragic character, the victim of the debate between King and Szent-Györgyi. (Here is a photo of him, which can be found in Somogyi Library, Szeged.) *(Illustration 12. József Svirbely)*

Illustration 12. Joseph Svirbely

In the USA he was accused of stealing the secret of vitamin C from his boss, Professor King, and bringing it to Hungary to Szent-Györgyi. In Szeged he was blamed for writing to King and revealing that hexuronic acid is identical to vitamin C. After returning to the USA later on, he had to explain himself. His friends told him to withdraw and keep away from the debate. He stopped

vitamin C research. There is no proof of his cooperation with Szent-Györgyi later on when Szent-Györgyi was living in the USA. In the 2012 August issue of Szeged Journal László Péter wrote an article with the title "The real Svirbely" in which he tried to redress the researcher, who had an important role in vitamin C research. Due to the unjust accusations we fail to acknowledge his merits.

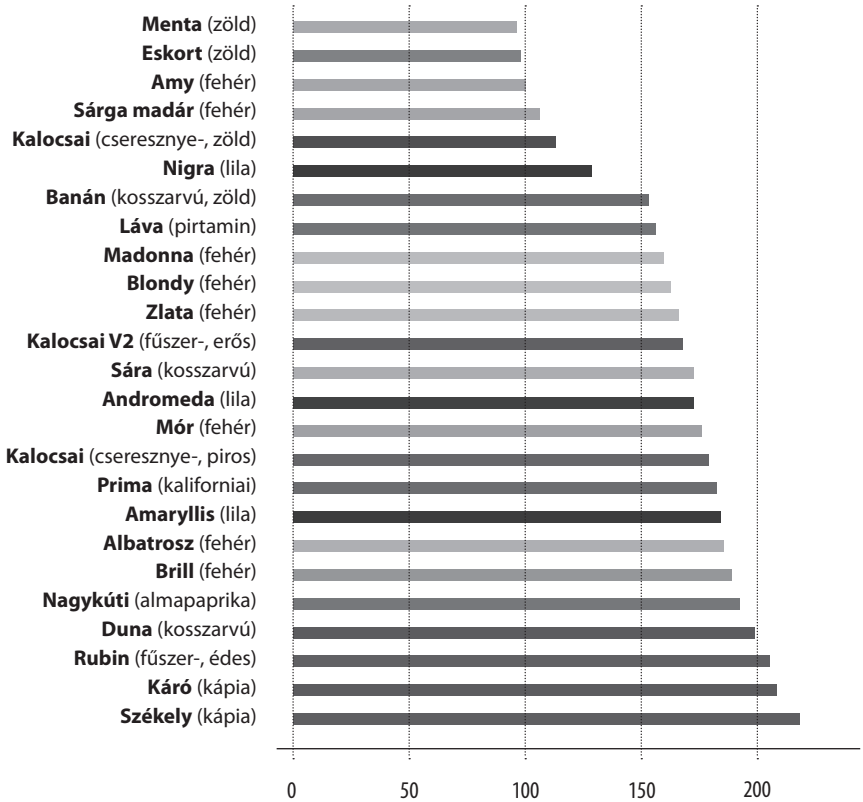
Here you can see the results of a comprehensive examination of the vitamin content of various fruits and vegetables initiated by HVG (a Hungarian weekly magazine on global economics). Now let us focus on vitamin C. Official data can be seen in the top row. We can see that pepper contains the highest amount of vitamin C. They usually bought pepper from various producers at the market. Pepper bought in discount stores contains the smallest amount of vitamin C, but even this small amount is as high as 100-200 mg. If 100 g of pepper contains 200 mg of vitamin C, the vitamin content of the pepper is 0.2 %. The study compared various types of peppers, the colours indicate the colour of the pepper. Green and white stuffing pepper from Cece (a Hungarian town) and red peppers, including the spice pepper from Kalocsa, all contain 150-200 mg of vitamin C per 100 g. Capia pepper is at the top of the list, and 'tomato pepper' is also near the top. So pepper is a "fountain of vitaminC', just as Szent-Györgyi noticed it 80 years ago.

(Illustration 13. The vitamin C content of various fruits, vegetables and peppers)

	PAPRIKA	PARADICSOM	SÁRGARÉPA	KÁPOSZTA	ALMA	SZILVA	SZŐLŐ
C-vitamin (mg/100 g)							
Hivatalos	**120**	**25**	**3**	**50**	**5**	**6**	**5**
Termelő 1	239	25	12	14	10	18	29
Termelő 2	259	32	11	18	10	35	27
Piac	157	36	17	11	20	27	22
Diszkont	102	33	Ő	20	11	40	23
B1-vitamin (mikrogramm/100g)							
Hivatalos	**50**	**100**	**50**	**40**	**50**	**50**	**50**
Termelő 1	101	59	79	75	23	34	55
Termelő 2	62	35	59	87	21	82	60
Piac	63	55	53	73	23	76	56
Diszkont	95	55	56	75	21	58	83
B2-vitamin (mikrogramm/100g)							
Hivatalos	**30**	**60**	**50**	**60**	**50**	**20**	**50**
Termelő 1	8	9	9	21	4	8	23
Termelő 2	24	5	11	6	3	17	21
Piac	9	6	14	21	8	12	19
Diszkont	25	5	10	13	7	8	22
B6-vitamin (mikrogramm/100g)							
Hivatalos	**240**	**70**	**200**	**310**	**70**	**40**	**70**
Termelő 1	776	66	166	160	44	35	103
Termelő 2	688	67	110	47	9	34	96
Piac	620	72	110	99	8	35	76
Diszkont	355	72	165	88	15	35	103

Illustration 13. The vitamin content of various fruits, vegetables and peppers

Vitamin C content of different Hungarian peppers (mg/100 g)



Forrás: *Semmelweis Egyetem egészségtudományi kar dietetikai és táplálkozástudományi tanszék 2004-es vizsgálata*

Szent-Györgyi tried to make some profit from his discovery. He obtained a patent for producing durable food products rich in vitamin C, such as Erős Pista or Édes Anna (concentrated spice pepper pastes). Szent-Györgyi had an anti-German, anti-war attitude, but ironically, most of his products were used to supply vitamin C to German submarine crews to prevent them from developing scurvy. Interestingly, his product marketed with the brand name 'vitaprik' was not really popular in England and the USA. Ralph Moss wrote in his book that Szent-Györgyi did not speak English well enough to know slang expressions. He was told that 'prick' is a vulgar word for penis. They quickly re-named the product pritamin, since then 'tomato pepper' has also been known as pritamin pepper.

Szent-Györgyi and his colleagues discovered another vitamin, vitamin P. Gábor Tóth told us in his presentation that the definition of vitamin is not

clear. There are 13 real vitamins, which have physiological effects, the body needs small amounts of them and they have an impact on certain enzyme mediated cycles. So vitamins are substances our body needs, or else we die. Vitamin P is controversial, because it does not meet this last criterion. They discovered vitamin P when they were trying to treat certain conditions with vitamin C. In some cases the permeability of capillary walls increased. When pure ascorbic acid was used, this effect was not observed, however, when they used pepper extract, they could achieve this effect. They realised that this is not due to vitamin C, but another substance in pepper, a flavonoid. Szent-Györgyi named this flavonoid vitamin P.

Szent-Györgyi should not have used 'P' to name this vitamin if he had followed the alphabetical order, but we can recall his creativity from the 'ignose-godnose' story. He followed a similar trait of thought: P should stand for permeability and pepper. Mihály Beck, author of the book Humour in Science, said that Szent-Györgyi "added another argument to support his choice, namely that the best thing in the world starts with the letter 'p' in Hungarian". Is it pipe? Flavonoids may fail to meet all criteria to be vitamins, but they have important physiological effects.

Effects of free radicals

Now let me finish my presentation by summarising the legacy of Szent-Györgyi and vitamin C. I have already referred to Ralph Moss's book which was published in the USA in 1988. This thorough book is worthy commemoration of Albert Szent-Györgyi. The author has Hungarian origins and is involved in cancer research, and these two facts motivated him to write the book. In the USA he talked to Szent-Györgyi many times, he made several interviews and visited Hungary to collect materials for his book. When he visited Szeged, he was guided by Szent-Györgyi's former student and the founding director of Biological Research Centre of the Hungarian Academy of Science, Brunó F. Straub. He took Moss to Miksa Déri school building where they visited the former location of the research laboratory. It was not until Moss's visit in the 1980s that the leaders of the school realised how famous events had happened in the building. The English title of Moss's book is 'Free Radical, Albert Szent-Györgyi and the Battle over Vitamin C'. Free radical is a chemical term which refres to an atom or a group of atoms that has only one, unpaired electron. It is therefore highly reactive, it needs another electron, because a chemical bond requires a pair of electrons. After the book was published, László Péter

wrote an article about it in Szeged's daily newspaper, Délmagyarország. In his article he suggested that the title 'Free Radical' also refers to Szent-Györgyi's independent, radical character, personality. His suggestion induced heated debate in the newspaper. I agree with László Péter, even so certain chapters in the book have ambiguous titles. 'Muscle Man' can refer to muscle research and Szent-Györgyi's versatility as a sportsman. In spite of the fact that this book is the most complete biography of Szent-Györgyi, it took a long time to translate it into Hungarian. When it was published in Hungary 15 years later, its title was 'Albert Szent-Györgyi' in order to avoid ambiguous interpretations. Those who have read it probably think that it was worth reading, but I would recommend it to everyone, I am sure they will find Szent-Györgyi's adventurous life and his remarkable scientific work intriguing.

People often ask about the daily dose of vitamin C, how much you should take. The recommended daily dose is 60 mg, although some people say it is 75 mg. Anyhow, it is less than 100 mg. Szent-Györgyi thought that (my apologies to doctors) veterinary surgeons are more humane to monkeys than human doctors to people, because the determined daily dose in monkeys is higher than that in humans. He said that 60-70 mg is enough to prevent scurvy. However, if we take more vitamin C, we can strengthen our immune system, the resistance of our body. After isolating the vitamin in pepper, he took 1000 mg daily. The forerunner of today's megavitamin therapy and multivitamin theory is Linus Pauling, who was awarded the Nobel Prize twice (Chemistry Nobel Prize in 1954, Peace Nobel Prize in 1962, both individually). In an attempt to promote his approach in the USA he visited Szent-Györgyi, who supported the idea of consuming higher amounts of vitamin C. Opponents of the idea say that excessive doses of vitamin C can cause kidney stones. The oxidisation equation of vitamin C shows that one of its break-down products is oxalic acid. There are three types of kidney stones: carbonate, phosphate and oxalate stones. If you are prone to oxalate stones, you should avoid high doses of vitamin C. Similarly, if you have a sensitive stomach, avoid consuming vitamin C, since it is ascorbic acid, it has acidic pH. Those who have a cast-iron stomach can take in 1000-2000 mg. Gábor Tóth told us that fat soluble vitamins can cause hypervitaminosis, which means that an excess of such vitamins can be harmful. Apart from indigestion and kidney stones, water soluble vitamins are not harmful. Since these vitamins dissolve in fluids, excess amounts leave the body unabsorbed with urine.

Returning to free radicals, when Szent-Györgyi was researching vitamin C, little was known about free radicals. Today we know that various external factors can produce free radicals which have highly reactive oxygen atoms with

unpaired electrons and form strong oxidising substances. In this illustration we can see that certain external factors, such as ozone, nitrogen oxide, radioactive radiation, UV light, heavy metal ions, diseases, medicines, smoking, or even strenuous training can increase the amount of free radicals in the body. Last time someone asked if you do a lot of sports, is it recommended to take high amounts of vitamin C. If the amount of free radicals is increased due to any reasons, an increased intake of vitamins (E, A or particularly C) can fight these free radicals. PUFA stands for polyunsaturated fatty acid. PUFAs, especially omega 3 fatty acids, are said to be beneficial for our body. This table shows that increased intake of PUFAs can increase the amount of free radicals, therefore more vitamin C is recommended. What impact does it all have on your body? Free radicals can lead to diseases and accelerate ageing. We cannot arrest the latter, we can only slow it down by consuming more vitamin C. *(Illustration 14. The causes of free radicals and their harmful effects)*

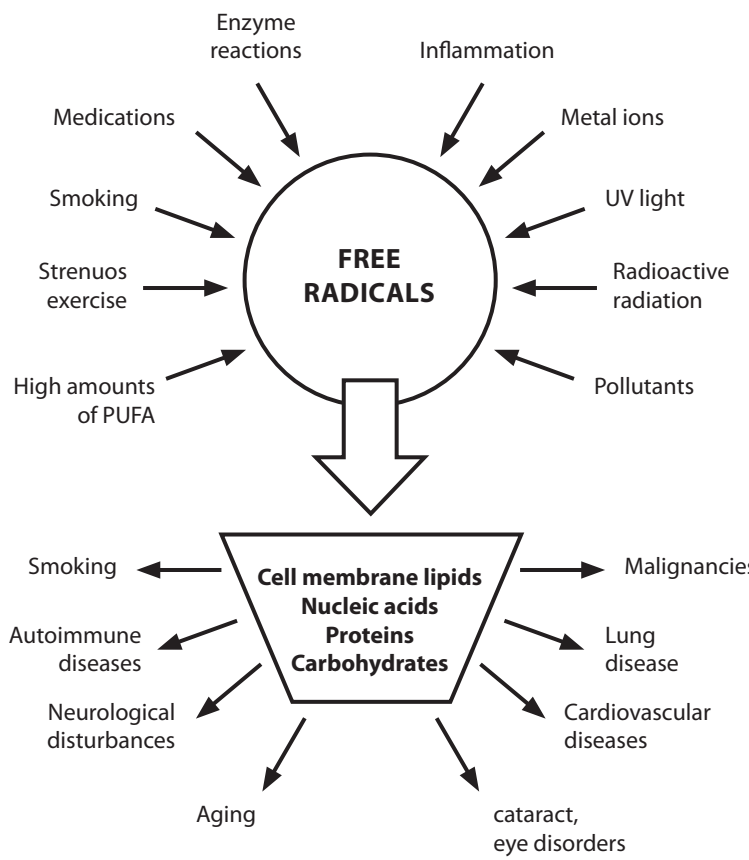


Illustration 14. The sources and harmful effects of free radicals

To sum up, I am not a doctor or an expert in vitamins, so I avoid making suggestions. All I can say is that my daily dose is 1000 mg. When Moss's book about Szent-Györgyi was published 25 years ago I was in the USA and I bought it right away. Since then I have been taking 1000 mg, my stomach is healthy, I do not have kidney stones and I am less prone to diseases. Some people say though, if you take such high amounts of vitamin C, you should be careful not to stop it, because your body is used to this higher intake. If you discontinue taking vitamin C regularly, you will be more prone to diseases.
In 2007 the University established a Memorial Room to Szent-Györgyi in the building of the Dean's Office of the Faculty of Medicine (109. Tisza Lajos street). There you can see, for example, a copy of the Nobel Prize or photos illustrating Szent-Györgyi's work. In 2012 another memorial room was established in the building of Miksa Déri Technical Secondary School on Kálvária Square, Szent-Györgyi's former work place in 1930-1935, the site of vitamin C discoveries.

In September 2013 on the 120 anniversary of Albert Szent-Györgyi's birthday the Csongrád County Division of the Society of Hungarian Chemists adopted guinea pigs as part of the adoption program of the Szeged Zoo.

References

- Ralph W. Moss, Free Radical, Albert Szent-Györgyi and the Battle over Vitamin C, Paragon House Publishers (1988)
- Ralph W. Moss, Albert Szent-Györgyi, Tipotex Publishing Company, 2003 (in Hungarian)
- C.G. King, W.A. Waugh, Science, 357, 75 (1932)
- J.L. Svirbely, A. Szent-Györgyi, Nature, 576, 129 (1932)
- J.L. Svirbely, A. Szent-Györgyi, Biochemical Journal, 279, 27 (1933)
- Mihály Beck, Humour inScience, Academy Publishing Company, 108 (2010 (in Hungarian))

Mária Homoki-Nagy

Protection of the creations of the mind in the history of Hungarian law. Copyright and patent rights; primacy and ethics in science.

One of the defining moments of Szent Györgyi Albert's work was when it was proved that the hexuronic acid he had examined is actually vitamin C. I want to introduce this discovery from the legal and legal history background in respect of the copyright law. The copyright and patents law is a modern legal institution which deals with the so-called intellectual property. Intellectual property rights are in the area of private law related in part to specific individuals, as entities, and in part related to ideas, writers work and invention within proprietary rights. It has long been the subject of debate in the legal literature where it is to be structurally regulated. Should it be linked to privacy rights and thus treated as a fundamental right enjoyed by natural persons or within the property law, related to ownership, and treated as legal power of subjects to deal with it as an embodiment of objects. In the debate it was finally decided that the human thoughts can not be independent objects from the man. As Bálint Kolosváry puts it, "the intellectual property is an elusive and integral part of the individual and it is so far under control that it depends on us if we want to express our thoughts or not?"[1] When the law

[1] Kolosváry even further stated: "It is therefore incorrect to say that the idea manifested in a specific form being a concrete work of a personality is an independent, separated thing. Just the contrary. Every picture, every statue, every book is an integral part of the spiritual world the author,s personality which is not to be identified with the expressions of publication, functions of letters, drawings or other materials e.g. with marble in the case of statues." Bálint Kolosváry: *A magyar magánjog tankönyve*. Budapest, *Politzer-féle Könyvkiadó vállalat*, 1907. pp. 233.; Károly Szladits wrote in 1933: "However, there are other kinds of things apart from intangible assets in respect of which the law provides the holder a right that is similar to property right i.e. an exclusive power (absolute right). In this sense we can talk about intellectual property. These exclusive rights are generally characterized by the fact that they grant defense to a certain product of thought. These rights stand in the middle between the direct ownership rights of belongings and the legal protection of the personality i.e. personality rights. Károly Szladits: *A magyar magánjog vázlata*. I. Budapest, *Grill Kiadó*, 1933. pp. 362

protects the individual's intellectual creation, it does nothing other than save and protect the intellectual product from the abuse of others.

How does the wording and legal regulation of intellectual property link to Albert Szent-Györgyi? To understand the question we should examine the discussion and relationship of three men: Albert Szent-Györgyi, C.G. King and Joe Svirbely. What was the background of the debate? In the early 20th century all three of those were involved to some extent in vitamins research. Originally, Szent-Györgyi did not want to deal with vitamins, however, once a student of Svirbely and King knocked on his laboratory in Szeged, who wished to expand his work as a Szent-Györgyi scholar. Szent-Györgyi put a bottle in the hands of the young researcher, in which the so-called hexuronic acid was, and asked him to prove that it is the substance of ascorbic acid, that vitamin C. In the spring of 1930 to 1931, in parallel with Szent-Györgyi's research, C.G. King was also dedicated to research, but done it in a different direction and slipped in time compared to Szent-Györgyi.

In 1931 Svirbely knocked on Szent-Györgyi's room to say that it has been demonstrated that the material, which Szent-Györgyi put in the hands of the scholar and called hexuronic acid is the ascorbic acid. Szent-Gyorgyi, the scientist, however, was cautious and instructed his disciple to carry out the experiments again, because you can only stand in front of the world with evidence. The experiments were repeated and the result confirms their expectations. In fact, hexuronic acid is vitamin C.

Joe Svirbely, the honest student says to Saint-Györgyi: "I am a student of Professor King, he is researching the vitamin C and we research that too. Here at Szeged we found out what vitamin C is. What do I do? "Szent-Györgyi said:" If you were my disciple and I would not say what results you have accomplished at another professor, you'd be a nasty guy."[2]

So, in March 1932, Svirbely wrote a letter to Professor King, explaining that hexuronic acid is the same as ascorbic acid that is vitamin C. From Professor King's letter of response it is clear that his research is not yet there to say that he had found vitamin C, but he is pleased that this has succeeded in Szeged.

A few days after the exchange of correspondence, King announced that he had found the vitamin C, and this is announced on April 5, 1932 in The New York Times. Then on 1 April 1932, the journal Science published the results of Professor King. When Szent-Györgyi found this out he says that this is plagiarism that is theft. "King and just published the letter which we wrote him,

[2] Ralph W. Moss: *Albert Szent-Györgyi*. Budapest, Typotex, 2004. pp. 98

with all the consequences of the discovery. […] I thought it will be noticed that the article has no scientifically valuable measurements."[3]

This sentence of Szent-Györgyi was the subject of debate, and this should be illuminated by legal historians.

In 1932, when this story took place, the concept of intellectual property has already evolved in the jurisprudence, and in relation to this, the regulation of copyright. In the jurisprudence, certain terms are used to describe certain phenomena. Thus, it protects property, which means that people have the legal power over a defined physical object.

Property right is an absolute structural right because it excludes anyone from the use of the given thing that is protected and forbids anyone from violating the thing, which is legally protected by the right. Thus, protects the law each person's idea from manifestation as well. The question, however, is basically what is protected by the law during the process of the research of natural sciences: the research process itself, or the outcome of the research.

May it be that when two people within the same time and parallel with each other conduct research, only just one, or just the other or both are entitled to protection?

In the everyday life, of course, it has happened quite frequently, and happens also today that scientists perform experiments in the same area.

The jurisprudence, therefore, developed the view that from results of the scientific life the one that is granted intellectual property is the one that was first made public. To establish who has the first place every day has importance, and in determining the protection of scientific results, it is taken into account whether a scientific magazine accepts for publication the article with the results of the research study.

In the Hungarian legal history in the National Judicial Conference by the Provisional Legislative Rules (PLR) Section 23 the following has been declared: "It is finally stated that the creation of the mind form such property which is protected under the law."[4]

As the rules of the Hungarian private law are primarily determined by the common law, it raises the question: how does the protection of intellectual property come into the scope of legislation?

The National Judicial Conference considered it a main task to end with the foreign, Austrian, rules of law, and with a compilation work, make an attempt to reconcile the feudal era legal system from before 1848 with the changes that were

[3] Same pp. 100

[4] Provisional Legislative Rules, Pest, Landerer és Heckenast, MDCCCLXI.

created as a result of the April 1848 laws, and the new accepted norms that entered into force during the neo-absolutism in Hungary. The result of this compilation work has been the Provisional Legislative Rules, which will be decisive for the development of the Hungarian legal institution as regards copyright laws.[5]

Before elaborating on this justification, it is necessary to examine what the reason was that the creation of the mind, that is literary and scientific work, needed the emergence of legal protection.

From the ancient times we know literary works, but even if we know the author, he did not make his fortune from that. In ancient times, the students copied these works, while with the spread of Christianity in the monasteries the codices were copied. In the middle ages, they did not even consider it to be important to give the name of an author at the end of a work.[6] First in the Renaissance age comes the importance of ensuring that future generations should learn about the authors, and later the absolute rulers raised the awareness of the dangers of published ideas because of fear of their power from the proliferation of unwanted thoughts.

As long as there was no printing, there was no fear from the rapid spread of ideas. The situation has changed with the invention of the printing press. Gutenberg's invention has made possible to reproduce works.[7] Another reason for the development of legal protection was the realization of the freedom of the press, that is, as the effect of the Enlightenment there was an increased

---

[5] György Ráth: *Az országbírói értekezlet a törvénykezés tárgyában*. Pest, 1861.; Provisional Legislative Rules as legal sources see: Bálint Kolosváry: *A magyar magánjog tankönyve*. 1907. pp. 41–43

[6] As an example let's mention the Corvinae: famous pieces from the library of Matthias Corvinus. Academic life calls Corvinae those sums of codices that were ordered by Matthias for his own library. In these there are works, copied by the monks, by known or anonymous authors from different eras.

[7] „As long as the printing technique was not known, which makes it possible in almost unlimited numbers to print the same literary or artistic creations in perfectly equal text and content format thus makes the writer's works or art across time and space infinitely available. Until this it was possible there was no copyright." Elemér Balás P.: *Szerzői jog.* In. Szladits Károly (ed.) *Magyar magánjog.* I. Budapest, Grill K., 1941. pp 676. compare Dezső Alföldy: *A szerzői jog újabb fejlődése. Magyar Jogászegyleti értekezések*. Új IV. évf. 1936. ; Elemér Balogh: *A Szemere-féle szerzői jogi törvényjavaslat*. In: *Szemere Bertalan és kora*. Borsod-Abaúj-Zempléni Történelmi Évkönyv, 7. Miskolc, 1991. pp 149.; Katalin Krisztina Part: *A szerzői jogi szabályozás kialakulása Angliában, Németországban és az Egyesült Államokban*. In: Iparjogvédelmi és Szerzői Jogi Szemle, 111. Nr 4. 2006. Aug. 141. (thereinafter: Part:); Mezei Péter: *A szerzői jog története a törvényi szabályozásig* (1884. XVI.tc.) In: *Jogelméleti Szemle* 2012. 5. pp 1–2.(thereinafter: Mezei: 2012.)

demand for "everyone to communicate its views and thoughts freely." [Article XVIII. 1848.] The two seemingly unrelated reasons are the foundation for the creation of protection of intellectual property.

The invention of printing made it possible for a literary work to be replicated, and the owner of the printing press gained income from their sale. This invention, however, started another process as well. The rulers feared their power from the opportunity that any thoughts, which may also be targeted against them, may be published freely. Therefore, on the one hand, the establishment of a printing press was a royal privilege. This privilege was general, and ensured that the owner of the printing press, excluding everyone else, had the right to reproduce the works of authors.[8] However, the privilege could be granted to issue a particular work such as the case of Henry, Bishop of Bamberg, who was granted the right in 1490

to print the liturgical book of Hamburg, or the right of the University of Trnava in 1584 to issue the *Corpus Iuris Hungarici*.[9] On the other hand, censorship was introduced, the rights of pre-audit. These ensured for them that the published and reproduced "thoughts" are under control.[10]

As any restrictions, censorship and printing privileges were getting stronger revolt. The end of the foundation of the royal privilege printing press formed a new threat to the authors. If anyone, depending on the financial conditions, may found a printing press, how could you determine the number of copies of an author to print, how many times to repeat this process and how to price the printed work? How could one establish the value of a literary or scientific work?

Censorship still hampered the sharp increase in the revenue of printing owners, but in the period following the abolition of the censorship there has been a growing conflict between the press owner and the authors. The printer's owner bought the manuscript for publication from the author, but after this, the authors had no control over what the owner of the printing press does

---

[8] The privilege of Johann Speier in 1496 in the city of Venice or the privileges of the British rulers. Hesse, Carla: A szellemi tulajdon. Könyvtári Figyelő. 2008. Nr. 1. 2010. October 8. http://ki.oszk.hu/kf/2010/10/a-szellemi-tulajdon downloaded: 2014. January 1.; Mezei: 2012.; Katalin Krisztina Part: pp. 142.

[9] Mezei: 2012. pp. 3

[10] "The rulers formed an alliance with the religious authorities to control the thoughts, the production and circulation of intellectual and technical information within their empire. In the early modern era the whole world established means of sophisticated complex systems of before publication censorship, state monopolies leased to monitor publishing and printing professionals and royal privileges or patent letters of exclusive monopolies to print and issue authorized texts." Hesse Carla.

with the manuscript. While the printing press owners have gained a good income, the authors have received nothing from the profits.

There was no guarantee whether the once, with the author's permission, printed manuscript was published by another press without a license and even change the original text. The age of literary piracy has started.[11]

However, the development of the legal institution of copyright only became possible when the private law dogmatism established the principle that literary and scientific works, as intellectual products, should be given legal protection. However, this protection is not realized on the book, painting, graphics, sculpture, as physical, i.e. tangible object, to be legally protected, but the legal protection is to be granted to the intellectual property, i.e. the intangible things of the authors. (If we think that by book-burning what intellectual property have been destroyed, then we can understand that it is not about the legal protection of books as physical and material objects, but rather about the individual, spiritual artworks, which is embodied in the printed book published.) The process, established in the private legal dogmatism, began to emerge only in the turn of the 18-19 century. First, the protection of personality had to evolve; secondly, a legal structure had to be constructed that has a feasible personnel and material side. As set out by Elemér P. Balázs: "The roots of the copyright law go down to privacy law; its technically developed rules show common features with material law – expressed as a paradox: the copyright is nothing more than the personality side of property.[12]

This duality is translated into everyday practice in a way that the law must protect the person himself as a person. (This includes the individual's life, his reputation, honour and name, the protection of his image: this is summarized in the literature as personality rights.) Copyright protection merged into the individual's personality protection the protection of his own, unique, unmistakable intellectual property. (This includes copyrights of works of literature, visual arts, music, etc, as well as the legal protection of patents, inventions and brands.)

---

[11] Éva Jakab: *Szerzők, kiadók, kalózok. A szellemi alkotások védelmének kialakulása Európában*. Budapest, Akadémiai Kiadó, 2012.*;* Bodó Balázs*: A szerzői jog kalózai*. Typotex Kiadó http://www.typotex.hu/konyv/bodo_balazs_a_szerzoi_jog_kalozai

[12] Elemér P. Balás: pp 675. "The intellectual property, on the one hand, is the symbolic expression of the human spirit, on the other hand, demands a substrate material that in itself is based on the personal and material synthesis approach i.e. itself a result of a dynamic approach to the use of material aspects. Of course, this is mostly in cases when the writer,s work or works of art are expressed through mechanical reproduction through the use of printing and other reproduction techniques"

The material side of copyright is the intangible intellectual property of people: books, manuscripts, paintings, music sheet, sculpture, etc, which are the material side of law.

The development of the Hungarian copyright law is inseparable from the European legal trends. Therefore, if only briefly, a reference must be made to those international solutions which led to the emergence of the idea of intellectual property.

In this process, the British played a leading role. Under the privileges it was a significant historic step when Mary I granted the right to Book Guild of Craftsmen (Stationers' Company) to exercise control over the book publishing and book sales. This guild, in 1557, gained the right to "seek out and confiscate all writings that are against the crown or the Church. To publish a book, the guild members asked for the sole right of publishing from the officials of the Guild chairman."[13] At the end of the 16th century, a phrase appeared: right to copy i.e. the rights of reproduction. This meant not only the right to print, but the exclusive reproduction right for the given book as well.

In 1709, the Statute of Anne was born, which is considered to be the world's first copyright law. This Act introduced two new concepts: on the one hand it stated that the author is the owner of his own work, on the other hand, it first determines that the legal protection of printed works is only valid for a period of specified time.[14]

The development of copyright law is also strongly influenced by philosophers. By the 18th century, it was the general perception that the ideas embodied in books are God's gifts. The man, the writer, the poet just passes it on to others.[15]

The Enlightenment philosophers formulated the opinion that to the artist embodies the ideas in his work, makes up the novel, the sculpture, the painting and, therefore, these are his property. In England John Locke explained that people are free to use their intellectual property, as these are their own property.[16] In Germany, Immanuel Kant said first, that the unauthorized reprint is *furtum usus*: stolen to be used.[17]

---

[13] Katalin Krisztina Part: pp. 142; Jakab: pp. 31–45; Mezei; C. Hesse

[14] Katalin Krisztina Part: pp. 143; Jakab: pp. 67–71

[15] C. Hesse

[16] John Locke: *Második értekezés a polgári kormányzatról*. Budapest, Polis, 1999. Chapter V: *A tulajdonról*. compare. Jakab: p. 89

[17] Elmar Wadle: *Beiträge zur Geschichte des Urheberrechts*. Berlin. Duncker-Humblot, 2012. pp. 17–18; Jakab: pp. 94–102

The intellectual property as property is linked in the mind of writers and philosophers in the 18th century. However, the legal protection was still missing.

The property right is an absolute right, which excludes everyone except the owner from the possession, use and disposal of the given thing. However, the jurisprudence could only interpret this property right in the terms of the physical object.

The creations of the mind are not simply the embodiments of artworks, but about the individual thing which could be formulated by a single author. Thus, for the definition of intellectual property the subjectivity of the artist and his unique character has become an essential element.[18]

Another trend has also emerged that has maintained the view that ideas come from nature, available for everyone, therefore, intellectual creations should be judged on the basis of their usefulness to the community.

At the same time when these discussions took place among philosophers, writers continued to have fundamental problems with the almost uncontrollable activities of book publishers. Writers have sought to enter into an agreement with the publisher, which is valid for only one release. In everyday practice, a publishing contract appeared between the writers and the publishers the so-called publishing deal.

In Germany, after the Statute of Anne, it was Article 996 in the *Allgemeines Landrecht* that first determined the publishing rights, according to which a bookseller may obtain the publishing rights only on the basis of a written agreement entered into with the author. This started the development of copyright law in a different direction: it did not primarily defend the author, but approached from the side of commercial law and defined those rights and obligations of the publisher which are related to the publishing, reproduction and distribution of written works.[19]

In Hungary, the development of copyright law formed in the same way as in Europe. Originally, only printers with royal privilege had the right to publish. The struggle for the protection of authors and their works started in the reform era. A prominent figure in this struggle was Ferenc Toldy. He first formulated the criterion for writer ownership: "Everything we write on our

[18] C.Hesse: "A thought to be looked at like a piece of real property, says Fichte, some distinctive features should be given, so as to allow a single person, and only him, to recognize ownership."

[19] Florian Vogel: *Urheber- und Erfinderrechte im Rechtsverkehr.* Ebelsbach, Aktiv Druck Verlag GMBH, 2004. pp. 53–55

own, with our inner talent or with outside tools, while not violating others' rights, becomes our real and inalienable property; our belonging".[20]

The need for legislation was forced by the practice of reprint. Allegedly it was Ádám Takács, a reformed pastor, who drew the local council's attention to the fact that "the work of Paczkó printers, which publishes his funeral sermon speeches, is disgraced by Landerer printers by reprinting the entire volume…"[21] As a result, the royal patent in the subject of reprint was enacted by the Austrians in 1793. The patent punished domestic reprints and defined a compensation for the author. The patent did not cover the protection of books that were published abroad and reprinted in Hungary, but, extended the protection to the successor of the writer. The patent issued in 1794 has established reciprocity between Austria and Hungary: it intended to punish the Hungarian reprint of books published in Austria and vice versa.

These patents gave the opportunity for a variety of copyright protections, but they could not result in a long-term solution for Hungary. First, the jurisprudential background was missing which could actually give the protection to intellectual property. Secondly, there still lived the institution of prior censorship, which basically prevented the free communication of ideas.

By the initiative of Ferenc Toldy[22], the *Kisfaludy Társaság* had attempted to settle the matter in a legal way. The draft prepared by the *Társaság*, was reassessed by Bertalan Szemere. He presented this on the district meeting at the National Assembly on September 23, 1844. The Board of Orders and Arms and later the Board of Peerage accepted the draft of Szemere. The proposal was presented to the monarch as a parliamentary ruling, but it has not been sanctioned – perhaps because legislation with similar content was not yet ready for the hereditary provinces.[23]

In the preamble of his proposal, Szemere has the following reasons for the laws to protect copyright: "Science and art, especially in our age, belonging

---

[20] Tamás Nótári: *A magyar szerzői jog fejlődése*. Lectum, 2010.

[21] Mór Kelemen: *Adatok az írói tulajdonjog hazai történelméhez*. Budapesti Szemle, 1869. XIV. p. 311

[22] "This property, which is violated by reprint, I consider one of the property rights based on natural law. Because if all this, what we get with our own talents without violating others' rights is our property not to be taken away. Ferenc Toldy: *Beszéd egy írójogi törvény ügyében*. in: *Toldy Ferenc irodalmi beszédei*. 1834–1872. Budapest, 1888. 2: pp. 304

[23] Legal history of copyright legislation in Germany see: Elmar Wadle: *Beiträge zur Geschichte des Urheberrechts*. Berlin, Duncker-Humblot: 2012.; Florian Vogel: *Urheber- und Erfinderrechte im Rechtsverkehr. E*belsbach, Aktiv Druck Verlag GMBH, 2004.

to the high conditions of life and well-being in the state, and we believe that neither one nor the other would be produced with enthusiasm and diligence if legal protection is not given to rights acquired with them … "[24]

The proposal by Szemere was the first to record: "Only the writer has exclusive rights, as they live, to publish, as original, his work in whole or in parts in print, lithography and engraving or by any means."

In this way Szemere would have granted exclusive rights to the author to dispose of his own works. This right included the arrangement between the living as well as the provisions in the event of death. With a between the living agreement, the author had the right to delegate the right of publishing his work to the publisher, and in case of his death, the author was entitled to make a will stating to whom he delegates the above-mentioned exclusive rights related to his intellectual creation.[25]

Considering the age, the provisions relating to the inheritance of copyrighted intellectual material is remarkable. If the author had never made a will about his work during his lifetime, then the rights of his copyright works goes to the author's legitimate heirs. For Szemere, the legal heirs also included, in contrast with the right of succession in this era as defined exclusively by customary law, the surviving spouse.

"If the author dies without a will, the full publishing rights of his work, under the laws of the personal assets earnings inheritance, go only to the descendant and ascendant blood lineal kinship and the spouse."

This meant that with assets, in the absence of a will, legitimate children, namely boys and girls can have an equal ratio for the legal succession. With the absence of lineal descendants, as acquired assets are concerned, the heir is the surviving spouse, in the absence of a spouse, the legitimate ascendants or sidelines step in as heirs.[26]

---

[24] Balogh: p. 167

[25] "This right of his, the writer, between the limits of the law, shall as gift, sale and by other means for shorter and sometimes longer periods may delegate to others." in: Balogh: pp 170.

[26] Nánásy Benjamin: *A magyar polgárnak törvény szerént való rendes örökösse*. Pest, 1799.; Czövek István: *Magyar hazai polgári magános törvényről írtt tanítások*. II. Pest, 1822.; Frank Ignác*: A közigazság törvénye Magyarhonban*. I. Buda, 1845. In connection with this issue, it should be noted that the literature highlights, by Szemere's proposal of this section, that Szemere grants the surviving spouse private property rights and unlike the feudal practice does not provide a right of interest. However, Szemere speaks explicitly in the proposal as the inheritance of movable property earnings which is in the common law system of the given feudal age, with lack of children, meant that

This provision of the proposal demonstrates that for Szemere the intellectual creation under legal protection is the property of the author. This reflected the English, French, German literature with the concept of the subjective standpoint. This is important to be emphasized because with this the Hungarian legal practice accepted the position that an author's literary or scientific work, "intellectual creation" is the author's own, unique thing and his exclusive property.

However, the structure of this intellectual property is different, in two respects, from the ownership of things in a physical sense. The content of intellectual property can not be expanded indefinitely, even though the author may change his own work without limitation as long as his copyright for reproduction is not be given to the publisher. Therefore, the practice has evolved in the case of intellectual property protection that laws created later in time gave an exhaustive list of what intellectual works are given legal protection.[27] In judicial practice, however, the copyright protection in Hungary was provided in a general sense i.e. it was extended to all intellectual property, even if they are not identified in the law.[28]

Another limitation of this property right is that it is limited in time. In both continental and Anglo-Saxon jurisprudence copyright protection is a legally precisely defined period: covers the author's life and the period after his death. In Szemere's proposal this protection period was 50 years. This was considerably different from the existing practice in Western Europe at this time.[29]

---

the surviving spouse had the right of inheritance. From this evolved in the civil era that the surviving spouse had the right not only to inherit movable property but also for unmovable property.

[27] Szemere's proposal: in Chapter I deals with the writer's works, chapter II. and IV. on plays, music works and the works of painting and drawing. in: Balogh.; 1884 Act XVI Chapter I deals with the writer's works, chapter II. and VI deals with music works, plays, public performance of music and musical theater works, the art works and maps, science, geometrical, architectural and other technical drawings and detailed diagrams and finally photographs. 1921 Act LIV deals with the writer's works music works, plays, public performance of music and musical theater works, the art works and maps, illustrations, maps, typographic illustrations, science, geometrical, architectural and other technical drawings with scientific relevance and detailed diagrams, sketches and plastic works, photographic works and cinematographic works. *Magyar Törvénytár*. Budapest

[28] Balás P. Elemér: p. 678

[29] Section 3. The writer's and his successor's exclusive rights, unless the law makes clear exception, always ends 50 years after the author's death. Compare Balogh, Mezei

After the suppression of the freedom uprising, together with the patent in November 1852 that enacted the Austrian Civil Code, came into force the 1846 Austrian patent, which regulated copyright for the hereditary provinces. This was in force in Hungary until 1861 until the PLR was formulated. The 1846 patent granted property rights to the authors and the term of protection was established in 30 years.[30]

This was the history of the provisions of the PLR which deals with the protection of the creations of the mind. Let's face it, the one-sentence provision of the PLR says almost nothing. Neither does it respond whether an individual intellectual work, created by the author, is his property, nor on how to regulate the question of reprint, nor the nature of inheritance. However, it should be emphasized that the wording: creations of the mind make a much broader interpretation possible for subjects that may fall under the legal protection of intellectual property then the proposal by Szemere. The exhaustive list of that one limited the law in what intellectual property is drawn into the scope of protection.

After the Austro-Hungarian Compromise, it was necessary that beyond the one-sentence PLR regulation, detailed standards are adopted by the Parliament to protect intellectual property.

This has become important, because Act XVIII 1848 stipulated the freedom of the press, which abolished censorship in Hungary. As stated in Section 1 of the Act, "everyone may communicate his thoughts freely through the press." The same law allowed the setting up of newspaper publishing and printing presses. Both activities are tied to placing a deposit. Instead of the censorship, it introduced the institute of afterwards liability, which meant that if someone has committed a libel, he was liable for the published misdeed within the framework of jury proceedings. Within the framework of progressive liability, first the author then the editor, then the publisher and finally the owner of the printing press was held accountable.

Article XXX, 1848 provided for the establishment of theaters and made sure that plays performed freely.

The freedom of the press, the possibility to establish a printing press and the freedom of theatre operation are closely related to the protection of intellectual property. The judicial practice, in the absence of appropriate legislation was unable to handle the increasingly frequent law violations. The solution was seen in the upcoming commercial law.

[30] Mezei.p. 8

However the law in the regard of copyright lagged behind expectations. Article XXXVII, 1875 regulated the publishing legal business as a special contract as part of the commercial transactions.[31] It held that "a business by which a person (the publisher) acquires exclusive rights from an author or his legal successor to reproduce, publish and sell finished or unfinished literary, technical or art work that business is a publishing business. If this provision is compared with the first section of the initial Szemere proposal, it is easy to see that while in the proposal of Szemere it is the writer's right to determined what he wants to do with his work in his life, in the Commercial Law, because of safety of commerce, the issue is regulating from the side of the publishers, and the publishers are granted exclusive right for the reproduction of intellectual property. Thus, the commercial law puts the protection of intellectual property on an entirely physical, material basis.[32]

The emerging literary and intellectual life representatives were not satisfied with the amenities covered by the law, and it is due to this, that the *Kisfaludy Társaság* and the Hungarian Academy of Sciences established a committee to develop a draft. The Committee requested Laszló Arany to work out the draft, who published his proposal in the *Budapest Szemle*. By the revision of this work was the XVI, 1884 copyright law completed.

The provisions of this law are very similar Szemere's proposal. It confirms the author's exclusive rights, ensures that the author has rights over the disposal of his intellectual property both in his life and in his death and regulates the inheritance of copyright.[33]

---

[31] *Magyar Törvénytár*, 1875: XXXVII. Articles: 515. - 533.

[32] In the last third of the 19th century in Hungary similar legal-dogmatic issues were debated similarly to Western Europe at the turn of the 18-19 century.

[33] 1884: Act XVI. Article 1 "The mechanical reproduction of the writer's art, publishing and putting into circulation, within the protection time set by the present law, is the exclusive right of an author. Section 3. The author,s right, in event of contract or action taken for death, either indefinitely or with limits is transferable. In the absence of such action, the author's right is transferred to the legal heirs. Section 11. "The protection that is provided by this Act against infringement of copyright is valid for the author,s whole life and after his death for 50 years. Compare Kolosváry: What is meant by literary works? The law does not specify which, with the considerable clarity and common sense of the concept, is a difficulty if the nature of the writer's work and the fine arts occurring together with a spiritual work is a question whether it is writer,s work or artwork. In general, writers work is to be understood as any intellectual creation which has been written in words or markings (writing notes, score notes), so may be made in writing and shall be made in writing as well." pp. 234

The violation of copyright should be mentioned. Szemere called this "false publishing", and gave an exhaustive list of activities which were in this scope. [Articles 12-13]

Szemere stipulated the punishment of the perpetrators doing false publishing as follows: "*All who violates these rights in this article by publishing, or such action which is regarded as false publishing under this Act, shall be fined by HUF 600 to be paid to the national museum, additionally forced to full compensation of the damage to the rights holder.*"[34]

In contrast, XVI, 1884 already stipulates the infringements of copyright: "The mechanical reproduction, publication and sales of a writer's work, if made without the consent of the rights holder, is an infringement of the copyright and prohibited." Subsequently, this Law also gives an exhaustive list of deeds, which may be within the scope of the infringement.

Perpetrators of the infringement were punished in accordance with the law:

"*Who wilfully or negligently commits infringement of copyright, shall be penalized for this crime up to HUF 1000 in addition to the damages payable to the author or his successors*".

As the two are compared, it may be concluded that in addition to the complete damages payable to the author, perpetrators of the copyright infringement are threatened to fines. The 1884 Act also ordered the confiscation of unlicensed reproduced copies.

The amendments of this law were forced out partly by the domestic judicial practice and partly by international jurisprudence. It has become necessary, at the turn of the 19th and 20th century, to settle the copyright law in international agreements between individual states. This gave rise to the so-called Berne Convention in 1886, which was codified in Hungary by Article XIII, 1922. This was complemented by the Rome Convention in 1908 (Article XXIV, 1931).

"*If the Convention provides for the benefit of the author a right that is not recognized by a country's domestic law, then, for foreign works, this country shall apply the provisions of the Convention even in cases when the foreign works enjoy a better protection than the domestic works*".[35]

That is why the National Assembly amended the 1886 Act and Act LIV 1921 was created. This again did not specify what is understood by a writer's work, however, the Act listed the exact cases of copyright infringements and regulated its legal consequences.

---

[34] Balogh: p 171.

[35] Alföldy: p 475

"Anyone who intentionally or negligently infringes the copyright commits a misdemeanour and shall be fined up to eighty thousand crowns; also the perpetrator shall give monetary compensation (damages) for the material and non-material damage for the victim. The compensation shall not be less than the wealth acquired by the perpetrator." Act LIV 1921 Section 18)

Copyright protection, its content and scope was developed by the Curia during its case-law practice. It said the following: "copyright protection is given only to those works which works bear the creator's separate, unique and individual marks. [Curia P.I. 277/1930, 1634/1934]

The law on copyright protection is bound to publicity. What do we understand by publicity? The concept of publicity in the copyright sense has been developed partly by legal literature and partly by judicial practice.

"Falls within the definition of public performance, in the copyright sense, a performance which goes beyond the scope of the family environment and marital domesticity, in which case the performance shall be regarded as public, even if in the attendance of the performance was not tied to buying a ticket and the a number of persons attended was limited."[36]

In respect of copyright the Rome Convention stated that "the taking of literary and scientific articles that appear in the press is unconditionally banned." It has made it clear that if someone has published his scientific research results then starting from the moment of publication he reported results are under legal protection. It was forbidden for anyone to take it or communicate it because that infringed the right of the author for his intellectual property and under the provisions of the law infringement had been committed.

Let,s return to the case of Albert Szent-Györgyi. It can be seen that in 1932, when he calls for plagiarism Act LIV 1921 was in force in Hungary covering copyright protection. In 1886, Hungary joined the international Berne Convention, and in 1931 the Rome Convention providing intellectual property protection in the international scene. This meant that in the international scene for professor C.G. King the same rules applied than for Szent-Györgyi in Hungary.

At the beginning of the lecture, I broke off the story by saying that after the letter from Joe Svirbely, King replied to his scholar on March 15, 1932 stating that he has not yet identified vitamin C. However, in April 1, 1932, King published an article in the scientific journal Science, also published it in April 5 in the New York Times, declaring that he had found vitamin C.

[36] compare. Kúria P.I. 980/1928. *Grill-féle új Döntvénytár.* 1928. Budapest, Grill ;

When Szent-Györgyi says to his scholar to inform his professor on the results of their research work, on March 18, 1932, before King makes his announcement in the New York Times, Szent-Györgyi says on the Hungarian Medical Association meeting that "for the first time we say it in public that vitamin C is the same as hexuronic acid." The publicity announcement does not specifically require a publication in a scientific journal or other periodical. According to the official of the Rockefeller Foundation: 24 March 1932: Szent-Györgyi announced that vitamin C has been found and later on 16 April 1932, Szent-Györgyi made his announcement to the journal Nature in which he describes his experiments and states that hexuronic acid is identical with vitamin C.[37]

It cannot be denied that the announcement in Science that vitamin C is the same as hexuronic acid had happened earlier in time. However, Szent-Györgyi was right that this article did not contain anything more than what Svirbely's letter described and the letter did not included the description of experiments and the concomitant results.

The primacy goes to Albert Szent-Györgyi. But this still did not convince the scientific public. If we read the study by C. G. King published in the journal Science, it may be concluded that it contains nothing more than what was formulated in Svirberly's letter i.e. a mere claim. The research process, which Szent-Györgyi made his scholar redo, was published only by Szent-Györgyi in Nature.

There's another issue what should be referred to briefly in the context of this story. Beyond copyright, intellectual works have another area too. In Szent-Györgyi's era this was referred to as patent law, now more widely known as industrial property protection. "Patent law i.e. copyright law on inventions, is an amendment on personality protection. […]

All commercially marketable new invention can be the subject to patent law."[38] The laws regulating this legal institution have also come a long way. In terms of our topic, Act XXXVII, 1895 is relevant. Here also prevail those international treaties that bind both professor King and professor Szent-Györgyi.

As the issue of primacy has not been decided for a long time, in 1933, King submitted a patent application, which was rejected by saying: "The appellants were not the first to discover or produce in a pure form hexuronic acid, which is identical to vitamin C. They did not discover that vitamin C is the specific medication of scurvy. The appellants argue however that the invention that hexuronic acid is the same as vitamin C should be considered a discovery. If

[37] R. W. Moss: pp. 100–102

[38] Kolosváry: p 240.

this material had not been known when the appellants isolated it, this claim could not be questioned. However, they produced a substance that had been known to the profession from Szent-Györgyi's publications."[39]

The aim of the presentation was to show how the science of law can help to protect the scientific results. In the 21st century, when researchers are forced to publish scientific results even faster, it is particularly important to know that the law, with its own tools, can help to protect a researcher's intellectual property, but for that moral attitude of the people in the scientific life is also necessary. It must not be forgotten that the most important thing is that people respect the moral norms because the violation of these cannot be prevented with legal tools only a later remedy may be possible.

[39] R. W. Moss: p. 105

Miklós Gábor

Albert Szent-Györgyi's Studies on Flavones. Impact of the Discovery

In 1936 Albert Szent-Györgyi and his colleagues published several papers on the influence of substances of the flavone group on the permeability of capillaries. The dates are also interesting. The first, 40-line article was published in English, signed by Rusznyák and Szent-Györgyi (27 May, 1936), the second one was published in German (14 August, 1936), and the third one in Hungarian (3 October, 1936). The latter 2 articles listed 5 authors: Armentano, Bentsáth, Béres, Rusznyák and Szent-Györgyi (Fig. 1–5).

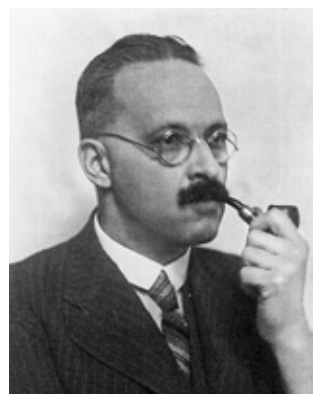


Fig. 1. István Rusznyák

Fig. 2. Albert Szent-Györgyi

Vitamin P: Flavonols as Vitamins

Various chemical and clinical observations have led to the assumption that ascorbic acid is accompanied in the cell by a substance of similar importance and related activity. In absence of both substances, the symptoms of lack of ascorbic acid (scurvy) prevail and conceal symptoms of the deficiency of the second substance. In the lack of suitable experimental animals or conditions, progress was dependent on spontaneous pathological conditions, caused or influenced by this second factor.

In collaboration with L. Armentano and A. Bentsáth, we have found that in certain pathological conditions, characterised by an increased permeability or fragility of the capillary wall, ascorbic acid is ineffective, while the condition can readily be cured by the administration of extracts of Hungarian red pepper ('vitapric') or lemon juice. The extracts were effective in cases of decreased resistance of the capillary wall toward whole blood (vascular type of hæmorrhagic purpura) as well as in cases in which the capillary wall showed an increased permeability towards plasma protein only (various septic conditions). The extracts were fractionated. The active substance was found in the end in a fraction consisting of practically pure flavon or flavonol glycoside. 40 mgm. of this fraction given daily intravenously to man restored in a fortnight regularly the normal capillary resistance. Spontaneous bleeding ceased, the capillary walls lost their fragility towards pressure differences and no more plasma protein left the vascular system on increased venous pressure.

These results suggest that this great group of vegetable dyes, the flavons or flavonols, also play an important role in animal life, and that the dyes are of vitamin nature. The group is not to be confused with the yellow dye, discovered by one of us and termed 'flaves' (like cytoflave), which dye forms the prosthetic group of Warburg's yellow enzyme and has later been renamed by R. Kuhn 'flavins'. We propose to give the name 'vitamin P' to the substance responsible for the action on vascular permeability.

This research is sponsored by the Josiah Macy Jr. Foundation, New York.

St. Rusznyák.
A. Szent-Györgyi.

1. Medical Clinic and
Biochemical Department,
University, Szeged.
May 27.

Fig. 3. Vitamin P: flavonols as vitamins (Rusznyák and Szent-Györgyi: Nature. 1938, 27 (1936).

DEUTSCHE
MEDIZINISCHE WOCHENSCHRIFT

ORGAN DER BERLINER MEDIZINISCHEN GESELLSCHAFT UND ANDERER VEREINIGUNGEN

BEIRAT

H. EYMER, MÜNCHEN · A. W. FISCHER, GIESSEN · K. SCHNEIDER, MÜNCHEN · R. SIEBECK, BERLIN

SCHRIFTLEITUNG

REINHARD VON DEN VELDEN · ARTUR PICKHAN · BERLIN W 62, KEITHSTRASSE 5

MONATLICHE BEILAGE: DEUTSCHES TUBERKULOSE-BLATT

HERAUSGEGEBEN VON PROF. DR. KURT KLARE, SCHEIDEGG

HALBMONATLICH: ARZT UND SPORT

MITTEILUNGEN DES DEUTSCHEN SPORTARZTE-BUNDES E. V. · REICHSFACHSCHAFT DER SPORT- UND LAGERÄRZTE

SCHRIFTLEITER: A. MALLWITZ, HAUS DER DEUTSCHEN ÄRZTE, BERLIN SW 19, LINDENSTRASSE 41

VERLAG GEORG THIEME · LEIPZIG C 1 · ROSSPLATZ 12

NUMMER 33 FREITAG, DEN 14. AUGUST 1936 62. JAHRGANG

Aus der Medizinischen Klinik (Direktor: Prof. St. Rusznyák) und aus dem Institut für Medizinische und Organische Chemie (Direktor: Prof. A. Szent-Györgyi) der Kgl. Ung. Franz-Joseph-Universität in Szeged

Über den Einfluß von Substanzen der Flavongruppe auf die Permeabilität der Kapillaren. Vitamin P[1]

Von L. ARMENTANO, A. BENTSÁTH, T. BÉRES, ST. RUSZNYÁK und A. SZENT-GYÖRGYI

Es war die Analyse pflanzlicher Oxydationssysteme, namentlich des Peroxydasesystems, die zur Entdeckung der Ascorbinsäure führte. Bereits in den frühesten Tagen der Isolierung dieser Säure suchte einer von uns nach der Substanz, die die Ascorbinsäure mit der Peroxydase zu einem gekuppelten Oxydationssystem verbindet.

Der Zitronensaft wurde durch Zugabe von 15% Bariumazetat dezitriert. Die abgetrennte Flüssigkeit wurde mit 2% Bleiazetat versetzt, der inaktive Niederschlag entfernt. Nun wurde mit Ammoniak alkalisiert, bis Bromthymolblau eine bläulich-lila Farbe gab. Das Präzipitat wurde in Wasser durch Salzsäure vom Blei befreit. Die wäßrige Lösung wurde eingeengt und durch Zugabe von Alkohol und Azeton von inaktivem

Fig. 4. Deutsche Medizinische Wochenschrift (1936) *(Armentano et al.)*

80. évfolyam. 40. szám. Budapest, 1936. október 3.

ORVOSI HETILAP

Alapította MARKUSOVSZKY LAJOS 1857-ben.

Folytatták:

ANTAL GÉZA, HÖGYES ENDRE, LENHOSSÉK MIHÁLY, SZÉKELY ÁGOSTON

Szerkesztőbizottság:

HERZOG FERENC, VÁMOSSY ZOLTÁN, ISSEKUTZ BÉLA, VIDAKOVITS KAMILLÓ, GORKA SANDOR, REUTER KAMILLÓ, HÜTTL TIVADAR, JENEY ENDRE

FELELŐS SZERKESZTŐ: VÁMOSSY ZOLTÁN EGYETEMI TANÁR SEGÉDSZERKESZTŐ: FRITZ ERNŐ

EREDETI KÖZLEMÉNYEK

A Ferenc József-Tudományegyetem Belgyógyászati Klinikájának, (Igazgató: Rusznyák István ny. r. tanár) és Orvosi Vegytani Intézetének (Igazgató: Szent-Györgyi Albert ny. r. tanár.) közleménye.

A flavoncsoportba tartozó anyagok befolyása a capillarisok permeabilitására. Vitamin P.*)

Irták: *Armentano Lajos dr., Bentsáth Aladár dr., Béres Tibor dr., Rusznyák István dr. és Szent-Györgyi Albert dr.*

mölcsben az ascorbinsavval együtt van jelen. Ennek az anyagnak további analyzise a következőképen történt:

A ciiromlét 15%-os bariumacetáttal decitráltuk. A különválasztott folyadékhoz 2%-os ólomacetátot adtunk, az inactiv üledéket eltávolítottuk. Ezután ammoniákkal alkalizáltuk, amíg bromthymolkékkel kékes-lila elszíneződést nem adott. A csapadékból az ólmot vízben sósavval távolítottuk el. A vizes oldatot bepároltuk, alkohol és aceton hozzáadásával a többi inactiv anyagoktól megtisztítottuk. Az alkohol és acetonban oldódó fractiót vízben oldottuk fel és alkalmaztuk a klinikai kísérletekre. (1. sz. készítmény).

Fig. 5. Orvosi Hetilap, 1936 *(Armentano et al.).*

Armentano (1936) achieved good therapeutic results in haemorrhagic diathesis with the vitamin C-rich paprika preparation vitapric. However, his group could not reach the same results when using pure vitamin C. Therefore, they suggested that the aforementioned beneficial effect should not be attributed to vitamin C but rather to another substance, which is present in the fruit together with ascorbic acid (Armentano *et al*, 1936).

Interestingly they used lemon instead of paprika to clarify the situation. It is worth mentioning that 200 kilos of lemon was processed and the resulting 70 litres of lemon juice was enough to produce only 2 g of a pure crystalline substance they called 'citrin' (citrus flavone).

Investigati on of the therapeutic effect

The therapeutic effect of citrin was examined in 17 patients, merely 3 of whom were suffering from vascular purpura and 4 from thrombocytopenic purpura. Since bleeding in such patients depends on unpredictable factors and acute thrombocytopenia can resolve spontaneously, chronic cases were examined to prevent flaws, and the course of the disease was followed with exact measurements (number of thrombocytes, capillary resistance). For the latter measurement, the method of Borbély was used, where negative pressure is exerted on the skin of the supraclavicular fossa until the first spot-like haemorrhage (petechia) develops. In addition, the Landis-Michel method was used to examine capillary permeability to plasma and proteins.

It is worth mentioning that the best results were achieved in vascular purpura and the therapeutic effect of citrin was best demonstrated in the above mentioned 3 patients (Armentano *et al*. 1936) (Fig. 6).

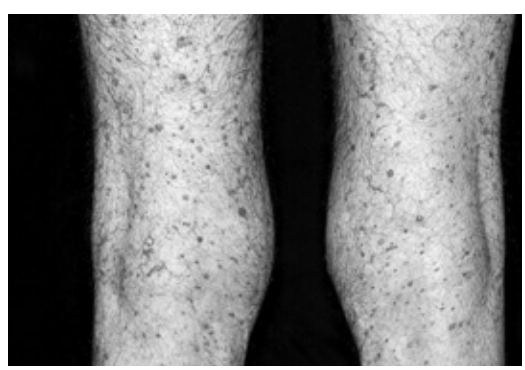


Fig. 6. Vascular purpura

It is also interesting that the findings of a study on only 3 patients drew attention to research on flavonoids worldwide. I should mention that citrin therapy was not found to be beneficial in thrombocytopenic purpura; however, its ineffectiveness was not explained.

The patients received daily intravenous flavone injections (equivalent to 20–40 mg of dry matter) and some days later, usually on the day 8–12, the effect on capillaries was checked. 75 years later, it is know that scorbutogenic guinea pigs were also given flavones, and they outlived the control subjects. It seems likely that these experiments preceded the studies on haemorrhagic patients, which would explain why flavone was administered intravenously to the human patients.

Attentive readers may note Szent-Györgyi's question as to whether the capillary effect described in connection with citrin is a characteristic feature of this substance only, or the other members of the flavone group have similar properties.

Informative experiments with quercitrin and rhamnetin yielded no results. However, Armentano *et al.* (1936) found it surprising that, while all the treated patients tolerated citrin injections well with no unpleasant side-effects, quercitrin and rhamnetin injections led to high fever and collapse in some cases; the treatment therefore had to be stopped early.

Szent-Györgyi and his colleagues concluded that, besides vitamin C, there has to be another capillary-active vitamin in plants (lemon and paprika). They succelded is isolating a substance (citrin) from lemon juice, which turned out to be a flavonoid glycoside. This substance was effective in the treatment of vascular purpura, while it had no beneficial effect in thrombocytopenic purpura. Citrin can also inhibit protein permeability in diseases where the capillaries are more permeable (serous inflammation). This substance was therefore called vitamin P (permeability).

In his foreword to my book on the anti-inflammatory properties of flavonoids, Szent-Györgyi states that he chose a letter on the far unoccupied side of the letters ABC' already being used to designate vitamins in case the bioflavonoids were found not to be true vitamins and correction could be made without confusion (1972).

At the end of 1936, Albert Szent-Györgyi published a paper entitled 'From Vitamin C to Vitamin P', In which he stated that 'If the vitamin character of this substance be firmly established, this will also mean that the great group of vegetable dyes, the flavones, which seem to play such an important role in plant biochemistry, also function in the animal organism.'

The chemical composition of citrin

Szent-Györgyi chose to determine the chemical properties of citrin as his next task. Fortunately, Győző Bruckner, one of the most excellent chemists and scientists of the 20th century, was working in his institute at that time (Fig. 7). According to a legend which survives to the present day, Szent-Györgyi also invited the world-famous professor of chemistry, Géza Zemplén from Budapest to help solve the problem. The discussions and the accompanying feast lasted all day. It was well known that Géza Zemplén needed alcoholic stimulation to set to work. In the evening, Győző Bruckner escorted Géza Zemplén to the railway station, then immediately returned to the laboratory and the same night discovered that citrin is composed of two flavone compounds: hesperidin and eriodictyol glycoside (Fig.s 8 and 9). In the morning Professor Zemplén was sent a telegram to inform him of the result. Bruckner and Szent-Györgyi published the findings of their investigation in Nature (Fig. 10).

The above-mentioned 'legend' is confirmed by a letter I received from Professor Bruckner (1977) (Fig. 11).

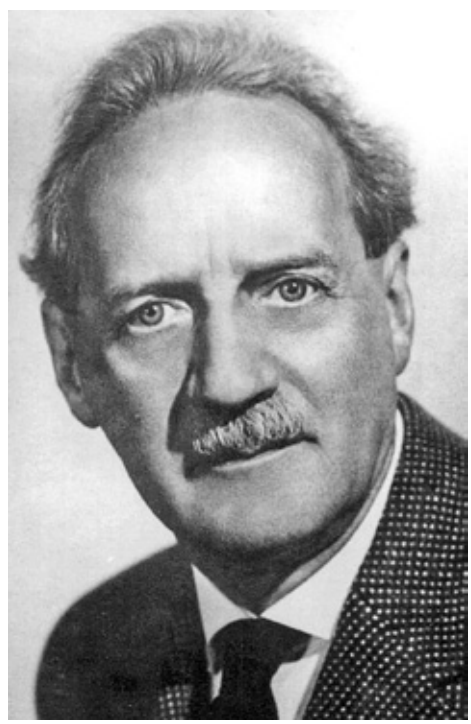


Fig. 7. Prof. Győző Bruckner

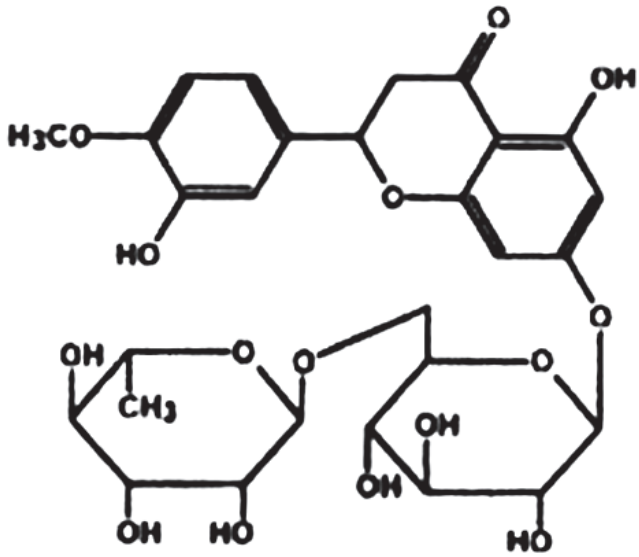


Fig. 8. Hesperidin

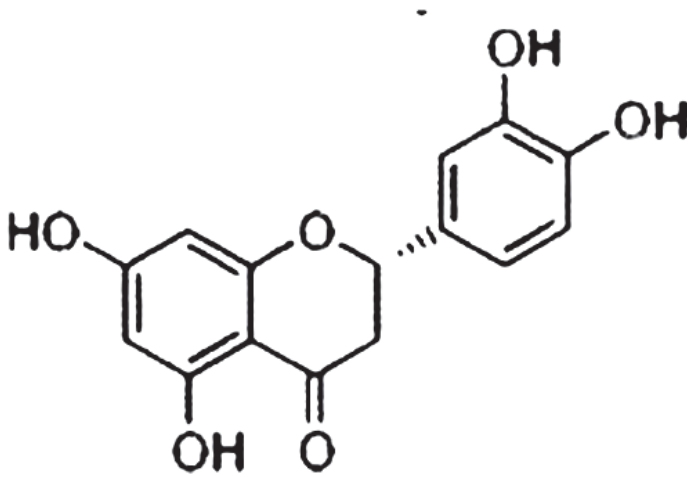


Fig. 9. Eriodictyol

Chemical Nature of Citrin

In a previous note (Rusznyák *et al.*) one of us reported on the isolation and physiological activity (vitamin nature) of the crystalline flavone fraction of lemon juice. The substance, being different from other known flavones, was termed 'citrin'.

Further work has shown citrin to consist of mixed crystals of two different dyes, one being hesperidine (m.p. 261°), the other an eriodictyol glucoside. Hesperidine forms the major part of citrin. The great reactivity and the colour reactions of citrin are due to the eriodictyol glucoside. Citrin contains no free eriodictyol. This substance can be isolated only after complete hydrolysis.

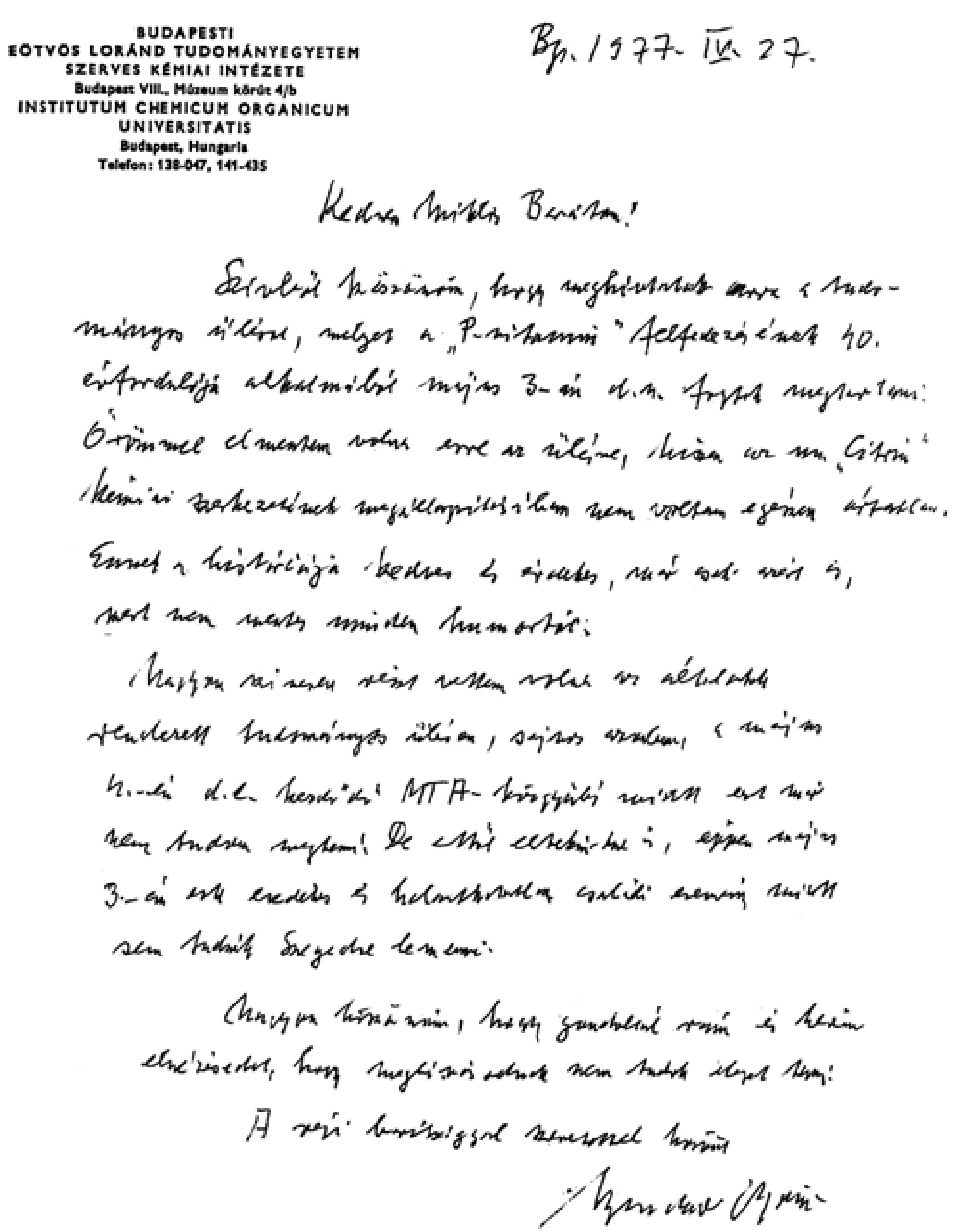
According to its formula, eriodictyol is but a demethylated hesperetine. This makes it probable that both glucosides constituting citrin are but two forms of the same flavanone glucoside. Eriodictyol glucoside was not found in any considerable quantity in unripe oranges, which, however, contain great quantities of hesperidine. This makes it probable that the eriodictyol glucoside is formed from hesperidine by demethylation on ripening of the fruit.

This research is being sponsored by the Josiah Macy Jr. Foundation, New York.

V. Bruckner.
A. Szent-Györgyi.

Inst. Org. and Med. Chem.,
Szeged.
Nov. 21.

Fig. 10. Chemical nature of citrin
(Bruckner and Szent-Györgyi: Nature, 1936).



BUDAPESTI
EÖTVÖS LORÁND TUDOMÁNYEGYETEM
SZERVES KÉMIAI INTÉZETE
Budapest VIII., Múzeum körút 4/b
INSTITUTUM CHEMICUM ORGANICUM
UNIVERSITATIS
Budapest, Hungaria
Telefon: 138-047, 141-435

Bp. 1977. IV. 27.

Kedves Miklós Barátom!

Szívből köszönöm, hogy meghívtatok arra a tudományos ülésre, melyet a „P-vitamin" felfedezésének 40. évfordulója alkalmából május 3-án d.u. fogtok megtartani. Örömmel elmentem volna erre az ülésre, hisz én az ún. „Citrin" kémiai szerkezetének megállapításában nem voltam egészen ártatlan. Ennek a históriája kedves és érdekes, már csak azért is, mert nem mentes minden humortól.

Nagyon szívesen részt vettem volna az általatok rendezett tudományos ülésen, sajnos azonban a május 4-én d.e. kezdődő MTA-közgyűlés miatt ezt már nem tudom megtenni. De ettől eltekintve is, éppen május 3-án este eredetileg is halaszthatatlan családi esemény miatt nem tudnék Szegedre lemenni.

Nagyon köszönöm, hogy gondoltál rám és kérlek elnézésedet, hogy meghívásodnak nem tudok eleget tenni.

A régi barátsággal szeretettel köszönt

Bruckner Győző

Fig. 11. Letter of Győző Bruckner (1977).

The effect of citrin on experimentally induced scurvy

The vitamin-like properties of flavones were widely researched by Szent-Györgyi and his colleagues (Bentsáth *et al*., 1936), work which was later criticized by many scientists. Guinea pigs were kept on the Sherman, LaMer, Campbell vitamin C-free diet (1922). One group, the untreated controls, died in an average of 28.5 days. The group given one milligram of citrin daily for 6 weeks lived an average of 44 days. All of the animals in both groups showed the typical symptoms of scurvy. Szent-Györgyi and his colleagues concluded 'that these results suggest that experimental scurvy, as commonly known, is a deficiency disease caused by the combined lack of vitamins C and P.'

In another experiment, Bentsáth, Rusznyák and Szent-Györgyi (1937) examined the vitamin P-like effects of hesperidin, demethylated hesperidin and quercitrin in guinea pigs. Animals that also received ascorbic acid showed normal growth patterns. Animals treated with hesperidin and demethylated hesperidin exhibited a similar response to those treated with citrin (Bentsáth *et al*., 1937). Animals that were fed a basic diet or basic diet+quercitrin died of severe scurvy around day 28.

Bentsáth and Das (1937) did not obtain the same results when they repeated their experiments. They concluded that the winter food of the animals was significantly different from their summer food and that studied animals had to be in a good physical condition for the vitamin P test and they could not lack any vital factors. In their opinion, if any vital factor was missing, citrin could not prolong the lifespan of the studied animals.

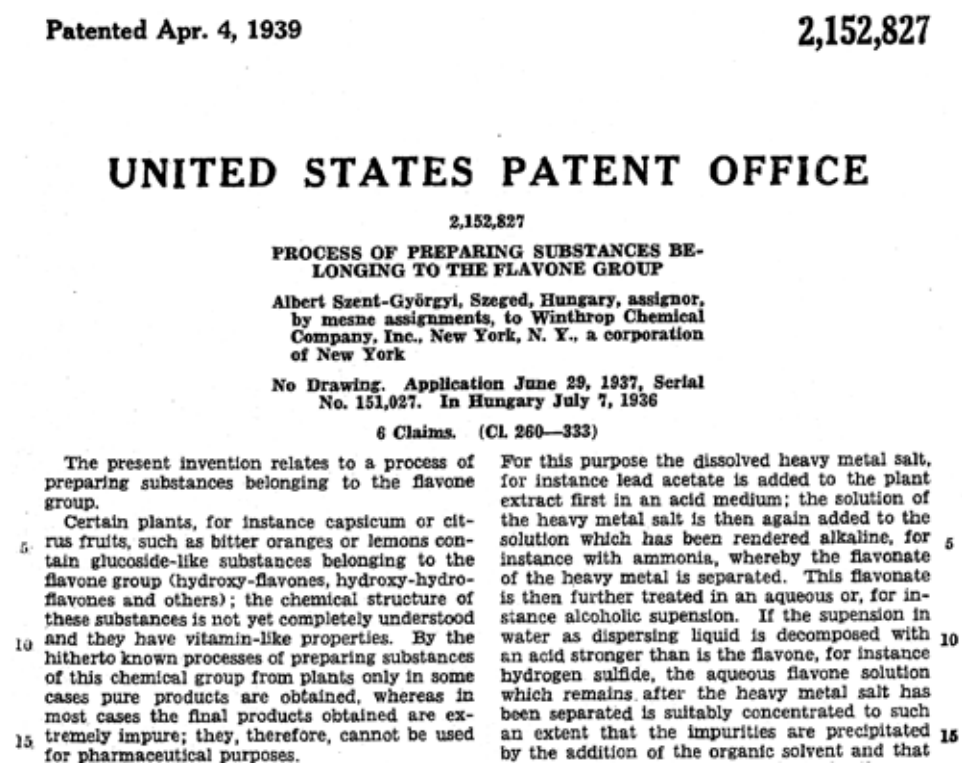
Szent-Györgyi asked other scientists to repeat his studies. The results were partly corroborative and partly negative. In 1937, Szent-Györgyi and Bentsáth stated, 'Vitamin P requires for its activity the presence of ascorbic acid. In the total absence of ascorbic acid, Vitamin P is inactive'.

Flavonoid research in the forefront of Albert Szent-Györgyi's interest

Albert Szent-Györgyi was passionate about flavonoid research, as illustrated by the following features:

1. He wrote an article entitled 'From Vitamin C to Vitamin P'.
2. He devised a method to extract greater amounts of citrin from lemon and published this method in Hoppe-Seylers Z. physiol. Chemie (1938).

3. When receiving the Nobel Prize, he gave an account of his research into flavonoids.
4. He developed a process to produce flavonoids and had this method patented in the United States in 1939 (Fig. 12).
5. At the conference on 'Bioflavonoids and the Capillary,' organized by the New York Academy of Sciences in 1955, he gave an interesting presentation on the perspectives of bioflavonoids.



Patented Apr. 4, 1939 **2,152,827**

UNITED STATES PATENT OFFICE

2,152,827

PROCESS OF PREPARING SUBSTANCES BELONGING TO THE FLAVONE GROUP

Albert Szent-Györgyi, Szeged, Hungary, assignor, by mesne assignments, to Winthrop Chemical Company, Inc., New York, N. Y., a corporation of New York

No Drawing. Application June 29, 1937, Serial No. 151,027. In Hungary July 7, 1936

6 Claims. (Cl. 260—333)

The present invention relates to a process of preparing substances belonging to the flavone group.

Certain plants, for instance capsicum or citrus fruits, such as bitter oranges or lemons contain glucoside-like substances belonging to the flavone group (hydroxy-flavones, hydroxy-hydroflavones and others); the chemical structure of these substances is not yet completely understood and they have vitamin-like properties. By the hitherto known processes of preparing substances of this chemical group from plants only in some cases pure products are obtained, whereas in most cases the final products obtained are extremely impure; they, therefore, cannot be used for pharmaceutical purposes.

For this purpose the dissolved heavy metal salt, for instance lead acetate is added to the plant extract first in an acid medium; the solution of the heavy metal salt is then again added to the solution which has been rendered alkaline, for instance with ammonia, whereby the flavonate of the heavy metal is separated. This flavonate is then further treated in an aqueous or, for instance alcoholic supension. If the supension in water as dispersing liquid is decomposed with an acid stronger than is the flavone, for instance hydrogen sulfide, the aqueous flavone solution which remains after the heavy metal salt has been separated is suitably concentrated to such an extent that the impurities are precipitated by the addition of the organic solvent and that

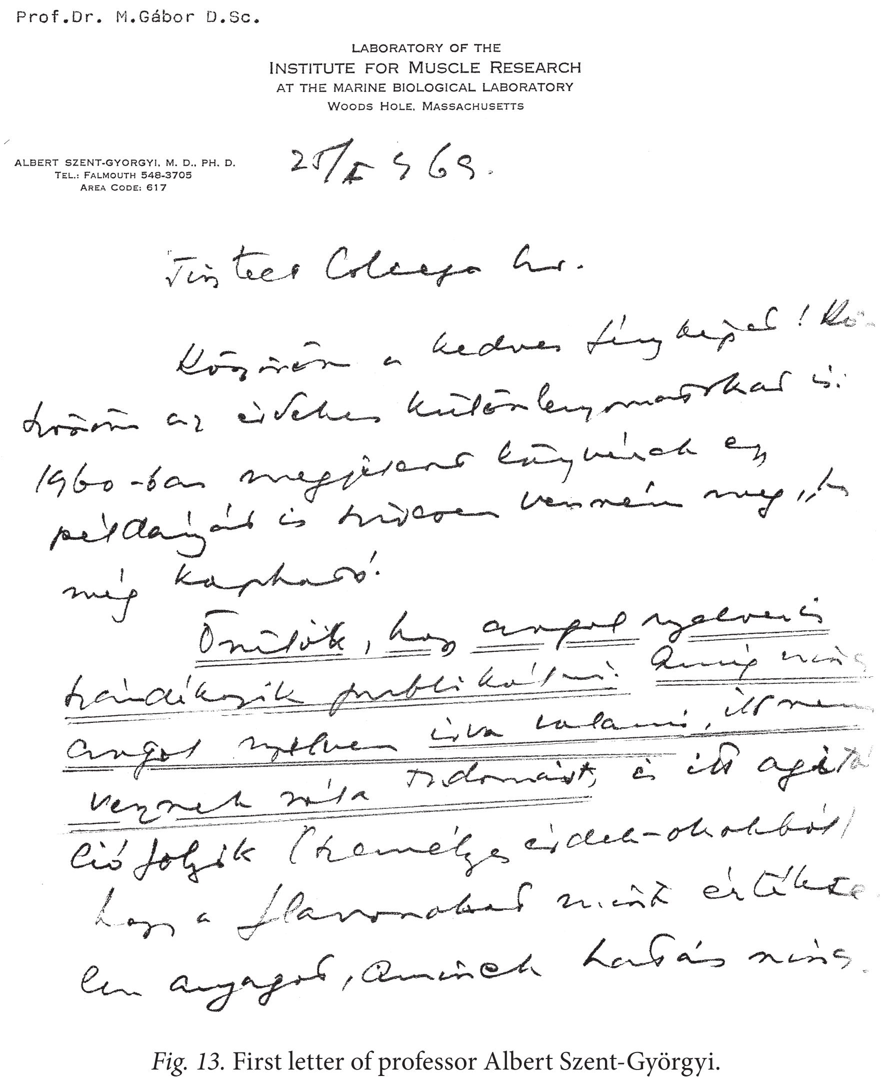
Fig. 12. Patent of Albert Szent-Györgyi (1939).

Correspondence with Prof. Szent-Györgyi

For several decades I had been researching the pharmacological properties of natural substances (plant dyes and flavonoids). By 1969, I considered that I had sufficient enough information to write a monograph on the anti-inflammatory effects of flavonoids. I had the idea to ask Professor Szent-Györgyi to write the foreword to this book. I attached the offprint of my publications,

the review of my monograph published in German by the Hungarian Academy of Sciences (Akadémiai Kiadó, Budapest) in 1960, and a photo showing Szent-Györgyi himself during an interview on the day of the Nobel Prize notification in 1937.

In his response, Szent-Györgyi expressed his delight at my intention to publish my book in English, arguing that everything published in a language other than English was ignored in the United States. He also complained of agitation driven by personal interests to force 'useless and ineffective' flavones out of the market (Fig. 13).



Prof.Dr. M.Gábor D.Sc.

LABORATORY OF THE
INSTITUTE FOR MUSCLE RESEARCH
AT THE MARINE BIOLOGICAL LABORATORY
WOODS HOLE, MASSACHUSETTS

ALBERT SZENT-GYORGYI, M. D., PH. D.
TEL.: FALMOUTH 548-3705
AREA CODE: 617

25/V 69.

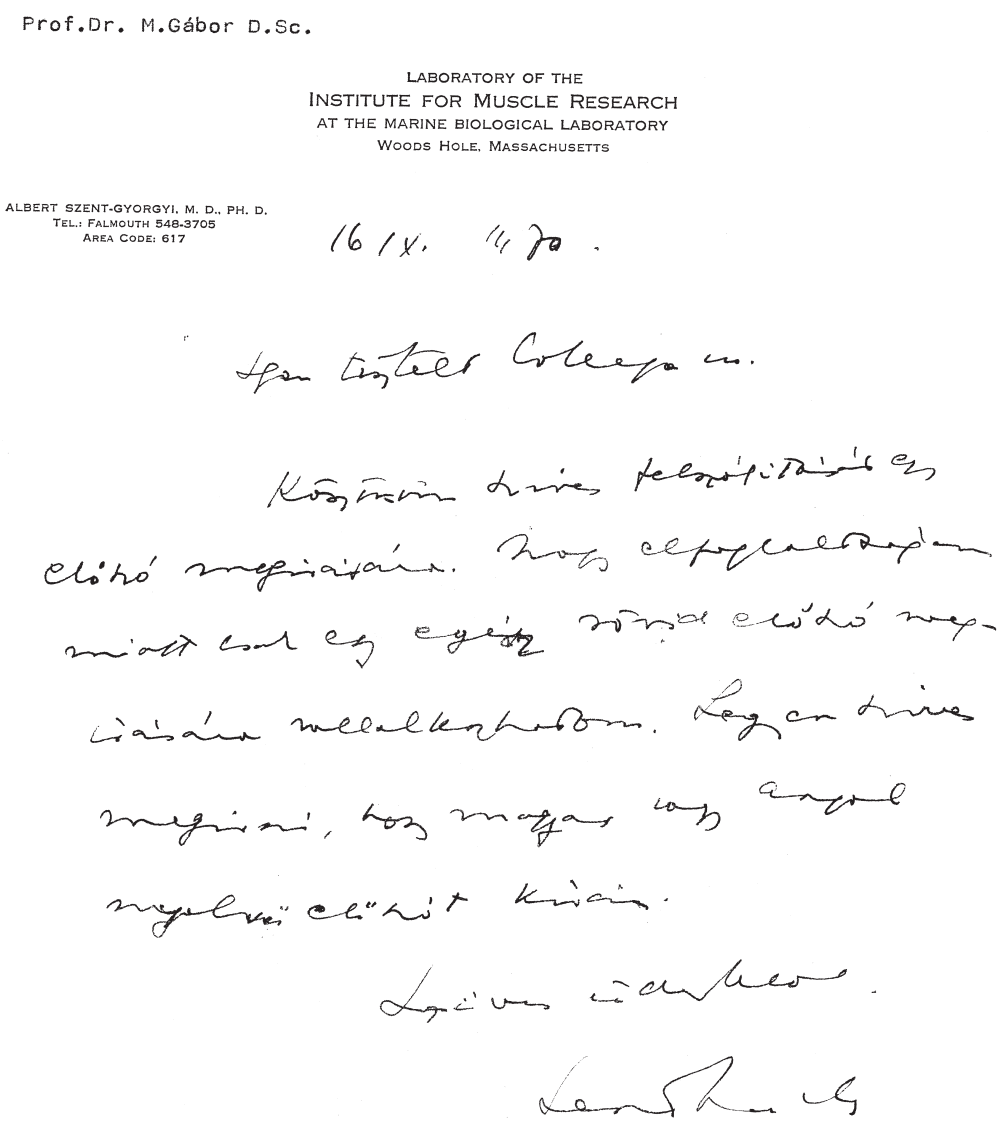
Tisztelt Collega Úr.

Köszönöm a kedves fényképet! Köszönöm az értékes különlenyomatokat és 1960-ban megjelent könyvének egy példányát is. Kiváncsian veszem meg, ha még kapható.

Örülök, hogy angol nyelven is kívánja publikálni. Amíg nincs angol nyelven írva valami, itt nem veszik tudomásul; és itt agitáció folyik (személyes érdek-okokból) hogy a flavonokat mint értéktelen anyagot, aminek hatása nincs.

Fig. 13. First letter of professor Albert Szent-Györgyi.

In 1970, I asked Szent-Györgyi to write the foreword to my English-language book, 'The Anti-inflammatory Action of Flavonoids.' In his response, Szent-Györgyi thanked me for the request, adding that he only had time for a short one (Fig. 14). The foreword and the accompanying letter arrived in January, 1971 (Figs. 15, 16).


Prof.Dr. M.Gábor D.Sc.

LABORATORY OF THE
INSTITUTE FOR MUSCLE RESEARCH
AT THE MARINE BIOLOGICAL LABORATORY
WOODS HOLE, MASSACHUSETTS

ALBERT SZENT-GYORGYI, M. D., PH. D.
TEL.: FALMOUTH 548-3705
AREA CODE: 617

16/X. '70.

Fig. 14. The response by Professor Szent-Györgyi, in wich he promised to write the foreword.

Prof.Dr. M.Gábor D.Sc.

ALBERT SZENT-GYÖRGYI, M. D., PH. D.
SEVEN WINDS
PENZANCE ROAD
WOODS HOLE, MASSACHUSETTS

HOME PHONE: AREA CODE 617
548-1879

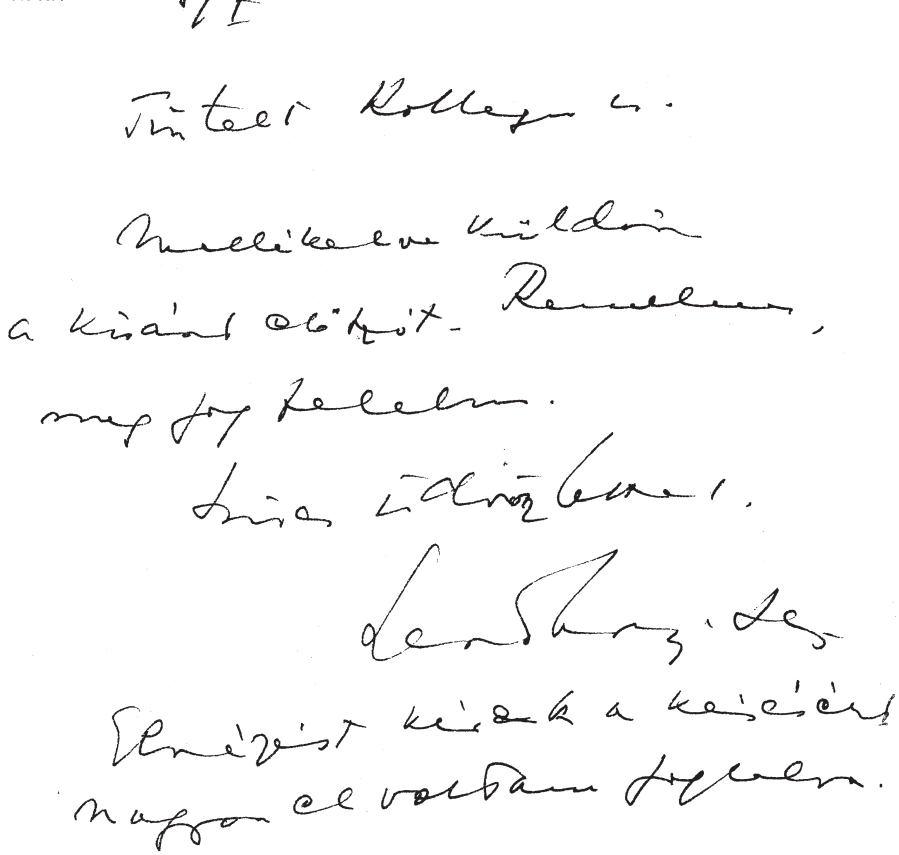


Fig. 15, 16. The letter that accompanied the foreword.

In 2008, our correspondence was published in Orvosi Hetilap, the oldest medical journal in Hungary, as requested by János Fehér, editor-in-chief.

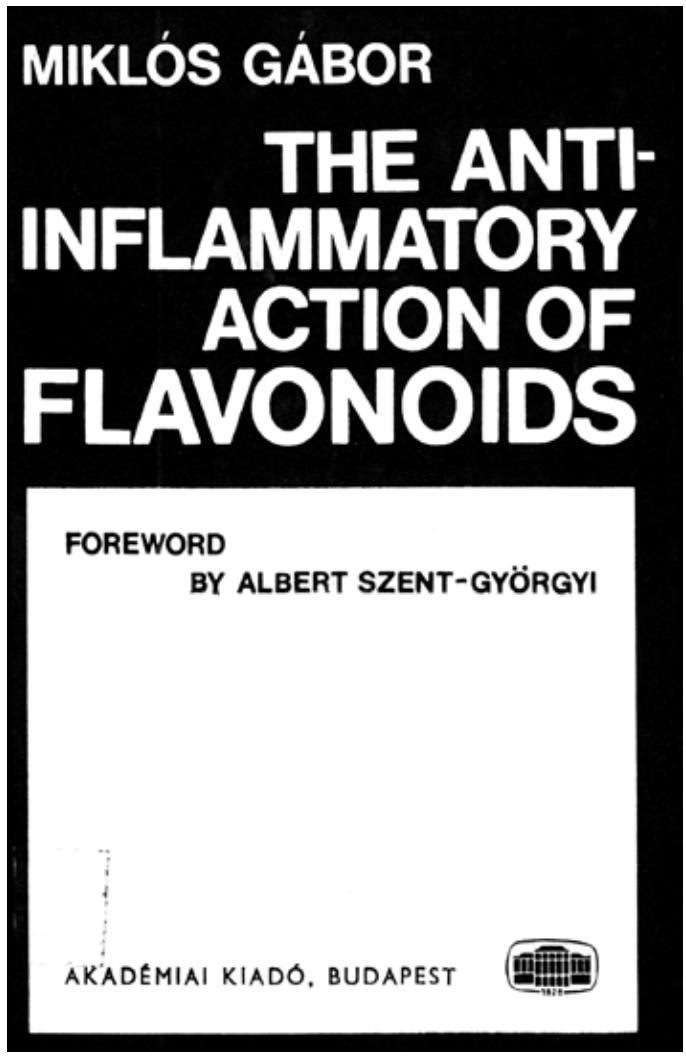
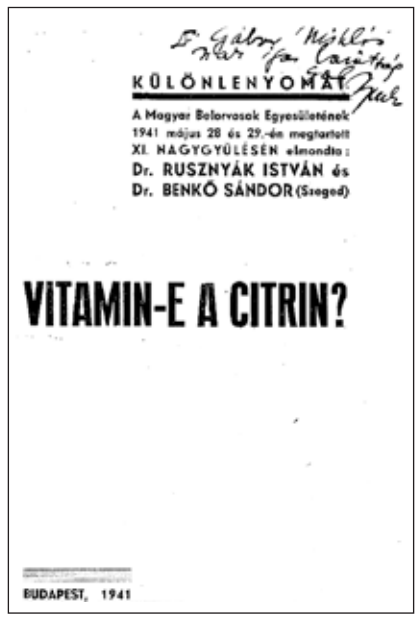


Fig. 16. The anti-inflammatory action of flavonoids (Akadémiai Kiadó, Budapest, 1972).

Can citrin be considered a vitamin?

Rusznyák and Benkő gave a lecture at the 10th Convention of the Hungarian Association of Internists {Magyar Belorvosok Egyesülete} on 28 May, 1941. Interestingly their lecture, 'Is citrin a vitamin?', was published as an offprint (Fig. 17).


KÜLÖNLENYOMAT

A Magyar Bolorvosok Egyesületének
1941 május 28 és 29.-én megtartott
XI. NAGYGYŰLÉSÉN elmondta:
Dr. RUSZNYÁK ISTVÁN és
Dr. BENKŐ SÁNDOR (Szeged)

VITAMIN-E A CITRIN?

BUDAPEST, 1941

Fig. 17. Is citrin a vitamin? (Rusznyák and Benkő, 1941).

Guinea pigs and rats were kept on the scorbutic Sherman – La Mer – Campbell deficiency diet and capillary resistance was measured on the shaved and depilated back of the animals with a glass cup 8 mm in internal diameter (Borbély method). In their guinea pig experiments they determined the minimum vacuum required to produce the first spot-like haemorrhage (petechia) in 15 sec. In rats they applied a vacuum of 250 mm Hg and measured the time until the first petechia appeared. As a result of the deficiency diet, the normal capillary resistance of the guinea pigs dropped significantly, and this decrease continued in spite of the fact that they were given 3 mg of ascorbic acid daily. However, the capillary resistance resumed its baseline level after the animals were injected with 4 mg of subcutaneous citrin (extracted according to the original Szent-Györgyi method). Here I would like to present the results with the original figures of Rusznyák and Benkő's article (1941) (Figs 18 and 19)

On the basis of their experiments, Rusznyák and Benkő (1941) drew the following conclusions:

- the scorbutic diet is low in both ascorbic acid and flavonoids,
- an insufficient intake of flavonoids leads to a decrease in capillary resistance, regardless of the vitamin C deficiency, but the resistance can be normalized by increasing the flavonoid intake,
- experimental scurvy is double avitaminosis.

As a result of a scorbutogenic diet, the capillary resistance of rats decreases significantly, often as rapidly as in 2 weeks.

Next, Rusznyák and Benkő (1941) described the course of an experiment. At the beginning of the experiment, the rat's capillary resistance was low and it took more than 5 min to induce petechiae with a vacuum of 25 cmHg. As a result of the diet this value decreased to 15 sec in 4 weeks. Daily administration of 4 mg of citrin (Richter-Budapest) increased the capillary resistance to the baseline level in 3 weeks (Fig. 19).

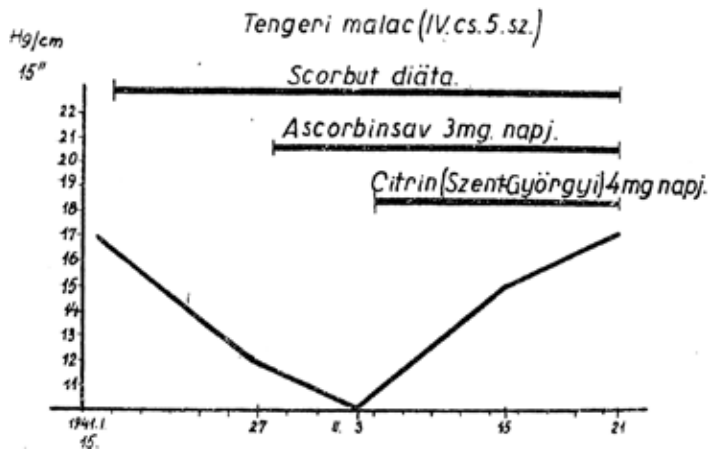


Fig. 18. Effects of citrin in guinea pigs kept on scorbutogenic diet (fig. original).

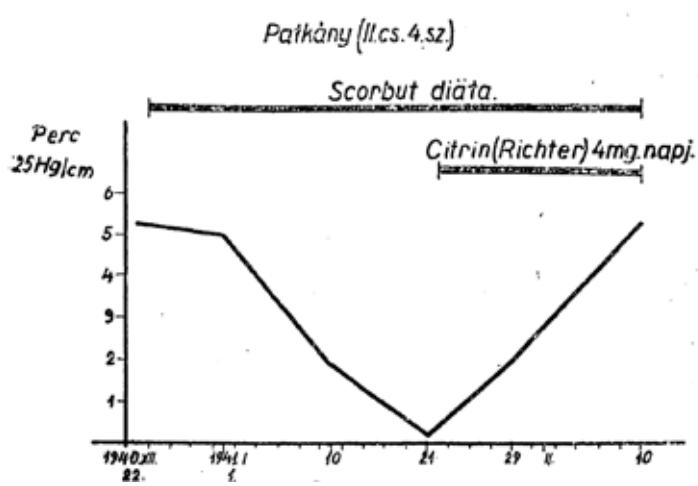
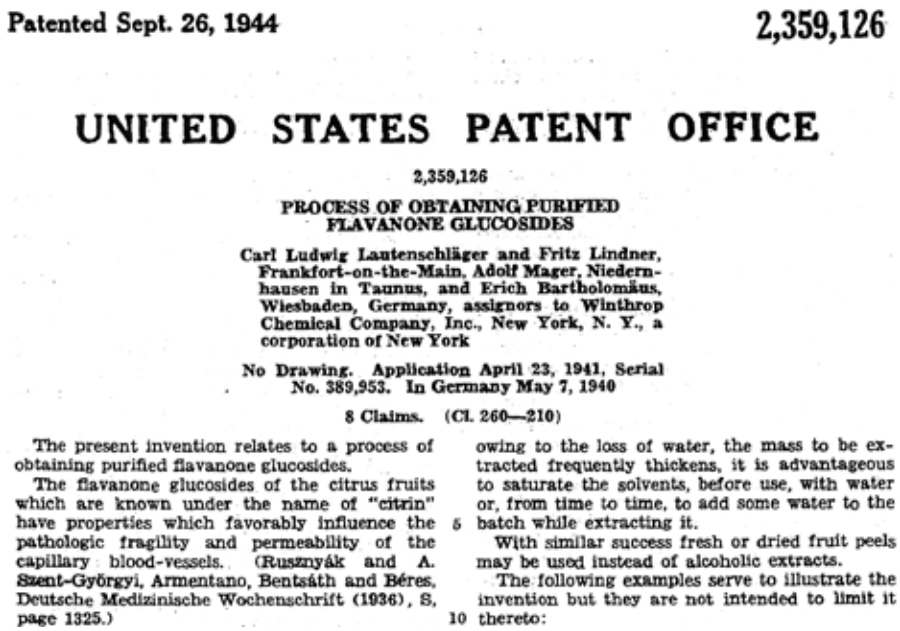


Fig. 19. Effect of citrin on rats kept on scorbutogenic diet (fig. original).

It is worth mentioning that Rusznyák and Benkő (1941) reached similar results when working with various citrin preparations (Richter, Budapest; Bayer, Leverkusen; Hoffmann-La Roche, Basel). These data demonstrate that citrin was produced by both Hungarian and foreign pharmaceutical companies as early as 1940.

The interest of pharmaceutical companies' in citrin is also revealed by the fact that Lautenschläger and Lindner (Winthrop Chemical Company, Inc., New York) submitted a request in 1941 to derive purified flavanone glycosides. The process was patented in 1944. Patent number: 2,359,126 [14] (Fig. 20).



Patented Sept. 26, 1944 2,359,126

UNITED STATES PATENT OFFICE

2,359,126

PROCESS OF OBTAINING PURIFIED FLAVANONE GLUCOSIDES

Carl Ludwig Lautenschläger and Fritz Lindner, Frankfort-on-the-Main, Adolf Mager, Niedernhausen in Taunus, and Erich Bartholomäus, Wiesbaden, Germany, assignors to Winthrop Chemical Company, Inc., New York, N. Y., a corporation of New York

No Drawing. Application April 23, 1941, Serial No. 389,953. In Germany May 7, 1940

8 Claims. (Cl. 260—210)

The present invention relates to a process of obtaining purified flavanone glucosides.

The flavanone glucosides of the citrus fruits which are known under the name of "citrin" have properties which favorably influence the pathologic fragility and permeability of the capillary blood-vessels. (Rusznyák and A. Szent-Györgyi, Armentano, Bentsáth and Béres, Deutsche Medizinische Wochenschrift (1936), S, page 1325.)

owing to the loss of water, the mass to be extracted frequently thickens, it is advantageous to saturate the solvents, before use, with water or, from time to time, to add some water to the batch while extracting it.

With similar success fresh or dried fruit peels may be used instead of alcoholic extracts.

The following examples serve to illustrate the invention but they are not intended to limit it thereto:

20. kép. Patent of Lautenschläger *et al.* (1944).

Recommendation to drop the name 'vitamin P'

The American Society of Biological Chemists and The American Institute of Nutrition Committee on Nomenclature recommended dropping the name 'vitamin P', arguing that there was no evidence at all that flavonoids increased the life expectancy of rats suffering from scurvy or fprocessed vitamin-like properties. The recommendation was signed by Vickery, H.B., Nelson, E.M., Almquist, H.J. and Elvehjem, C., on behalf of the Committee on Nomenclature, 1950.

Retrospective justification of the recommendation

From the beginning of the 1950s, we performed several series of experiments on the pharmacological effects of indenochromene derivatives (haematoxylin, haematein, brazilin and brazilein) (Fig. 21). Similarly to Rusznyák and Benkő (1941) we examined the effect of haematoxylin on capillary resistance in rats the kept on a scorbutogenic diet (Gábor and Dux, 1952). As a result of the diet, capillary resistance stagnated at a low level for several weeks and petechiae appeared following a vacuum of seconds (Fig. 22, curve C).

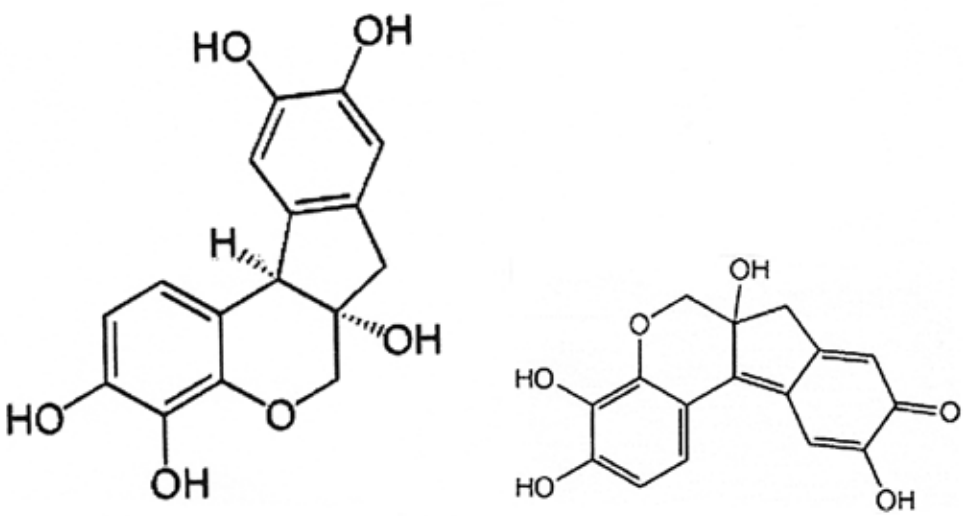


Fig. 21. Haematoxyline and haemateine

Rats weighing 190–210 g received a subcutaneous (occipital region) injection of 15 mg of haematoxylin every third day. Only 2 weeks following the onset of the therapy it took more than 5 minutes to induce petechiae. Measurements performed 12 days after the completion of the therapy showed minimum capillary resistance (Fig. 22, curve A). Haematein therapy yielded similar results (Fig. 22, curve B).

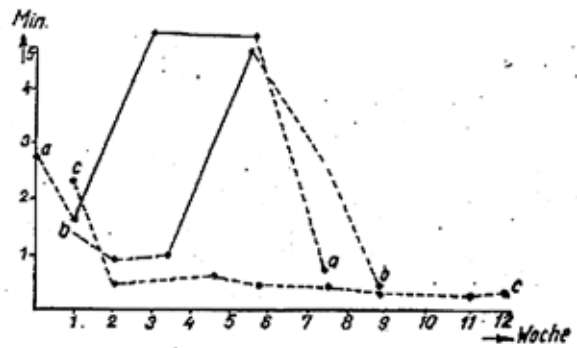


Abb. 1

Abb. 2

DIE EXPERIMENTELLE BEEINFLUSSUNG DER KAPILLARRESISTENZ MIT HÄMATOXYLIN UND VERWANDTEN DERIVATEN

Von

M. GÁBOR und E. DUX

PHARMAKOLOGISCHES INSTITUT DER MEDIZINISCHEN UNIVERSITÄT, SZEGED

(Eingegangen am 25. Januar 1952.)

Fig. 22. Effects of haematoxylin and haematein on rats kept on scorbutogenic diet (fig. original, Gábor and Dux, 1952).

Our experiments confirmed that the resistance-increasing effect of a drug ('pharmacon') does not justify its vitamin-like properties, and it therefore cannot be named a vitamin.

The first conference on bioflavonoids

The conference on 'Bioflavonoids and the capillary' was organized by the New York Academy of Sciences and held on 11 February, 1955. As revealed by the programme of the symposium, the term 'Vitamin P' was no longer used.

We should also note that Albert Szent-Györgyi gave a presentation entitled 'Perspectives for the Bioflavonoids' at the conference.

BIOFLAVONOIDS AND THE CAPILLARY*

Conference Co-Chairmen: Gustav J. Martin and Albert Szent-Györgyi

Consulting Editor: Gustav J. Martin

CONTENTS

Part I. Laboratory Studies

Part II. Clinical Studies

* This series of papers is the result of a conference on *Bioflavonoids and the Capillary* held by the Section of Biology of The New York Academy of Sciences, February 11, 1955.

Fig. 23. Bioflavonoids and the capillary (Conference in New York, 1955).

The mechanism of action of flavonoids

Exploration of the mechanism of action of flavonoids is an important field.

In connection with this, it is worth citing Szent-Györgyi's presentation (1955): 'As a chemist, I am deeply impressed by the reaction of flavonoids with metals, while as a biochemist, I am increasingly impressed by the central role metal atoms play in biological function. So it seems possible that the reactions of flavones with metals hold the key to the understanding of their biological function, while the flavonoid metal complexes may hold the key to a better understanding of the working of the machinery of life.' (Szent-Györgyi, 1955). To illustrate his ideas for the sake of better understanding, I would like to introduce the formation of quercetin-copper chelate complexes, published by Clark and Geissman (1949). 3',4'-Dihydroxy and 3-hydroxy-4-keto groups are important constituents of flavonoid compounds (Fig. 24).

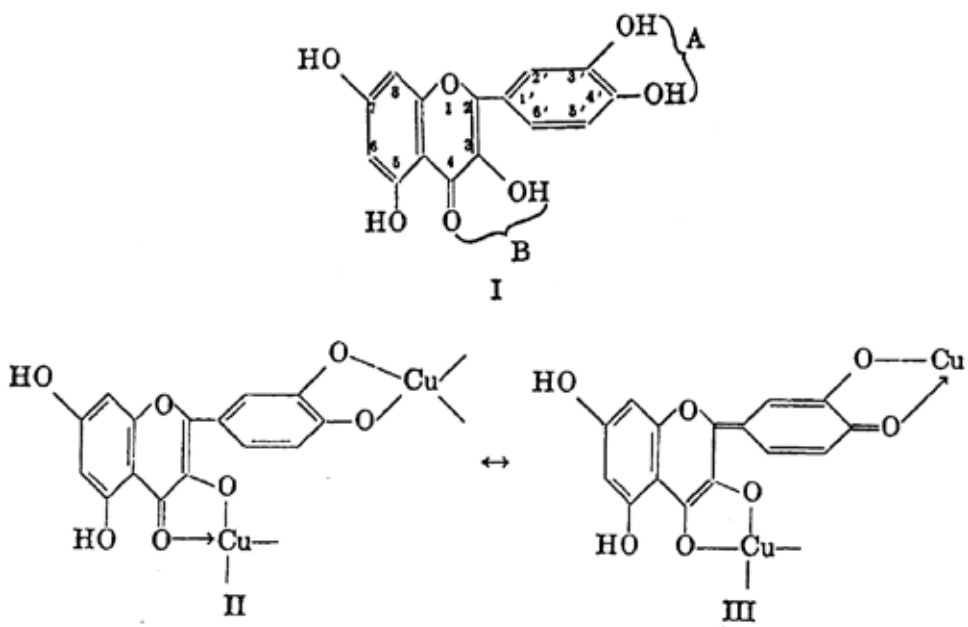


Fig. 24. Structure of quercetine-copper chelate complexes.

Modern ideas concerning the mode of action of flavonoids are illustrated with a figure taken from the paper of Kim *et al.* (2004) (Fig. 25).

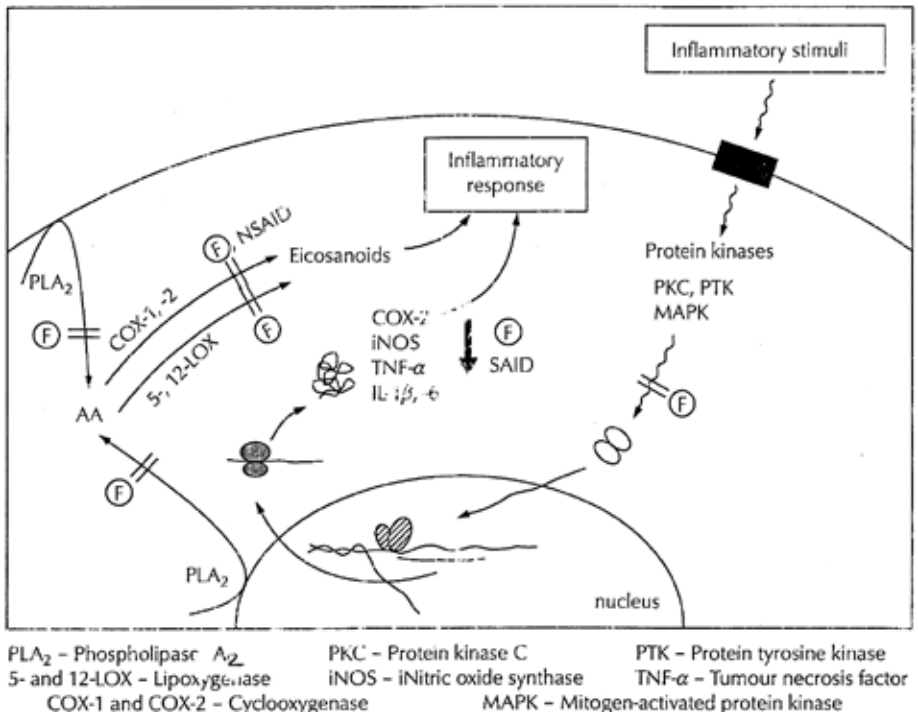


Fig. 25. Mechanism of action of flavonoids (Kim *et al*., 2004).

Phenylbenzopyrone, chromone and chromane derivatives in medications

Threeimportant chemical formulae may be given (Fig. 26).

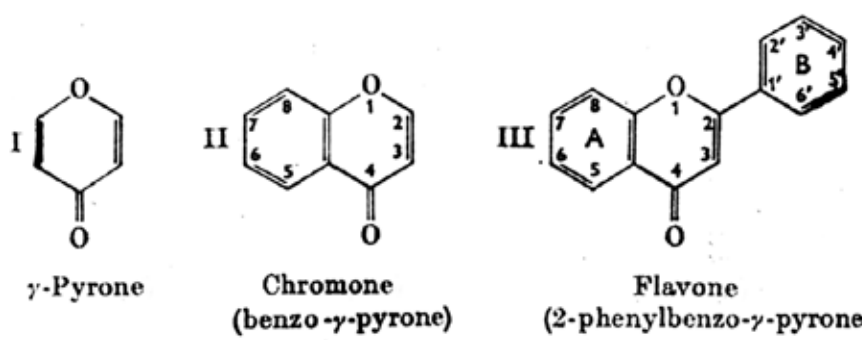


Fig. 26. Structural formulae of pyrone, chromone and 2-phenylbenzo-γ-pyrone (flavone).

Nowadays there is no doubt that it was the result of Szent-Györgyi's research that focused attention on the study of phenylbenzopyrones (flavones) and related derivatives.

The research into phenylbenzopyrone, chromone and chromane derivatives is of outstanding importance; it has already led to the discovery of a number of medications with various pharmacological effects. I have described the pharmacology of these derivatives and other related compounds in my books (Gábor, 1986, 1988) (Fig. 27).

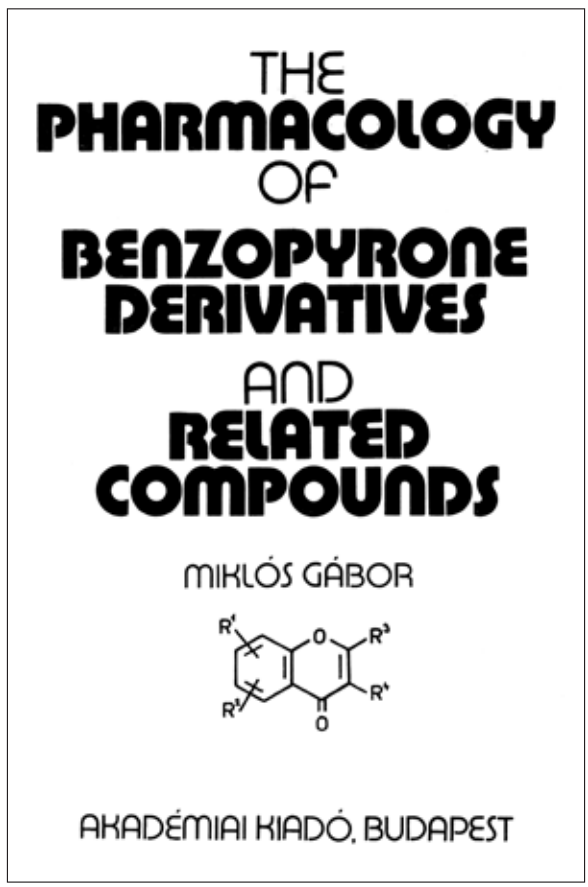


Fig. 27. The Pharmacology of Benzopyrone derivatives and Related Compounds (Gábor, 1986).

It is worth mentioning the monograph by Casley-Smith and Judith Casley-Smith, published in Australia in the same year: High-protein oedemas and the benzo-pyrones' (1986) (Fig. 28).

The pharmacological study of benzopyrones led to the discovery of new medications, many of which are available on the market. I would like to mention some which are used in medical treatment.

Flavone-containing medications marketed in Hungary

Rutascorbin

Rutascorbin is one of the flavonoid drugs with the longest history. It is used in the treatment of a chronic venous insufficiency and haemorrhoids. In ophthalmology, the range of application includes subconjunctival haemorrhage and diabetic retinopathy.

Detralex

The active substance is a purified and micronized flavonoid fraction, which contains diosmin and other flavonoids expressed as hesperidin. It is recommended for the treatment of chronic venous insufficiency of the lower limb and haemorrhoids. In some countries a micronized purified flavonoid fraction containing 450 mg of diosmin and 50 mg of hesperidin is also marketed under the name Daflon 500 mg.

Venoruton

This has been used for decades in the treatment of venous insufficiency, venous circulatory disorders, leg ulceration, haemorrhoids and diabetic retinopathy. Composition: 0-(β-hydroxyethyl) rutosides (oxerutin).

Medications containing benzopyr one or its derivatives on foreign markets

Earlier gave a detailed description of the pharmacology of benzopyr one derivatives and some related compounds (Gábor, 1986). (For the sake of brevity, I reform here to this monograph.) I mention merly ormeloxifene, the selective oestrogen receptor modulator, which is interesting from a pharmacological aspect.

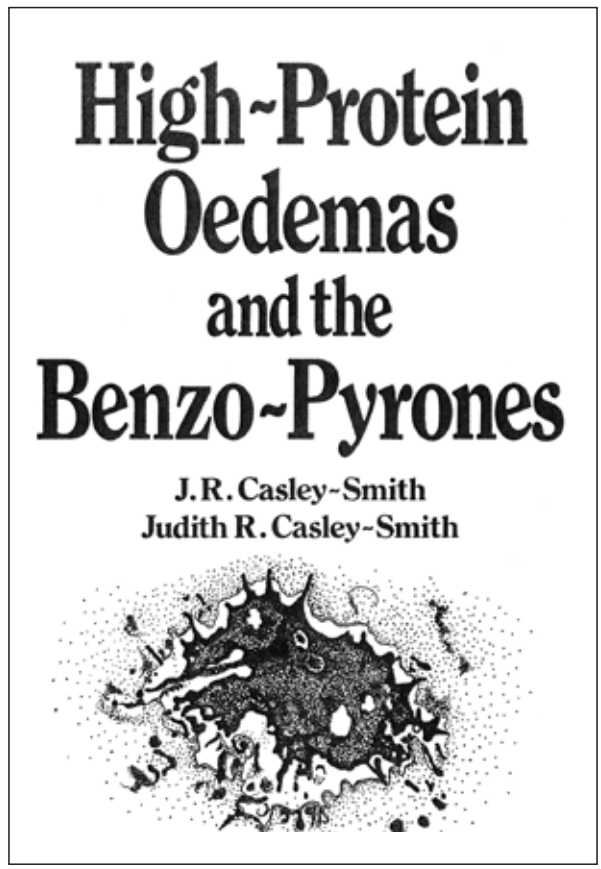


Fig. 28. High protein oedemas and the benzo-pyrones (J. R. Casley-Smith and J Casley-Smith, 1986).

Ormeloxifene (Centchroman)

It is 3,4-trans-2,2-dimethyl-3-phenyl-4-(p-(β-pyrrolidinoethoxy)-phenyl)-7-methoxychroman. Its anti-inflammatory effect was first reported by Dhawan and Srimal in 1973. It is worth mentioning that in India it has been available since the beginning of the 1990s as a contraceptive under various names (Saheli, Novex; Hindustan Latex Ltd). For the treatment of dysfunctional haemorrhages, it is marketed under the name Sevista by Torrent Pharmaceuticals.

As a contraceptive, ormeloxifene is recommended to be taken orally, once a week (Twice a week in the first 12 weeks). Its contraceptive use was legalized in India in 2009.

Flavonoid-containing herbal combinations used as drugs

Scutellaria species are widespread in nature *(S. lateriflora, S. hastifolia, S. altissima and S. baicalensis).* In the last decade, *S. baicalensis* was used in the development of 2 medications.

SK Ato formula

Lim *et al.* (2006) reported a topical anti-inflammatory flavonoid preparation, SK Ato Formula. The preparation contains flavonoid mixtures from *Scutellaria baicalensis,* Georgi roots and *Ginkgo biloba* L. leaves with an extract of *Gentiana scabra.*

Several flavonoid compounds have been isolated from *Scutellaria baicalensis* (baicalin, wogonin, oroxylin A, etc.). The leaves of *Ginkgo biloba* contain myricetin, quercetin, and the biflavone, ginkgetin among other.

Flavocoxid (Limbrel®)

Burnett *et al.* (2007) analysed the cyclooxygenase-1, 2 and 5-lipoxygenase inhibitor effect of the mixed extract of *Scutellaria baicalensis* and *Acacia catechu* (baicalin and catechin). The mixed extract (flavocoxide) is used in the treatment of inflammatory knee diseases (osteoarthritis).

Bioflavonoid conferences, international polyphenol associations

As I mentioned earlier, the first conference on bioflavonoids was organized by the New York Academy of Sciences in 1955. I am glad to report that the Hungarian Academy of Sciences founded the Committee for Flavonoid research in 1964 to coordinate and publish the findings of Hungarian flavone research. It was at one of the first sessions that we decided to replace the term 'vitamin P' with 'bioflavonoids' when referring to biologically active flavone compounds. This terminology has not changed in the past 4 decades.

The following institutions have contributed most to the work of the Committee: Budapest University of Technology and Economics, Department of Organic Chemistry at the University of Debrecen, and the Department of Microbiology, the Institute of Pharmacognosy and the Department of Pharmaceutical Technology at the University of Szeged.

The first president of the Committee for Flavonoid research was Academician Rezső Bognár. Later the Committee was presided by Academicians Loránd Farkas and Sándor Antus.

The first and second symposia (1965 and 1967) were held in Szeged, while the next one was hosted by Debrecen (1970). Since then, the national symposia have been held every year and the international ones every four-to-five years. The lectures presented at the international symposia are published in English by the Hungarian Academy of Sciences.

I may note that the 6th Hungarian Bioflavonoid symposium was held in Munich (1977), the 7th in Szeged (1985) Fig. 30, and the 9th in Vienna (1995).

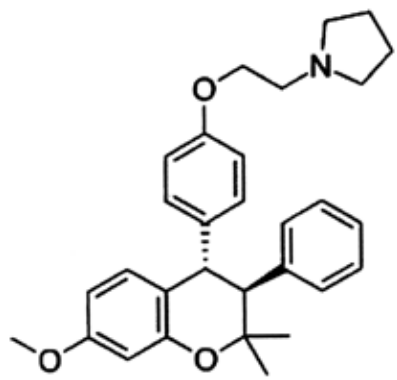


Fig. 29. Ormeloxifene

In 2012 the Committee received new tasks under the new name 'Committee on Alkaloid and Flavonoid Chemistry'. Its sessions are held every year following in the footsteps of Hungarian flavonoid research.

I would like to mention the Venoruton symposia (in the German literature: O-(β-hydroxyethyl) rutoside) where experimental and clinical results were presented. (Nyon, 1972, Mayschoss, 1978, Ludwigsburg, 1982, and Darmstadt, 1990). The presentations were also published by Springer Verlag and Medikon Verlag.

The Groupe Polyphénols (GP) society is an international association founded in France in 1972 with the aim of promoting research on plant polyphenols. Its head office is in Bordeaux and its conferences (International Conference on Polyphenols, ICP) are held every 2 years.

The research on polyphenols is still at the focus of attention, as indicated by the 7th World Congress of the International Society of Antioxidants in Nutrition and Health, entitled Polyphenols Applications, held in Bonn in 2013. (Fig. 31). These congresses have been organized yearly since 2004.

Fig. 30. The 7th Hungarian Bioflavonoid Symposium (Szeged, 1985).

I conclusion, we can say that the intensity of flavone (polyphenol) research is still unbroken, following in the path of Szent-Györgyi and his colleagues. It gives me special joy to see that Hungarian scientists continue to play a significant role in this research. I think it is most appropriate to finish my presentation with a quotation from the Nobel-laureate Albert Szent-Györgyi (1955): 'I hope to leave the reader with the impression that flavonoids comprise one of the most exciting, broad, and hopeful fields of biological inquiry, and I am glad to close on such an optimistic note.' (Szent-Györgyi, 1955).

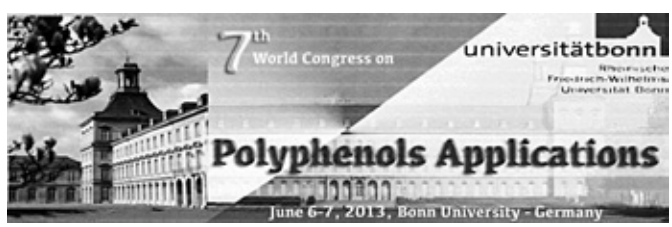


Fig. 31. International Society of Antioxidants in Nutrition and Health, Polyphenols Applications, 7. World Congress (Bonn, 2013).

Tamás Vajda

Effects of the discovery of vitamin C on the paprika industry and the economy of the southern part of the Hungarian Great Plain

This rather mundane topic seems to be somewhat out of line with the topics covered during the Szent-Györgyi memorial year of 2012, and the 2014 Open University, Szeged, since it deals with the economic effects of the scientific activities of the world-renowned scientist, influential professor and one of the most prominent rectors of the University of Szeged on the daily lives of paprika producers living in Szeged, around Szeged, and in Hungary as a whole. In addition to his activities in the fields of science, public life and cultural diplomacy it is probably justified to study this aspect of Albert Szent-Györgyi's life, too. This endeavour was encouraged by two articles published in contemporary daily papers. One of them was written in March 1933 and came out in *Szegedi Napló*. The title of that article called this rather new substance – hardly known to the general public – "Szeged vitamin". The article also revealed that the University of Kolozsvár (currently Cluj-Napoca in Romania), which was moved to Szeged in 1921, had just started to repay the city all the funds it had provided beyond its own possibilities to become the host city of the university. In the last sentence the author pointed out that the vitamin C related discovery of Albert Szent-Györgyi envisioned an inestimable boom, which would solve the daily problems of the city's producers for years to come. Four years later, after getting to know about Albert Szent-Györgyi's Nobel Prize in the autumn of 1937, rector József Gelei claimed that the triumph of Hungarian paprika could be attributed to Szent-Györgyi's vitamin related research. These two articles also make us realise that Albert Szent-Györgyi's scientific discovery in the autumn of 1932 brought significant financial benefits to the residents of the city too.

Paprika production and processing in Szeged

The history of spice paprika production and processing in Szeged goes back much earlier than 1932. It was first grown in the area in the 18th century, and several of its properties helped it become a popular spice in Hungarian cuisine. Its colour, aroma and flavour, as well as its high vitamin content all contributed to the growing use of paprika in Hungarian dishes. Subsequently it was Albert

Szent-Györgyi who pointed out one of its beneficial properties, namely that extensive paprika consumption alone can offset – at least to a certain extent – the dangers of the unhealthy, one-sided diet of the Hungarian population due to the many useful vitamins and other nutrients it contains. The former include vitamins B, C, E and pro-vitamin A, while the latter include capsaicin, which helps the absorption and digestion of fatty and heavy food. In Szeged larger-scale paprika production started in the 18th century, primarily in the southern and southwest regions (Alsóváros, Alsótanya, Röszke, Szentmihály). The Pálfy brothers introduced a technical breakthrough in the paprika industry of Szeged in the second half of the 19th century: they developed the technology of modern, large, steam-operated paprika mills. The publication of a cookbook (featuring a nice, huge paprika pod on the cover page) at the turn of the 19th and 20th century is also credited to them. Another name worth mentioning is that of Mrs. János Kotányi. She also started her career in Szeged. She opened her first spice shop in the city in 1880, one year after the great flood. A year later she acquired a paprika mill in Szeged, and a few years later she opened paprika shops in Budapest and then in Vienna. Finally, at the turn of the century she opened her own paprika mill in Vienna, but even then she mostly processed paprika grown in Szeged.

János Kotányi's paprika mill

Paprika processing in Szeged had become industrialised by the turn of the 19th and 20th century, and the technology remained practically unchanged for the next 50 years. The harvested paprika pods were threaded into strings so that they could undergo post-harvest ripening when hung from porches.

Threading paprika pods into strings

Paprika market on Valéria tér (current-day Bartók Béla tér)

These long strings were sold on Valéria tér (currently Bartók tér), practically in the heart of the city, to entrepreneurs processing the paprika. They employed women experienced in paprika splitting to chop up the pods, which were then ground in the mills. In Szeged the livelihood of entire families depended on the paprika industry.

Sale of paprika strings on Valéria tér (currently Bartók Béla tér)

The process of paprika splitting

Valéria tér was considered to be a wholesale market for paprika trade. Paprika retailers sold their products at another market, in Széchenyi tér, next to the City Council. This was called *literös* market in the local dialect, where customers could buy ground paprika by the litre.

Szeged – Paprika market in Széchenyi tér

Economic difficulties in Szeged

Szeged's economy reached a significant turning point in the 1920s. The previously flourishing city was confined to a rather small "cage" by the Treaty of Trianon, since it lost most of its economic catchment area due to the territorial adjustments. It must be noted that until 1920 the catchment area of Szeged lay only to the south of the city, and since these territories were annexed from Hungary, Szeged practically lost its economic catchment area. In addition, thousands of refugees remained in the city, and caring for them remained an unsolvable task for the city leaders for almost a decade.

Problems were aggravated by the fact that in the 1920s further investments were undertaken by the city leaders. The first such project was the construction of the Votive Church, which started back in 1880, but was halted during the turbulent years of the Great War. Construction was resumed at a higher speed only after the end of the war. The rural narrow gauge railway line was constructed in the middle of the 1920s. Although it subsequently contributed to the development of the city and the surrounding villages, it created almost unconquerable budgetary problems for the local government in the years of construction. As I have already mentioned, from 1921 on the city took enormous sacrifices to relocate the University from Kolozsvár to Szeged. Beginning in 1926, the city undertook further university related construction projects. This was the time when the construction of the university's teaching hospitals and the buildings for theoretical research and education was started in Dóm tér.

This required significant contribution from the city. These factors jointly led to the unprecedented indebtedness of Szeged by the middle of the 1920s, and only very optimistic economists could believe that the city would be able to repay its debts in the 1920s. In this situation the city with daily financial problems could do only one thing: it had to drastically raise the land rents, which was detrimental to small producers. The annual rent of one acre of arable land increased to an amount equalling 1-1.2 tons of wheat in value. This means that around 60% of the expected produce had to be used for paying the rent, which put an almost unbearable burden on farmers. For tenants the only way out of this grip was the production of commodities more valuable than wheat, and paprika was thought to be a good solution. Some small producers took out loans to purchase new lands for production, while others in a more difficult situation did the same to alleviate their daily financial problems. As a result, by the end of the 1920s indebtedness plagued not only the city, but paprika producers and processors too.

	Szeged	Kalocsa
1891	1100	?
1892	585	?
1893	1036	?
1894	2164	?
1895	1330	?
1896	1375	?
1897	1128	?
1917–1925	1208	532
1926	2072	849
1927	1151	818
1928	1266	546
1929	2302	645

Spice paprika growing lands before the economic crisis (acres)

Paprika production and trade in the 1920s

In the 1920s paprika production in Szeged reached record levels. If we look at the figures only, we can witness an unprecedented success: while in 1918/19

only 1,000 tons of paprika was produced in Szeged, production between 1920 and 1926 grew from 1,600 tons to 2,630 tons. Seeing this boom, paprika production was also started in other, more distant regions, estates, as well as in areas of the Szeged paprika growing regions that had been annexed to the Kingdom of Serbia, Croatia and Slovenia (Horgos /Horgoš/, Martonos / Martonoš/).

Év	Produced	Processed
	paprika (t)	
1920–21	1600	1380
1921–22	1200	1020
1922–23	1300	1150
1923–24	2000	1395
1924–25	2630	1620

Paprika production in Szeged in the first half of the 1920s

The problem of Szeged based paprika producers and processors was caused by the fact that although the quantity of crops increased, trading opportunities became less and less predictable. On the one hand, neighbouring countries, which were considered as a domestic market for Szeged based producers before the Great War closed their doors to products from Hungary, including Szeged-grown paprika. On the other hand, by the 1920s the Spanish paprika industry had significantly invigorated, which meant that in regions further away from Hungary the cheaper Spanish paprika turned into an almost unbeatable competition. This fierce competition significantly restricted the export possibilities of Hungarian paprika. Consequently, trading difficulties became permanent, and the paprika buy-up prices strongly fluctuated depending on momentary supply and demand. The problem was further aggravated by the fact that the land structure around Szeged was rather unfortunate. Paprika was grown by dwarf- or smallholders, and the average paprika growing land around Szeged was one acre per family. Approximately 7,000 families around Szeged were involved in paprika production. This means that if we take into account paprika producers and wage labourers too, it affected the livelihood of around 15,000 families if the buy-up price of paprika rose or fell by a few fillers *(small change coin in Hungary – translators note)*.

	Szeged	Kalocsa
1910–12	10	36
1915–20	185	36
1925–29	492	36
1929–30	787	36
1930–31	713	36
1931–32	733	36

Number of paprika processors in Szeged and Kalocsa before the economic crisis

Paprika trade crisis

The expansion of paprika production was halted by the global economic crisis, which hit the paprika industry of Szeged the hardest in 1931. From 1931 on dozens of articles in Szeged based newspapers called for action to save Szeged-grown paprika, which had become almost impossible to sell abroad. An article in *Délmagyarország* highlighted that action was needed in connection with 200 railway carriages full of paprika. This amount equalled 2,000 tons, i.e. nearly two thirds of Szeged's paprika production. The trading problems with paprika were aggravated by the behaviour of the National Bank of Hungary (NBH). As it turned out, when producers managed to sell their crops abroad NBH was not willing to convert the foreign currency to Hungarian currency, and it did not authorise those affected to sell the foreign currency they owned by themselves. This completely paralysed paprika exports, since sooner or later traders ran out of forints, and were no longer able to pay producers and processors.

Five days later the press reported that in the wake of the actions taken by Sándor Popovits, president of NBH, the bank converted the schilling revenues from paprika exports at an exchange rate of 80 fillérs, and would continue to do so in the future. However, this was not the end of the problems with currency conversion. On 13 March 1932 the press reported that finance minister baron Frigyes Korányi wrote to Kuno Klebelsberg that the National Bank of Hungary had in theory authorised to use the foreign currency revenues from paprika exports to offset the pengő claims payable for goods imported from abroad.

In 1932 the crisis deepened even more. The problem was caused by the fact that crop levels were record high due to the favourable weather conditions,

but its sale was even more difficult than usual. According to the papers, a delegation of 500 travelled to Budapest in order to save Szeged-grown paprika, because this quantity was impossible to sell. It was in 1932 that salami and paprika exporter Márk Pick sent a letter to the director of the Institute of Chemical Experiments, in which he wrote about paprika lawsuits in Germany launched on the basis of allegations that butchers had added too much paprika to their salamis. In his letter he asked Ernő Obermayer to get paprika acknowledged as a spice and not as a food colorant. Then they would be able to raise the interest of foreign markets in paprika. Since the sale of the paprika produce did not go smoothly, the affected producers and processors were unable to meet their loan repayment obligations. By 1933 85% of the producers had so much debt that was impossible to repay. This meant that only 15% of the paprika producers were debt-free. The paprika crisis jeopardised the entire agriculture of Szeged, and indirectly the economy of the entire region, as well as the local credit and financial institutions.

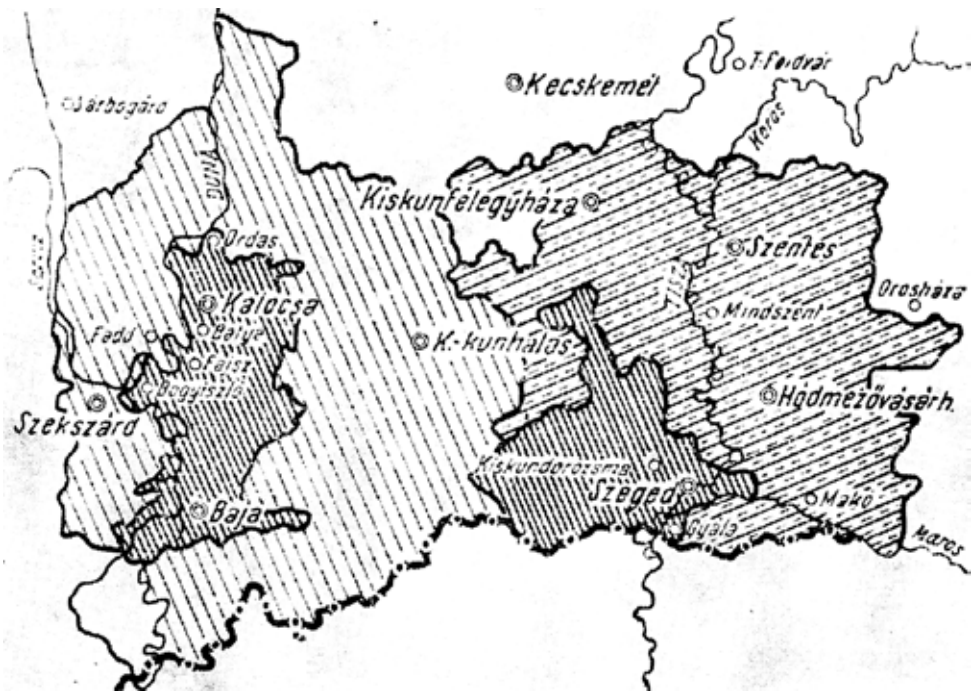
	1929	1930	1931	1932	1933
Ausztria	303,4	349	386	412	339
Csehszlovákia	143	187,7	200	289	154
Franciaország	0,9	1,5	1,4	1,8	1,4
Hollandia	0,8	1,4	1,4	2,1	4,1
Kanada	0,1	0,4	1,7	0	13,1
Lengyelország	19,9	22,9	17	19,2	20
Nagy-Britannia	2,7	0,9	1,9	2	24,3
Németország	108,5	128,9	111	135	109,8
Tunézia	0	0	0	0	16,1
USA	17	29,8	23,2	65,6	371,4

Hungarian spice paprika exports to 10 countries in the years of the economic crisis (tons)

Measures aimed at the restriction of production

By 1933 the situation had stretched to breaking-point. In the first step lands available for paprika production were downsized in 1934 by Decree 1890/1934 M E (and the enforcing Decree 52.000/1934): an area was assigned for paprika production in the vicinity of Kalocsa and Szeged, and spice paprika could

exclusively be grown there. The production of spice paprika was banned in other areas of the region, where only other types of paprika could be grown. Even within the smaller growing area only those producers could receive production licences who (whose business predecessors) had been involved in the production of spice paprika in the "confined area" for at least three years between 1926 and 1933, even if with interruptions. In this year paprika was produced by 7,245 farmers on 7,168 acres in the Szeged area, and by 5,612 farmers on 3,850 acres in the Kalocsa area.



Demarcation of areas for paprika production (1934)

In the second step Decree 1900/1934 M E forced producers to join cooperatives for the reduction of production, and the operation of such cooperatives was supervised by the minister of agriculture. One third of the board members were also appointed by the minister. If objected by the minister, the cooperatives had to change their resolutions. Although these decrees were objectionable in terms of private law, they proved to be economically progressive, because they tried to turn the anarchy of production into a reasonable system. In contrast with the rights of the individuals they tried to put an emphasis on the benefits of the community.

In 1936 a decree was passed to regulate the sale of paprika as well. Pursuant to Decree 4650/1936 m E (and the enforcing Decree 26.500/1936 F m) producers and paprika processors could only sell their produce to the cooperative centre specified by the minister of agriculture, and that centre was mandated to buy the entire annual produce. In other words, spice paprika could only be purchased at designated places by designated cooperatives. Paprika ground by the producers themselves or processing entrepreneurs in supervised mills could only be purchased by the local cooperative. The buy-up price was intended to be raised through the centralisation of the paprika trade. Consequently, the Cooperative of Kalocsa and Szeged based Paprika Producers was set up, and was joined by all paprika producers. The same aim was served by the rule that allowed paprika processing only by those having a trade licence. Later spice paprika trade was delegated to the so called Hangya (Ant) Cooperative, which set up the Central Cooperative for the Sale of Hungarian Spice Paprika for the completion of these tasks. This move was not received with unanimous applause. According to the bitter but witty criticism of a contemporary newspaper article: "What phylloxera is to grapes, scale insects are to fruits Ant is to paprika". In 1935 and 1936 buy-up prices dropped below the 1934 level.

According to the general opinion of contemporary state and supervisory organisations, the only solution to this problem was the curtailment of paprika production, and the centralisation of processing and trade. However, in reality the production, processing and exports of spice paprika in Szeged underwent a wonderful growth beginning in the mid 1930s.

Researching the medicinal effects of Szeged-grown paprika

From 1928 on, grass-root non-governmental organisations and movements started in scientific circles wanted to draw the attention of the public to the medicinal effects and high quality of Szeged-grown paprika. An excellent opportunity for this was the 2nd International Herbs Conference, which was organised in Szeged in the autumn of 1928, and was attended by 75 foreign and 30 Hungarian experts. Having arrived at Szeged railway station, they visited three paprika processing plants by bus. Then the participants of the conference visited the Tisza steam-powered paprika mill to study how paprika was ground. Then they travelled to Szentmihály to observe the paprika fields. The Szeged based newspapers enthusiastically reported on the event which spread the reputation of Szeged-grown paprika.

Géza Váradi, a Szeged born teacher living in Miskolc contacted the mayor of Szeged in 1930 and offered his help to improve the sales figures: this paprika had nothing to do with the old, extremely pungent Szeged-grown paprika, therefore it could be advertised abroad as sweet paprika close to the foreign taste. He emphasised that the omission of spice paprika from meals containing fatty dishes would directly lead to problems. This opinion was in sharp conflict with the subject of the paprika lawsuits launched in Germany. Finally he asked that Szeged-grown paprika be scientifically analysed by the University of Szeged. This could in turn confirm the validity of the medicinal observations made by the local people. The Mayor's Office recognised the significance of Váradi's action. In the first place the city's authorities submitted a request to the minister of agriculture, asking him to subject paprika to chemical analysis and have its clinical value determined. However, the minister turned Szeged's request down saying that it was beyond his scope. Then the city asked the Medical Faculty of the University of Szeged to analyse paprika. This time the Medical Faculty responded to the city's request. They wrote that they were happy to undertake the task, and that the necessary investigations and research activities had already started in the institutes of the Medical Faculty. They also wrote that they were expecting to see favourable results, and would then publish them in scientific journals. They also authorised the city in advance to use the scientific findings to be published in its brochures to be produced for the promotion of Szeged-grown paprika.

Due to the great interest in paprika, Mária Várady and Mária Koturnya completed a study on the effects of capsaicin in 1931 after conducting many tests on animals. The authors concluded that the substance, which is toxic if taken in large quantities, has a beneficial effect on the secretion of gastric juices and digestion if administered in small doses. In 1932 László Tokay proved that "the colorant in paprika is not toxic" and "Szeged-grown sweet paprika, which is used as a spice, is not toxic even when consumed in larger amounts than usual".

Albert Szent-Györgyi's scientific results based on Szeged-grown paprika

Examinations surrounding the medicinal effects of Szeged-grown paprika include the discovery of Vitamin C by Albert Szent-Györgyi in 1932, and his experiments with Szeged-grown paprika. In the spring of 1932 Szent-Györgyi could prove the beneficial effects of vitamin C, and then during the following autumn he managed to synthetise vitamin C from Szeged-grown paprika.

In 2005, János Marton compiled an excellent study in which he collected the different versions of the story of the first successful experiment for the synthetisation of vitamin C from paprika. 1) One summer evening green paprika was served with the dinner. Since Szent-Györgyi did not like it, he angrily tossed it aside. After dinner it occurred to him that he should take it to his lab to analyse. 2) During the same evening meal his daughter asked him if paprika contained vitamin C. 3) The dinner was attended by a boring guest, and Szent-Györgyi escaped his company by saying that he had to examine the paprika. 4) According to a friend's recollections, his guest that evening was Professor József Tomcsik, head of the National Institute for Public Health. They had paprika too with their meal. Suddenly Szent-Györgyi jumped to his feet and collected all the paprika pods he could find in the house. He hurried to his laboratory and worked with his wife until morning. 5) In 1983 Albert Szent-Györgyi made the following recollections: "One evening my wife served bread and butter with paprika for supper. To tell you the truth, I was quite tired of it, but I did not have the courage to ask for something else. And then, while I was sitting at the table with the bread and butter in my hand I remembered that paprika was the only plant I had not tested… And I acted immediately. My flat was in the same building as the laboratory. At midnight I already knew that paprika was a true reservoir of ascorbic acid." 6) According to Ilona Banga's statement made in 1983: "It happened during a summer evening meal that the Professor arrived at our table brandishing a thick green paprika in his hand. He said his wife had served it for supper, and suggested that we should check whether it contained a reducing agent that was present in lemon. We immediately prepared a iodine/starch solution. Then we crushed the pericarp of the cut up paprika in a dish, strained its juice through a cheesecloth, and started titrating it right away. We were pleased to see that it indeed consumed the iodine solution, and turned the blue iodine/starch solution into a clear liquid. In two paprika seasons we managed to produce 5 kg of crystallised substance." 7) According to a statement made by Sándor Szalay in 1984: "One Sunday evening, after I returned from a rowing trip on the River Tisza, and I was eating in the kitchen, Szent-Györgyi entered with a Bulgarian plant grower, who was carrying a large bag of green paprikas on his back. The Professor asked me to help. We ground and centrifuged the paprika. Half an hour later it turned out that paprika juice contained much more vitamin than the juice of pressed cabbage." There is one common point in all the seven recollections, i.e. that the analysis of paprika was initiated by Professor Szent-Györgyi. However, it is assumed that the test could not be conducted in the summer months, but

rather between early October and mid November during the high harvesting season. The fact that the analysis was conducted in October was also confirmed by Albert Szent-Györgyi in the lecture he gave at the 19 December 1933 meeting of the Central Committee for Medical Further Training: "All of my experiments were futile. But coincidence came to my aid again. During an evening meal in October I did not like the paprika I was eating. I angrily tossed it away from my plate. Then it occurred to me that I had not examined paprika yet. I took the paprika fruit from the dinner table to the laboratory, and I worked all night. In the morning I was surprised to discover that paprika contains an extremely large amount of vitamin C." The successful extraction of vitamin C from paprika was first reported in *Szegedi Új Nemzedék* on 4 December 1932: "The prominent scientist is in constant search of plants that contain plenty of vitamin C. This is why he started to analyse the chemical composition of Szeged-grown tomato-shaped paprika this past October, and after a few days of work at the laboratory he made a major discovery." In response to the journalist's question: 'How long have you been analysing the chemical composition of Szeged-grown paprika?' Professor Szent-Györgyi reiterated: "Unfortunately, only since October. And since then, despite that the end of autumn was drawing near, we have processed 2,000 kg of paprika."

So first he extracted vitamin C from the Szeged-grown tomato-shaped paprika, and then he purchased two tons of paprika in order to conduct a large-scale laboratory experiment. At that time almost everybody in the institute was cleaning paprika. The whole institute looked like a family farm, which tried to produce paprika juice for sale on the market. However, instead of producing for sale at the market, they produced half a kilo of crystallised vitamin C. On 26 October 1933 the Medical Department of the Friends of Franz Joseph University held a scientific session, where Albert Szent-Györgyi gave the second talk under the title *Tests carried out on vitamin C*. In this talk he mentioned that "the half a kilogram of vitamin C produced in Szeged preceded a large-scale international research project, which on the one hand clarified the chemical structure of ascorbic acid, and on the other hand it confirmed that the substance is indeed a vitamin. The very last step in the process was the synthetisation of vitamin C, which provided an ultimate proof to all the claims made so far. For the time being the laboratory in Szeged is involved in the production of a larger quantity of vitamin C, which serves as a tool for a large-scale international clinical experiment, the aim of which is to clarify whether or not vitamin C can be used for clinical purposes.

Paprika centrifuge in operation

Based on the descriptions, Albert Szent-Györgyi's recollections, and the technical literature of the second half of the 1930s paprika processing must have been carried out the following way: apart from the colleagues of the institute women highly experienced in splitting pungent Szeged-grown paprika were also involved in the work. We also know that the pungent paprika juice occasionally splattered into the women's eyes, and sometimes they needed Albert Szent-Györgyi's help to flush the juice out of their eyes. The quantity of the paprika used, as well as the timing and difficulties of processing all indicate that the large amount of vitamin C was extracted from Szeged-grown paprika in the institute led by Szent-Györgyi late in the autumn of 1932.

Vitamin C synthetised from Szeged-grown spice paprika

World fame, first economic effects

Albert Szent-Györgyi, who reported his successful paprika experiments for the first time in a newspaper article dated 4 December 1932, emphasised the economic impacts of his discovery: "I hope that this discovery will lead not only to the general consumption of fresh paprika internationally, but large factories will also use paprika as a raw material for the production of pure vitamin C. As far as I know, the Budapest based Chinoin factory has already processed thousands of kilograms of paprika for this purpose. Several Swiss and English chemical factories have contacted me about its production, and I have no doubt that these factories will try to produce vitamin C on a mass scale."

The discovery of Albert Szent-Györgyi was first put into the international limelight in 1933. In April the professor set out to Stockholm, and then continued to promote Szeged-grown paprika and his discovery of vitamin C in many west European countries, including Sweden, Denmark, England, France and the Netherlands. The articles reporting on the professor's international tour also mentioned the economic effects of the discovery. In the same article Szent-Györgyi pointed out that all Swedish newspapers had written about

Hungarian paprika in connection with the scientific research: "All Swedish newspapers have written about Hungarian paprika in connection with my scientific research, and the words 'Hungarian paprika' appeared in bold on the front pages of the newspapers. My lecture was received with special interest everywhere, especially the part in which I talked about the rich vitamin content of the paprika, since this is the only thing that makes the mass production of pure vitamin possible. I think that paprika will be an outstanding export product when canned appropriately. It is possible that the effect of my analyses will be felt on the paprika market already this year."

A little less than a year after vitamin C was synthetised from Szeged-grown paprika, a type of canned paprika with high vitamin C content was produced under the name Vitapric. The newspaper article, which was the first to report on the successful industrial production, emphasised that enormous export possibilities would open up. It claimed that arable lands would be utilised to the maximum, the threat of paprika overproduction would be eliminated, and the product would boost paprika production in the Szeged area. In November 1933 it was reported that "a Hungarian cannery has come out with canned paprika, which is already marketed in Sweden. It has an enormous significance. Paprika has come into fashion abroad, and demand is on the rise".

The contemporary poster of Vitapric

From that time on paprika was regarded as a dietary supplement, and the marketing of various types of canned paprika also contributed to enhanced paprika production and sale. The significance of canned paprika was also highlighted in Lajos Armentano's research project, which was completed in 1940. "However, various types of paprika are listed as rich sources of vitamin C. It can be found in especially high quantities in green and tomato-shaped paprika. In connection with this I was especially eager to find out how this typical Hungarian produce could be used to cover our vitamin needs in winter. The question seemed to be easy to answer, since several factories in Hungary manufacture canned food from tomato-shaped paprika, which is then marketed under various names (Vitapric, Pritamin, etc.). At our clinic I tried the product called Pritamin, which contains 0.6 g % vitamin C according to the manufacturer; this ratio was confirmed by our direct analyses too …Canned paprika products manufactured in Hungary retain their vitamin C content even during storage and preservation, therefore they are a very important source of vitamin. For example, as little as 10 g (a level teaspoon) of Pritamin is enough to meet the daily needs, and 50 g Pritamin a day can eliminate deficiencies caused by serious infections in 9-10, or maximum 14 days."

In 1935 another significant experiment was carried out: researchers managed to breed non-pungent paprika from Szeged-grown pungent paprika on a larger scale. Before 1935, producers both in Szeged and Kalocsa were only able to grow paprika that was rather pungent according to the Hungarian standards, however, on the international market less pungent spice paprika was in demand: "They realised it a long time ago that if their paprika was not pungent, they would have considerably larger selling opportunities on the world market." In order to produce non-pungent paprika, Ernő Obermayer tried to breed a less pungent, high-yielding, modern Hungarian paprika species by the cross pollination of Spanish and Hungarian paprika varieties. The successful breeding and large-scale production of completely non-pungent spice paprika boosted demand for Szeged-grown paprika so much that after a few years non-pungent species dominated the paprika fields. In 1938 protective measures had to be taken in Szeged in the interest of the original, pungent paprika. However, ground paprika made from non-pungent paprika fruits could not fully reach the qualities (flavour, aroma and colour) of the old noble sweet paprika processed by way of splitting. Therefore, in the first year major educational and lobbying activities were needed so that more and more fields were planted with non-pungent paprika seedlings in Szeged, too.

Further scientific results related to Szeged-grown paprika

It came to light in November 1933 that during his research in Szeged, József Gagyi successfully used vitamin C to treat animals suffering from the deadly diphtheria. An extremely small amount of vitamin C, extractable from a few paprika pods, is sufficient for the complete eradication of diphtheria that otherwise leads to death in 4 or 5 days. Animals treated with vitamin C do not only survive the fourth day, but they also show the signs of some weight gain.

Károly Waltner, the professor of the Paediatric Teaching Hospital of Szeged completed his comprehensive examinations regarding the carotene content of paprika for medical use by 1934. He found that the vitamin A content of 1 g of freshly ground paprika was 20 vitamin units, i.e. identical with raw carrots, twice as much as cooked carrots, four times more than butter, 13 times more than salad and fifty times more than cow's milk.

László Berkesy, who studied the effect of paprika on gastric functions, also finished his research in 1934. According to his conclusion, "the use of paprika as a spice should not be generally prohibited for patients with stomach problems. It should be banned only for patients suffering from hyperacidity, and in the case of hypoacidity it is suitable to stimulate the secretion of gastric juices. This is all the more so because we have not met any patient, not even one with hyperacidity, who showed the signs of undesirable stomach agitation". This annulled the former accusations made about paprika.

In 1934 József Ambrus also analysed the physiological effects of paprika: paprika causes increased blood flow to the skin, the stomach and the mucus membranes of the intestines. It enhances the secretion of digestive juices, increases intestinal peristalsis, and due to its emulsifying and hydrotropic properties it improves the gall bladder functions, too. This provided a scientific proof to the popular observation according to which Hungarian people use paprika mainly to season lard, fatty meat and stew dishes in order to facilitate the absorption of fats.

On 25 October 1934 several talks were held on the identification of latent vitamin C deficiencies at the meeting of the Medical Department of the Friends of the University of Szeged Association.

A few medical therapies led to miraculous recoveries, which significantly improved the international acknowledgement of paprika and vitamin C extracted from it, and magical enthusiasm evolved around it. When Professor Szent-Györgyi gave lectures in Belgium in 1935, he was asked to treat the Prince of Liége, the younger son of the king of Belgium. The young prince was suffering from a constant fever, and his doctors were unable to treat his condition. Szent-Györgyi prescribed him crystallised vitamin C, and

the prince soon recovered. Due to the unexpected success Szent-Györgyi was declared a medical genius, and the recognition of vitamin C rose spectacularly.

The fame of paprika was further increased due to the fact that it was found to contain other useful elements, too, i.e. so called bioflavonoids (so called vitamin P), which were extracted from Szeged-grown paprika by Szeged based researchers. However, it subsequently turned out that although this substance has very good medicinal effects (it can efficiently be used to cure a type of haemophilia), it cannot be regarded as vitamin.

Szeged-grown paprika also played an important role in the selection of the winner of the Nobel Prize in chemistry in 1937 (as it had been predicted by Szent-Györgyi). The prize was awarded jointly to Norman Haworth (1883-1950) and Paul Karrer (1889-1971). The former was awarded for his research related to vitamin C extracted from Szeged-grown paprika. In the winter of 1932-33 Albert Szent-Györgyi sent Haworth, who was working at Birmingham University, a portion of previously extracted crystallised vitamin C, which helped him make vitamin C discoveries. In other words, Szeged-grown paprika made it possible to recognise the high natural vitamin C content of paprika, and it also contributed to the exact analysis of the vitamin, as well as the description of its structure and physiological effects.

The beneficial effect of paprika consumption on the female menstrual cycle was studied and confirmed by a German doctor, Margarete Raunert, who visited Hungary.

The Nobel Prize in physiology, 1937

In 1937, upon learning that he had been awarded the Nobel Prize, Albert Szent-Györgyi acknowledged in almost all of his interviews and talks that he owed the results of his examinations to Szeged-grown paprika.

After it became public on 28 October 1937 that the Nobel Prize in physiology had been awarded to Professor Szent-Györgyi in Stockholm, he received plenty of letters of congratulation and salutation from the most diverse members of Hungarian public life. From among them, the letter written by the Board of the Hangya Cooperative on 30 October raised special economic correlations. "Honourable Sir, we the undersigned, the central board of the Hangya Cooperative, as well as all the rural cooperatives under our supervision, and especially the board of the Central Hungarian Spice Paprika Trading Cooperative would like to congratulate you with deepest respect on your global success achieved by winning this year's Nobel Prize. The farm-

ing communities of the cooperatives are filled with special joy and pride, since through you, who have received the award of the highest acknowledgment available to any scientist, the role of the Hungarian land, and that of the fruit that Hungarian peasants grow with their own sweat has significantly improved. We are forwarding to you the good luck wishes of all cooperative members, and ask God to bless your scientific work, which has proved to be invaluable for the entire mankind, and has brought fame to our country."

Some ten days later, on 9 November, the chairman of Hangya Cooperative, Elemér Balogh, royal counsellor, member of the Upper House, wrote a letter to the professor. "My Honourable Friend, Please allow me to sincerely congratulate you on the high award you have received, crowning your scientific work and results. We are proud of you and we truly wish to share in your joy. This award has turned the world's attention to vitamin C. I am not familiar with its method of production or use as a medicine. Therefore, please do not take it as an offence if I suggest as a layman if steps should be taken for its large-scale production and for a relevant international patent. This could improve the livelihood of paprika producers in the Szeged region, and would enhance our economy and exports, and consequently bring new acknowledgement to Hungary. This idea has come into my mind after the Government entrusted the institute I head with the supervision of paprika production and trade. However, we have a subsidiary company (Hangya Ipar Rt.) which is engaged in the manufacturing and marketing of industrial products too. With their involvement we could establish vitamin C production, and if this would require capital, we could make that available too. Being an altruistic company, we would be involved in this matter only from the economic and moral aspect, and not from the business side. If my suggestion would reverberate in you, then general director Mr. Frigyes Wünscher and myself would be very happy if you could visit us (at IX. kerület Közraktár utca 30.) during your stay [in Budapest] – in any case upon preliminary notice – in order to discuss this matter."

The letter of salutation written by the Cooperative of Spice Paprika Producers in Szeged and the Szeged region on 29 November 1937 also shed a light on the economic effects of the vitamin C related scientific discovery. "Honourable Mr. Professor, At the election meeting held on 16 November 1937 the members of the Cooperative of Spice Paprika Producers in Szeged and the Szeged region decided with unanimous enthusiasm to congratulate you on winning the world's most prestigious award, the Nobel Prize for your scientific work. We Hungarians, Szeged residents and paprika producers are proud of you, Mr. Professor, since you have demonstrated and proved to the world the Hungarian genius, the Hungarian spirit, the superiority of Hungarian

research and culture, as well as the Hungarian desire to live, and has thus brought fame and glory to Hungary. Our life has become more meaningful, our eyes have become brighter, our perseverance will increase, and our work may be more successful, because through the epoch-making discoveries and scientific results of yours the world's attention has again turned to Hungarian paprika. We hope that this would contribute to the increased and improved distribution of the Hungarian spice paprika abroad, and may even make our bread bigger and whiter. May God bless your work and research. We too wish you, Mr. Professor, strength to continue your activity for a long time, and similarly to the successes you have achieved bring value to the scientific life and the Hungarian people. May God bless you!"

The letters of salutation and congratulation include the 20 December letter written by the Committee responsible for determining whether or not a paprika has the distinctive Szeged features (the Committee). "The Committee has decided to congratulate you, honourable Mr. Professor in acknowledgement of your world renowned and significant work that you have completed through your epoch-making activities related to vitamin C extracted from paprika. By attaching the summary of the related minutes please allow me Mr. Professor to reiterate the sincere and respectful salute to the pride of our city and country, and at the same time let me pray for God's blessings on you and on your work. Honourable Mr. Professor, please accept my distinguished salutation as an expression of my deep respect."

In November 1937, Rector József Gelei wanted to use public donations to buy a villa for Albert Szent-Györgyi, whose world renowned scientific discovery led to the growth of Hungarian paprika exports. In his proposal he explained in detail that the economic effect of the discovery more than justifies the construction of the villa from public funds, since in the past two years the professor had brought 2 million pengős worth profit to the country, which was a multiple of the cost of the villa in New Szeged. Based on the decision of the assembly the lord lieutenant (főispán in Hungarian), the mayor, the upper class members and the representatives of the city went to Budapest to have negotiations with finance minister Tihamér Fabinyi and minister of culture Bálint Hóman. The basic idea was to construct a house on a lot to be given by the city as a gift, and to share the costs of construction equally between Szeged and the state, and to give the house to the world renowned professor as a joint gift.

Two weeks later Albert Szent-Györgyi was elected honorary citizen of Szeged. In his salutation speech mayor Dr. József Pálfy pointed out the following: "Professor Szent-Györgyi got to know and understand the Hungarian land, the especially nutritious soil of Szeged near the Szeri puszta (steppe). He ploughed it with the plough of soul and knowledge, and following what his

soul told him he bent down and lifted the fruit of the Szeged soil, paprika, which shimmered like ruby. And it was this paprika that helped you rise and achieve the highest scientific award". In his response Albert Szent-Györgyi emphasised that the aim of his productive intellectual work was not only to conduct scientific research, and to implement and practice the concepts of education on a daily basis, but also to facilitate the daily lives of people engaged in physical work: "I am happy if my work could at least to some extent express the gratitude of science and the university towards the city, and chance so ordained it that my modest endeavours are the next example showing that science not only brings you laurels, but that today's abstract achievements can come to the aid of toiling farmers already tomorrow, and that intellectual work is an indispensable brick in a nation's house, just like the farmers' work.".

Hungary's paprika exports following the scientific discoveries

In the 1930s Hungarian paprika exports underwent major changes. From the middle of the decade the value of our exports not only reached the pre-crisis levels, but increased the average volume of the 1920s by three or four times. Hungary's paprika exports totalled 2,450 tons in 1937, 2,770 tons in 1938, and 2,280 tons in 1939 despite the war conditions. In 1939 the revenues from paprika exports increased despite the shrinking volume: from 3,336,000 pengős in 1938 to 4,118,000 pengős in 1939. This enormous growth could be attributed to the world famous scientific discovery related to paprika. This was mentioned already in a 1935 article reporting the successful breeding of non-pungent paprika: "Hungarian paprika is a top class export product even though Spanish paprika represents strong competition on the global market, and its significance in foreign and domestic trade has grown especially in the past few years thanks to Professor Szent-Györgyi's sensational research and discovery".

In a January 1938 report Lajos Szekerke, head of Szeged's tourist office wrote about Albert Szent-Györgyi and how his scientific discovery promoted Szeged-grown paprika, and what impact this had on tourism: "The globally renowned success of Professor Szent-Györgyi turned the attention and interest of the entire educated world to Szeged and paprika. Consequently, the agency of the Hungarian Tourist Board in England called for the publication of 10,000 copies of a new, multilingual brochure structured and printed in a state-of-the-art fashion exclusively for the presentation of the scientific research of Professor Szent-Györgyi in layman language, and to serve as an effective promotional material for Szeged-grown paprika."

From 1939 Hungarian paprika exports declined compared to the extraordinary values of the years before. This was in part due to the fact that in the years following the end of the civil war Spanish paprika gained ground again on the American markets, while Hungarian paprika became increasingly isolated due to the war blockade. According to a report on paprika trade in 1940, "Exports have heavily declined. Exports to the German Empire increased from 375.5 tons to 735.1 tons, but exports to the US decreased. – This was largely caused by the fact that overseas transportation costs increased, and that exports to the US completely stopped after Italy joined the war. Exporters suffered enormous losses when they had to ship the goods that were stuck in the ports back to Hungary".

From 1933 on neighbouring successor countries had a smaller share of the exports than the other countries. This process continued at such a speed that in 1937 Hungarian paprika exports to the neighbouring successor states hardly accounted for one fifteenth of Hungary's exports to other countries. In the 1930s large quantities of Hungarian paprika were exported to the US, as well as to Austria, Bohemia, Germany, Algeria, Great Britain, Argentina, France, the Netherlands, Canada, Poland and Tunisia, but smaller quantities were also exported to Australia, South Africa, Egypt, India, Java, China, Norway, Italy, Peru, Switzerland, Turkey, New Guinea, Uruguay, etc.

Year	Production (t)	Consumption (t)	Export (t)	Exports including	
				successor states	other countries
1926	2470	1370	1100	740	360
1927	2920	1750	1170	850	320
1928	2980	1940	1040	620	420
1929	2280	1630	650	300	350
1930	2710	1960	750	360	390
1931	2870	2100	770	410	360
1932	3200	2220	980	610	370
1933	3240	2170	1070	310	760
1934	2470	2050	420	60	360
1935	2980	2320	660	60	600
1936	4160	1920	2240	30	2210
1937	4800	2250	3000	20	2980

Major performance indicators of Hungary's paprika industry between 1926 and 1937

From the mid 1930s one of Hungary's largest markets was the US. Albert Szent-Györgyi travelled to the US to hold a longer series of lectures in the spring of 1939, and an article reporting on the continuous growth of paprika exports to the US came out in *Szegedi Napló* approximately at the same time. In 1937 Hungary exported 2.5 thousand tons of ground paprika to the US, which equalled 50% of the total paprika imports of the US. In 1938 exports grew even further, more paprika left the country, but for the same amount of money. Hungarian exports to the US then equalled 75% of the paprika imports of the US. These fantastic achievements, which were unprecedented in the Hungarian economy, were in part due to the fact that the Spanish civil war was fought between 1936 and 1939. By 1938 the Hungarian spice paprika enjoyed increasing demand not only in the US, but also in several countries of South America (e.g. Argentina, Uruguay). With such trading opportunities ground paprika produced in the Szeged region grew from 1,590 tons in 1929 to 3,240 tons in 1937, and its value exceeded 5 million pengős. And the size of lands sown with paprika increased year after year.

	Szeged	Kalocsa
1934	6851	5559
1935	5748	3808
1936	5600	4272
1937	5719	4402
1938	6949	5628
1939	6884	7056

Number of Szeged and Kalocsa based paprika producers in the second half of the 1930s

	Szeged	Kalocsa
1932–33	866	36
1933–34	625	36
1934–35	767	36
1935–36	772	183
1936–37	782	261
1937–38	870	269
1938–39	665	273

Paprika processors in Szeged and Kalocsa in the 1930s

	Szeged	Kalocsa
1934	3780	2235
1935	3525	1692
1936	3342	1615
1937	2900	1677
1938	3260	2457
1939	4431	2762

Spice paprika growing lands in the Szeged and the Kalocsa regions in the second half of the 1930s (hectares)

It is worth knowing that despite the publication of the fantastic scientific discoveries related to Szeged-grown paprika, paprika was still mainly considered as a natural food colorant in America, and was mainly sought after for industrial purposes. Therefore, in the case of paprika shipped to the US colour was of primary, and aroma and contents were only of secondary importance. Hungarian style paprika dishes could gain popularity in the American cuisine only slowly and only to a limited extent. This was due to the preference for making quick meals, as well as the quality of American lard: the aroma of Hungarian spice paprika can only be enjoyed to its maximum when fried in lard made the Hungarian fashion. Not even the Hungarian kitchen set up at the New York World Fair could help overcome this resistance despite the fact that Hungarian paprika exports were at their peak in these years.

	1934	1935	1936	1937	1938
Algéria	0	0	0	73,2	60,3
Argentina	0	0	6,6	135,8	217,1
Ausztria	150,2	217,8	220,7	189,9	284,4
Csehszlovákia	48	52,1	36,9	19,7	12,3
Franciaország	1,7	1,5	4,5	37,8	52,6
Hollandia	4,3	4,6	4,6	9,9	12,2
Kanada	0	0	0	6,6	48,8
Lengyelország	9,4	12	4,4	1,4	11
Nagy-Britannia	3,5	7,7	18,1	30,7	45,4
Németország	121,9	151,5	190,1	232,3	212,3
Tunézia	0,1	0	1	25,4	69,2
USA	62,6	190,2	540,7	1570,1	1559,9

Hungarian paprika exports to 12 countries in the second half of the 1930s (tons)

By 1940, the largest buyer of Hungarian spice paprika was Germany and the German army. This was largely due to the high vitamin C content of spice paprika, which – in sharp contrast with Albert Szent-Györgyi's all humanistic and political convictions – was beneficial for the German army in world war II, since by consuming paprika products German soldiers could stay at sea in submarines much longer without developing scurvy. Szent-Györgyi used the profit from the sale of pritamin for the development of the Szeged based laboratory, which made it possible to pursue further state-of-the-art biochemical research.

In 1939, chemical engineer Ferenc Balla from Szeged "founded a cannery with his own strength, practically with his two hands with a view to process the crops of lands around Szeged, and to turn fruits and paprika into products that can be sold both on the Hungarian and on foreign markets. The plant has already started to operate in Liget utca with the name *Szeged Cannery*, and one of its most important tasks is the production of products containing vitamin C. …Ferenc Balla experimented to develop a method with which a special product rich in vitamin C could be produced from the paprika fruit with the highest vitamin C content in Szeged, in the homeland of vitamin C. The cannery was developed in a special direction: to produce the tasty paprika purée called Papririt in tasteful packaging. This interesting product, which was about to undergo significant development, contained 0.487% of vitamin C according to the measurements of the National Chemical Institute and Central Chemical Experimental Station. In layman's language this meant that a tablespoon of Papririt contained as much vitamin C as six lemons. The paprika extract could be used in various ways. It could be readily used for seasoning food after cooking (soups, meat dishes, vegetable stews, bread and butter, etc.) and due to its pleasant flavour and aroma it could be consumed on its own too. The innovative product of the young, Szeged based chemist enjoyed great demand not only in Hungary, but abroad too, and the increasing demand meant that the canned product would considerably inflate the value and exports of Szeged-grown paprika. The processing of paprika fruits on an industrial scale would presumably reach a new level of development, because more fruit paprika had to be produced for the canning industry.

It also happened in 1939 that Barna Györffy (the son of Szeged based professor dr. István Györffy) developed a pesticide containing colchicines, which made the leaves and the fruits of the paprika plants grow larger. As a consequence, the yield grew and the plants showed increased adaptation to the extreme conditions of the land on which they were grown. "Paprika that can be easily grown using colchicines treatment will revolutionarise paprika production. Its extremely large economic significance mostly lies in the fact

that it is very probable that the vitamin C content will considerably grow in the tetraploid paprika too, even if not by 100%."

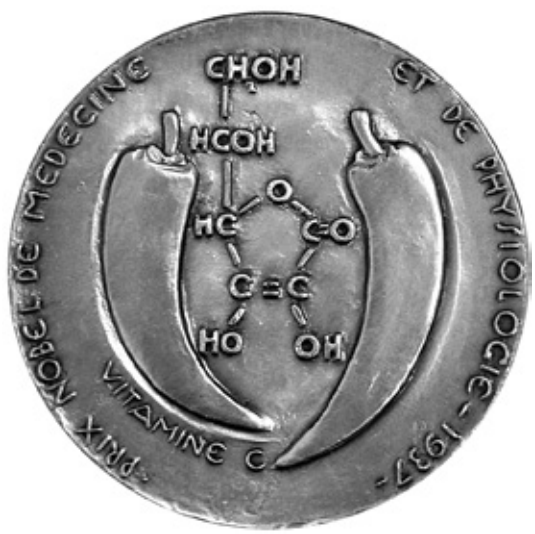
The international technical and chemical congress of agricultural industries was organised in Budapest between 10 and 20 July 1939, and one of its most significant advocates was Albert Szent-Györgyi. According to the original programme of the congress, the world-famous researcher of vitamins was to give a talk on his recent scientific research activities. According to newspaper articles published before the congress, "The talk to be given by the Nobel Prize winner professor looks interesting in all aspects, because he will also discuss the significance of the Hungarian soil in the cultivation of plants rich in vitamins".

In 1942 the newspapers reported that vitamin C could be extracted from ground paprika with an even higher efficiency: "I spent years on finding the way to produce ground paprika that retains its vitamin content. This work led to results this spring for the first time. I could not only manage to produce ground paprika without a loss in vitamin content, but it also had a better flavour and aroma than the paprika produced the old way, and it showed surprising benefits while cooking, too. Its production, to which I submitted a patent application this past June, is very simple. If we can manage to transform paprika processing, and market this vitamin rich ground paprika as a national product, significant export possibilities will open up, the attainable prices will also be much more favourable, and the money will eventually be channelled back to the people farming the land." However, at that time the economic interests too were subordinate to the war needs.

Szentmihály, the Lábdy paprika mill

The Lábdy family in the yard of their house in the 1930s

The discovery made by Albert Szent-Györgyi created not only an opportunity to escape smothering loan debts, but also secure and stable financial conditions for Szeged and the Szeged region. This historic economic success was cast into form in 1983, for Albert Szent-Györgyi's 90th birth anniversary: artist András Beck, who was living in Paris then, designed a coin the tail of which showed the formula of vitamin C, and two paprika pods to express how much the scientist owed to Szeged-grown paprika, and how much his discovery helped the people living in this area.



The anniversary coined designed by András Beck

The economic significance of Albert Szent-Györgyi's discovery was also acknowledged by István Szanyi István in his paper written in 1939: "The sensational discovery made by Nobel Prize winner Albert Szent-Györgyi, professor of the University of Szeged, i.e. that Hungarian paprika contains vitamin C in the largest quantities, had an extremely beneficial effect both on domestic consumption and exports. Professor Szent-Györgyi found that the Hungarian grown, tomato-shaped paprika fruit contained four times more vitamin C than lemon. The series of analyses he made proved that the fruit of spice paprika contains even move vitamin C. His discovery of the method of vitamin C (ascorbic acid) production benefited not only Hungarian spice paprika, but also the entire mankind." Sándor Farkasfalvy stated something similar in his paper in 1941: "Among the smaller agricultural industries a major position is taken by spice grinding, or rather the production of paprika mills, the grinding of excellent quality, vitamin rich sweet Hungarian paprika into red spice paprika, which has become the focus of worldwide attention in the wake of the vitamin related research activities of Nobel Prize winner Professor Szent-Györgyi.

Based on the production and exports data showed above it can be rightly stated that Albert Szent-Györgyi's finding about the vitamin C content of paprika belongs to scientific discoveries with the most significant economic effects. It contributed to the improved livelihood of the people living in Szeged and in the southern Great Plain for decades.

Béla Pukánszky

The thoughts of Albert Szent-Györgyi on pedagogy

The classic idea of universities in Europe assumes freedom in the fields of research, teaching and thinking in general. Because of this, professors at a university are not only interested in their own field of study, but also show interest in the fundamental issues of university life outside their study rooms and laboratories. Professors are interested in such fundamental issues as the possibilities of teaching, training and education within the walls of the university. In the life of a scientist, such problems usually appear as an issue to be made available for the general public, when the scientist becomes a dean or a rector. (Exceptions from this reality are, of course, those professional educational researchers who are professionally required to describe these issues in a methodical and systematic way.)

Albert Szent-Györgyi, Nobel-prize winner biochemist, was one of those professors who was constantly and highly interested in university and public life. With exaggeration, we may risk saying that in his person an exceptionally versatile and generally curious late "Renaissance man" was reborn in the specialization age of the 20th century. In addition to his natural scientific research topics, he was constantly looking into the theoretical and practical issues of philosophy, social sciences and arts.[1]

The adventurous biography of Szent-Györgyi suggests that he was a world citizen who preserved his inner patriotism and, although he had lived in several countries, returned when he was convinced that he was needed at home. In the 20s and 30s, as a researcher, he spent more or less time in Prague, Berlin, Leiden, Groningen and Cambridge, but in 1929, accepting a call from Kuno von Klebelsberg, contemporary minister of religion and education, to return home, Szent-Györgyi returned to Hungary for a visit and later, in 1931, he and his wife moved back to Hungary and settled down in Szeged. With the issues concerning the relationship between university and education, Szent-Györgyi was most concerned here, during his professorship (1931-1945) at the University of Szeged. Before attempting to reconstruct Szent-Györgyi's line of thoughts on university pedagogy in the given period, it is worth elaborating on the first Szeged-based decade of the university, where Szent-Györgyi became a teacher.

[1] It is well-known that at the beginning of 1941, during Szent-Györgyi's time as a rector and with his support, the play Hamlet was famously staged by the university students in Szeged; directed by István Horváth: a talent who died young.

1. University of Kolozsvár "temporary" located in Szeged

On 12 May 1919, the Romanian authorities used executive force to cease the operation of the University of Kolozsvár. This ended a period in the history of Hungarian education; a period which began in 1872 with the establishment of the University of Kolozsvár, the second state university following the university in Pest, and ended after almost fifty years of successful operation. This ended the development of Hungarian university education in Transylvania. The University that was expelled from Kolozsvár spent two years in Budapest and from October 1921 continued its operation in Szeged.

Law No. XXV, on the temporary location of the University of Kolozsvár, proposed by József Vass Minister of Culture and codified June 1921, ended a long dispute.[2] Those teachers who moved to Budapest earlier could only expect temporary placements and those who stayed in Kolozsvár also had to leave following an unsuccessful attempt to save the University.[3] There was another possible location: in addition to Szeged, the town of Debrecen also expressed its willingness to embrace the university.

The newspapers in Szeged continuously followed the events of the moving in of the University. For example, in its issue on 16 January 1921, the daily: *Szeged* informs its readers that Debrecen is working in full swing to embrace the university. Szeged may easily lose the contest if the town does not make itself attractive for the teachers and leaders of the university. Satisfactory housing should be offered because nobody should expect the teachers from Kolozsvár "to come to Szeged and have only the few benches at *Stefánia* and the numerous chairs at the walkway as their only place to rest. The willingness of the teachers should be attained."[4] The leaders of Szeged did a lot to attain the willingness of the University of Kolozsvár. In 1920, the mayor of Szeged, Szilveszter Somogyi, had already sent the proposal of the town council to the Minister of Culture: István Haller. The proposal attempts to explain to the Minister the advantages of the town near the Tisza-river. It is in favour of the town that it can easily be approached both on land and on water from any part of the country: "It is positioned in the best possible way in the middle of an agriculturally cultivated, airy and wide plain where the town develop-

[2] The same law located the university expelled from Bratislava "temporary" to Pécs.

[3] On the topic read: Béla Pukánszky: *Tanárképző vagy egyetem? A kolozsvári egyetem Szegedre költözésének körülményei 1919–1921. Magyar Pedagógia,* 1987. Nr. 4. URL: http://www.pukanszky.hu/Fantom.htm Downloaded: 20 December 2012.

[4] The daily newspaper: Szeged, 26 January 1921.

ers ensured the healthy conditions for development with forth sight: straight and wide streets, several large 8-10 arpents of space, huge areas of trees, gardens and walkways, sewer systems, pavements, building operations in line with the strict building regulations, healthy drinking water, public baths and healthcare institutions."[5] After Szeged succeeded in embracing the university, the leaders of the town aimed to create an adventitious environment for the placement of the university. This did not go easily. The five secondary school headmasters whose institutes were to be evicted were especially fierce to protest. In their proposal sent to the minister of religion and education, the headmasters predict the "crippling" of the secondary education in Szeged should the town's verbal offerings be followed by action.[6]

The teachers and students of the University of Kolozsvár began their 1921/22 school year already in Szeged. At the beginning, in spite of the town's benevolent, but still limited support, the working conditions were very poor. A contemporary researcher of the University's history used the following words to describe the difficulties: "The first months, even years, brought the same difficulties that were present at the time when the University was founded in Kolozsvár. At the same time, both teachers and students had the unbreakable faith to provide everyone with the most and the best, and prove that the University is necessary and worthy just in those times when, due to the difficulties in the economy, the public was about to mature a frame of mind against universities."[7]

In the 20s and 30s, especially under Minister Kuno von Klebelsberg, the situation had consolidated and the university begin to advance. Spectacular signs of this progress were the University construction works that were carried out following the plans of excellent architects. First, between 1924 and 1929, along the bank of the river Tisza, the clinics of the University were erected. These were designed by Flóris Korb. Following the clinics, between 1929 and 1930, realising the plans of architect Béla Rerrich, the natural sciences research institutes were erected at Dóm square.

---

[5] The text of the proposal can be found in the National Archives of Hungary. K 636 1920. 11.

[6] The conditions of moving in are described in detail in a monograph by Gábor Vincze: *A száműzött egyetem*; Szegedi Egyetemi Kiadó, Szeged, 2006

[7] Iván Vitéz Nagy: *A száműzetés évei Szegeden 1920–1940*. In: Bisztray Gyula, Szabó T. Attila és Tamás Lajos (edit.): *Az erdélyi egyetemi gondolat és a M. Kir. Ferencz József Tudományegyetem története*. Budapest, 1941.

Inaugural ceremony of the natural sciences research institutes at Dóm square. 25 October 1930. Kuno von Klebelsberg, Ernő Foerk, Ernő Dohnányi and Béla Rerrich.

Together with the development of the infrastructure there was a significant structural development in the history of higher education in Szeged: in 1928, Kuno von Klebelsberg Minister of Culture reorganised in Szeged the teacher training college for state civil schools that was moved here from the capital. For the 10-14 year olds, the secondary level state civil schools provided useable and practical knowledge. For these schools male teachers were exclusively trained in Szeged, while female teachers were trained here and in two other institutes within a denomination. As a result of this, the teacher training college had soon become one of the most important teacher training institutions of the Hungarian higher education with a national recruit radius. By moving the new institute and the closely linked state civil school, where training practice is completed, to Szeged, Kuno von Klebelsberg wanted to realise several goals. Firstly, he established new grounds for teacher training; secondly, he assisted the University of Szeged by creating a concept of cooperation between the two institutions and facilitating the practical implementation of this concept. On their new four-year-long course, the teacher training college students had to, on one of their majors, attend lectures at the university and take part in seminars and practical lessons. The number of university study lessons varied according to subject and were around 4 to 10 lessons. At the university the teacher training students were referred to as teacher candidate student. (This is not to be confused with those university students who are to become

secondary school teachers.) The material of the attended lectures was examined by a university appointed examination committee and through a comprehensive examination. If the examination failed, the semester at the teacher training college had to be repeated automatically. An exception from this rule could only be granted in exceptional cases. Students with excellent grades were exempt from training fees at the teacher training college, while excellent grades at the university did not mean an exemption from training fees. (The names of those students who had unpaid fees were listed on the notice board.)

The university contributed to the education of teacher training students through an in-depth academic specialization training. There was no cooperation on the training of pedagogy and methodology. The teacher training college had its own state civil school, where training practice had been completed. The model state civil school was referred to as Active School meaning that the teachers who work there identify themselves in many aspects with the principles of reform pedagogy that advocates action and self-activity.

As a result of the cooperation between the teacher training college and the university, there was an increase in the number of students at the University of Szeged from the end of the 20s:

Year	1921/22	1925/26	1930/31	1935/36	1939/40
University students	1977	2124	4393	2841	2168
Total number of university students and teacher training college students	–	–	4921	3572	3252

The results of the economic recession did not spare the university. Its effect is also shown for example on the fact that from the beginning of the 30s the number of faculties had decreased.

Faculty	1872	1918	1931	1934
Law and state science	12	16	16	11
Medical	11	17	16	14
Arts	11	16	18	13
Natural sciences	8	12	12	9
Total	42	61	62	47

(Based on the charts by Iván Vitéz Nagy.)

The recession also shows itself in the decrease in the number of assistant teachers (assistant lecturers) employed by the university. In 1921, the number of these employees was 103 and went up to 177 by 1931 (59 of them without remuneration), while, as a result of the recession, in 1934, there were only 98 paid assistant lecturers employed by the university.[8]

Therefore, Szent-Györgyi had arrived to become a researcher and professor at a university that, following a relocation procedure, had serious financial difficulties, had a noteworthy development curve in the 20s, but this velocity was broken by the beginning of the 30s.

2. The progression of the views of Albert Szent-Györgyi expressed on university education and upbringing

2.1 Speech on the congress of the National Council of Physical Education, 1930

Within the time period of discussion, the first speech of Szent-Györgyi, who had just returned from England, was made in 1930 at the congress of the National Council of Physical Education. He begins his speech with a dramatic illustration:"Our country is in its most tragic hours when every spark of skill is needed from its sons if our country's name is not to be wiped out from those of the living. This difficult challenge poses very new goals and demands also for our school system. Schools, as builders and creators of the youth and the future, have an imperative say in the outcome of the battle for the nation's existence."[9] Therefore, in times of crises, we may expect the schools to bring us a brighter future through the proper education of the youth. However, the school system is in a crisis itself: "it does not meet the new and heavy demands of the times".

For present-day readers, it may be unusual that Szent-Györgyi examined the duties of an ideal school not through the school types within the general education system, but through their relevance on the university. To answer the enquiries on the goal of the university, Szent-Györgyi draws a remarkable

[8] Reference: Vitéz Nagy: i.m. p. 366

[9] The speech of Albert Szent-Györgyi on the congress of the National Council of Physical Education, November 1930. Full text available: *http://www.waldorfsuli.hu/index.php/wal-dorf-pedagogia/olvasosarok/396-szent-gyorgyi-albert-az-iskolai-ifjusag-testnevelese* Downloaded: 18 December 2012.

parallel between the two most famous English private universities, Oxford and Cambridge, and the contemporary European universities. He starts with the European ones: "The university, as every school, may do two things to its students: teach and educate them. In the continent most of the universities are on the opinion that they are not educators, but purely teaching institutions and training schools."[10]

Albert Szent-Györgyi counterpoints the continental European, or believed to be such, model with the English model. They do prepare a small number of excellent scientists within the walls of Oxford and Cambridge, but the main role in these institutions is education: "Here they do not educate lawyers, chemists or doctors, but, first of all, form human characters" – summarizes the main point Szent-Györgyi. To highlight the main point of the English model, Szent-Györgyi recalls a personal story: meeting a Cambridge student. "The first time I got close to solving the mystery was when I made an attempt to meet a student in the afternoon in his apartment. When I rang the bell at the student's apartment in the afternoon, the person who opened the door was surprised at my lack of knowledge that, in the afternoon, I was looking for the student in his apartment and not in the sports field. I sat down in the student's room to wait for him. In the room it was noticeable that there were all sorts of things: paddles, hockey sticks, golf clubs, croquet mallets, etc, except for one thing: academic textbooks. When, after a long wait, the student arrived home still warm and red from the sport activity, I introduced myself and asked him what he was doing in Cambridge. He replayed that he was rowing. He was surprised when I told him that that wasn't what I meant because I wanted to know what his major was. After a short thinking time he told me that it was philosophy and psychology. I asked him what he wanted to be and he told me that he would go to India to become a tradesman.

[10] It should be noted that at this point the scientist from Szeged is a bit generous in his way of dealing with the trends in university history. The fact is that the most significant archetype of the modern European university is built on the neo-humanist education thought that is the outcome of the philosophical discourse that runs from the end of the 18th century. The main representative of this thought is Wilhelm von Humboldt (1767–1835). He believes that the basic thought that determines the operation of a university is the unity of research and teaching and the formation of the human character by realizing the human content through the *Bildung* (character development through education). Parallel with this thought, and as a counterpoint, ran the French concept that emphasises the professional training role (training school) function of the universities.

The problems of the Hungarian school system begin in the secondary schools and not at the universities. Secondary schools believe that their main purpose is "to push the content of 100 or 200 kilograms of textbooks into the students' heads and then release them." This bleak pushing procedure kills the child. From the young person who arrives at the university "the 12- year-long conning and full pace had destroyed and killed every bit of originality and interest. Such students are only interested in having to learn the material from the bottom of which given page to the top of which given page in order to pass his examination. His only wish and hope is to have his diploma and some kind of job and, with that, to transfer the burden and annoyance of his life to the state. In our country today the same thing happens to a six-year-old as with someone who commits patricide: he is sentenced to 12 years of imprisonment and strict hard labour. In the school every virtue of a child's soul: vigour, liveliness and joyfulness are sins. The need of a child's spirit to learn is satisfied by conning, threats and lifeless teaching. And after 12 years of such preparation, the adolescent youth is sent to us at the university: we teach, teach, teach and teach. When, after five years, we completely deprive them of every skill to act and think freely, we suddenly push them out into the real life and we are really surprised that they cannot stand on their own, and that this poor country cannot move out of its own misery." What do young people learn in the secondary schools? Almost nothing, says Szent-Györgyi. "…young people who leave secondary schools do not know anything about nature or natural sciences, they do not know modern languages on a level to be able to write a simple letter or speak to a foreigner."

These words suggest a passionate and dramatic illustration. The solution is a deep educational reform that changes the learning material, and also assigns an important role to sport activities and body culture.

The overgrown secondary school learning material, the uncontrolled quantities of homework and the lack of sport activities lead to the mental overload of the youth. This criticism is not without precedent because such ideas had already been expressed by German physicians in the first half of the 19 century. In 1836 an article appeared in the German *Medizinische Zeitung* journal. Physician Karl Ignatz Lorinser warns about the overload of secondary school students.[11] Through the generations, the restlessness and increased exploitation of the soul had lead to a growth in the weight of the nervous system. The schools have only worsened the situation. The mass of subjects and home-

[11] Quoted from: Plake, Klaus: *Reformpädagogik. Wissensoziologie eines Paradigmenwechsels*. Waxmann, Münster-New York, 1991. 149.

work impede the natural growth of the body. Already in 1893 Lorinser says the following: "The ones who work the hardest are the most vulnerable and the most prone to illnesses. A physician from Breslau, Hermann Cohn, had carried out research and, based on that, suggested that the increased mental exploitation of the youth and the increase in the demands for performance have lead to short-sightedness. In the 70s there was a whole line of publications on the topic and conferences were organized on the topic of school overload. By that time, experts had agreed in that overload is not restricted to school lessons. The quantity of homework is to be reduced so that in the lower classes of secondary schools the completion of such work should not take more than two hours a day. Meanwhile, several doctors have expressed increasingly critical views on the overload of children in schools. They emphasised that in addition to short-sightedness, headache, nose bleeding, digestion problems and asthma are all symptoms of illnesses that are caused by the school. Overload was also blamed for the increased number of suicides among students at the end of the century. Finally, in 1890, Kaiser Wilhelm II made a statement regarding the issue: during the opening at an educational conference in Berlin, he compared the work burden that the youth carries to an overstretched string in a bow, which calls for a significant decrease in the learning material. The Kaiser's wish was followed by action: during the reform of the German secondary schools, the curriculum, which came into effect in 1892, had a 16 hour reduction in the weekly number of lessons and there was a significant reduction in the material regarding the Latin and the Greek subjects. Furthermore, there was a drop in the demands of the school leaving final examinations.

In 1930, Albert Szent-Györgyi is looking for a solution for the problem of university overload: "Here, at the university, the first step should be a drastic reduction in the number of lessons. This step should ban every lecture after 13 p.m. to allow every student to spend at least every second afternoon with sports."[12]

2.2. Natural sciences training and laboratory work in university education, 1936

In comparison with the previous views, when we look at the content of this text, we notice a complete paradigm shift. At the beginning of the century, Szent-Györgyi uses the English educating university model as an example to

[12] Albert Szent-Györgyi (1930): i. m.

follow, and is against the one-sided mental overload, but now he writes about three functions in balance, where, in addition to the teaching and cultivation of sciences there should be a place for professional training that prepares for a career in life. The strengthening of the university's role in professional training is reasoned by the scientist with the fact that from the end of the 19th century natural sciences had changed the lifestyle of a significant part of mankind, established new forms and created great industries. "This new situation assigns new tasks to universities, which organization and entire structure derives from an age before the modern times. While earlier, those few who wanted to gain knowledge, attended the universities and the professors there, mainly for the knowledge itself, but today the university opens its gates for a great number of young people, most of whom do not seek science, but professional training to be used in their professional life to earn their bread and be useful workers in life."[13] Because of this, the university should have the role of a professional training school that prepares for life. Thus, young people "have the right to demand the training that that we had admitted them to and for which they had paid their fees". "It is our duty to provide them with this training." But who is to give this training for the students? A professor "refuses the idea, with righteous irritation, to stand every day for hours at the lecture table and recount the basic material, after and after again, from the aspect of various professions instead of cultivating and teaching his own scientific field." It should be the duty of the assistant lecturer staff, whose number and quality needs to be improved urgently, to run those courses that would satisfy the needs of professional training.

In the same study, Szent-Györgyi mentions three more issues that are lead factors in his earlier and later thoughts on the role of universities.

One of these thoughts has already been mentioned: criticism of mental overload. In 1936, he elaborates further on the topic that he started in 1930: The university doesn't teach young people what they need: by referring to academic values these institutions put too much weight on students. The results are depressing: "a semi-scientist with a bent back, who is useless in life."

The next topic is the misunderstood role of textbooks:"There is a misconception in the entire Hungarian education system that says that books are to

[13] Albert Szent-Györgyi: *Természettudományi képzés és laboratóriumi munka az egyetemi oktatásban.* Magyar Felsőoktatás. *Az 1936. évi december hó 10-től december hó 16-ig tartott Országos Felsőoktatási Kongresszus munkálatai*. Published by: Bálint Hóman, Edited by: Károly Mártonffy. III. Bölcsészeti, Orvosi és Műszaki Szakosztályok. Budapest, 1936.

be learned. This is fundamentally wrong. If we keep the data in our heads, why do need books? (…) What we need to learn is exactly what's not in the book: how to see and understand the bigger, inner correlations and use the book in a proper way." The head is for thinking not to store various data. This pattern also recurs later in the writings of Szent-Györgyi.

The third topic is good teaching practice. The main criterion for this is taking the personality of the students into consideration: "Teaching should get down to earth and understand that it deals not only with brains, but young people. This is to be considered especially with natural sciences where independent vision and thinking can make the student understand the already known facts and conquer the unknown."

Albert Szent-Györgyi drinking tea with his students

2.3 Inaugural speech for the Rector's office, 1940

In 1940, as a result of the Second Vienna Award, The University of Ferenc József, which was moved temporary to Szeged, was relocated to its original residence: Kolozsvár. In the school years 1940/41, in spite of the very difficult conditions, the work began in five faculties. These were the following: 1.The faculty of law and state sciences, 2.The faculty of medicine, 3.The faculty of arts, languages and history, 4.The faculty of mathematics and natural sciences and 5.The faculty of economics. Article XVIII, 1940, which relocates the run away university, also states that the town of Szeged, which was ready to make sacrifices, should be compensated with the establishment of a new university. In line with the law, at this new University of Magyar Királyi Horthy Miklós, the following four faculties are to be established: 1.The faculty of law and state sciences, 2. The faculty

of medicine, 3.The faculty of arts, languages and history, 4.The faculty of mathematics and natural sciences. Although the legal frames had created the opportunity for the two institutions to be separate, and develop in different ways, in practice, at the beginning, the university in Kolozsvár, residing in Szeged up until that time, had broken into two. Some of the professors moved back to Kolozsvár, while others stayed in Szeged and formed the core staff of the new university. Albert Szent-Györgyi was in the latter group.

At the beginning of the 40s, the prime officers of the university, in line with customs, had an annual rotation basis for the Rector's seat. After they were inaugurated as Rector, they welcomed the members of the university with an inaugural speech. In these speeches, which later appeared in print, the newly inaugurated Rectors mainly elaborated on their own policies regarding the university.

In the school years 1940/41, Albert Szent-Györgyi was the Rector of the University of Horthy Miklós in Szeged. As regards the content of his inaugural speech, it falls in line with the pattern that had begun a year earlier, where the author uses the criticism of general education and the university to explain what he thinks the main tasks of an ideal university are. It is noteworthy how the definition of these tasks varies in the different publications. In his inaugural speech, Szent-Györgyi describes four tasks for a university: "The oldest mission of the university is to collect, distribute and increase the knowledge of mankind. Its second task is to educate, in small numbers, scientists for the future, scientists, who shall later inherit this task form us. A third, newer, but not less majestic task of the university is to educate citizens for the country, citizens, who are equipped with intellect." Its fourth special task is "to be the centre of the great Hungarian plain: the *Alföld*."[14]

The first three tasks, as seen above, appear in his previous works on the topic, but the last one is a new part of the system. By reading the idea on the *Alföld* as a centre another thought comes to mind. From the history of Hungarian schools, we know very well the unique knowledge concentrating and distributing role of protestant schooling that work within a linear system: from elementary training up to the academic level. With a present day term, we can say that these schools also operated as regional knowledge centres. This happened in two ways. In the first place, these schools accommodated poor, but talented pupils, who in the facility turned into educated professionals. In

[14] Albert Szent-Gyögyi: *Rektori székfoglaló, 1940.* (Inaugural speech for the Rector's office, 1940) In: Albert Szent Györgyi: *Egy biológus gondolatai.* Gondolat Kiadó, Budapest, 1970. pp. 120–124.

Hungarian school history this is an early example for talent care. In the second place, it had been a century old practice that the facility sends twenty-something-year old senior students to do teaching in the schools of nearby or farther located towns or villages. These senior (toga wearing) students acted as living links when they distributed the knowledge they gained at the facility to the pupils trusted to them. This was a decentralized school system that had operated for centuries. It is possible that Albert Szent-Györgyi had something similar in his mind: the establishment of a system that distributes culture and counterpoints the capital as centre.

If we return for a moment to the third task that was mentioned in the speech, we can see that Szent-Györgyi was still interested in the old dilemma of universities: should they prepare scientists or provide professional training and prepare for civil life? Now, Albert Szent-Györgyi puts more emphasis on the latter tasks. He reasons that the university has opened its gates for the masses of young people who do not want to be scientists, but useful citizens in public life. This is one reason that suggests that the role of professional training should be given prominence. The other is that the university had given up its financial independence and accepted the financial support of the state. Because of that it cannot close itself, but has to adapt to the changed needs of society. The university has to meet both the demands of the state, which finances the university from the taxpayers' money, and the students, who have to be prepared for public professions, in line with the needs of such training. However, the training of scientists and professionals cannot be mixed without a drop in the level of quality, therefore, the two should be separated. To enable the dual channel training, it is necessary to raise the number of teaching staff members.

However, a university providing professional training is not the same as a vocational school. A university should also educate its students: it should expect a long line of "moral and metal characteristics" among which are the need to be creative and being able to take action, the feeling of responsibility, readiness to take action, clear-headed and fast judgement skills, honesty, interest and selflessness. In addition to these qualities, the university should educate people to lead a healthy life. As the newly inaugurated Rector says at the end of his speech: "…to fulfil a professional role, one also has to be healthy, so I wish to see that the university students have broad shoulders, straight backs and lively faces; our university should make sure that the opportunity is given to realise these goals as well."[15]

[15] Albert Szent-Györgyi (1970): i. m 123.

2.4. Lecture on correct and incorrect pedagogy, 28 February 1941

In the examined period, the line of publications on university pedagogy is closed again by a lecture that was held by Albert Szent-Györgyi to the audience of the *Szegedi Egyetembarátok Egyesület* and the transcript of which was published in *Magyar Nemzet* on 28 February 1941. For today's readers, it may seem strange that there is a paradigm shift that is apparent from the text of the newspaper. In his lecture, Albert Szent-Györgyi says (*expressis verbis*) that the main goal of the university is professional training: "the main goal of the university is not to train scientists, but primarily to prepare young people for public careers. The university owes a great and new responsibility towards the nation that sustains it. The university has to make sure that the masses of young people coming to the institution become useful members and citizens of life and the nation."[16] Before we draw the conclusion that in this speech the scientist admires only the down to earth utilitarianism, it is worth reading further: "It is not the aim of the school to serve theoretical pedagogical ideas, but to educate useful, happy and healthy citizens. […] It is not enough to train people for a profession because without a line of values in character, morals and body, profession in itself is valueless or directly harmful." Here, the principle of usefulness is complemented with the aspiration to fit into a community and become happy, which is impossible without success in social life. All these are supplemented with the task of educating the character and preserving health. Here, the reader faces a complex idea on man that bears both the effects of the antique Greek harmonic ideas on man and the modern English philosophy that strives to be practical.

Albert Szent-Györgyi was an excellent speaker: he was able to convey his thoughts by adapting the qualities of live speech and use the means of rhetorical forms. This feature of his becomes especially noticeable when he, in a vitriolic style, criticises the contemporary education system. The following citation illustrates this: "I look at our 12-year-old boy scouts. We can hardly find so much talent, pleasantness, selflessness and spirit elsewhere. This is not the easy high-flying spirit of the youth; here the spring of our national spirit flows undisturbed. And what becomes of these values? Where do they get lost? The young man who leaves the secondary school is apparently tired and worn-out, while the 25 year old, who enters life, only dreams about a job until retirement, where he doesn't have the burden of any sort of responsibility on

[16] Albert Szent-Györgyi: *Előadás a hibás és a helyes pedagógiáról.* (Lecture on correct and incorrect pedagogy) Magyar Nemzet, 28 Februrary 1941

his shoulders. There must be a fundamental error in education, teaching and the ways of teaching, as these, squeeze the most precious qualities of the soul out of the 10 to 20 year olds; qualities that are the most needed ones in doing creative work. Our youth go to university with a great ballast of unnecessary knowledge." This is a striking to-the-point evaluation of the contemporary (only contemporary?) school system…

Albert Szent-Györgyi with his students

3. The university pedagogy of Albert Szent-Györgyi

In Albert Szent-Györgyi's publications on the topic of university pedagogy, the constant and changing patterns are highly noticeable. In this respect there are three topics:

1. It is noticeable that in the period between 1930 and 1941, Albert Szent-Györgyi's notions on the duties of the university had changed. His notions on the tasks of training scientists, researchers and professionals have changed, and, by the end of the decade, the emphasis was on training practical professionals.

2. On the other hand, his thoughts on the duty of the university to improve character and shape personality have not changed. With this distinctive idea, Szent-Györgyi has created an important trend in the history of Hungarian thinking on the role of universities.
3. A constant topic of these publications, which is elaborated on with a more and more critical attitude, is school criticism. This not only refers to secondary level schools, but to the university itself.

As mentioned above, Albert Szent-Györgyi did not express his thoughts on pedagogy as an official representative on the field of education, or a writer on pedagogy, but as a scientist who is very much interested in several issues in public life, and as a university member who feels responsibility for the fate of the university. The intellectual environment, where he formed his thoughts on education, shaped the change of his ideas. In his publications and published speeches on the topic, there is a distinctive and new pattern, which, as far as we can judge, makes Szent-Györgyi's pedagogy unique, and for today's readers illuminating: the need for an education that prepares people with full values and the establishment of such a program also in higher education that shapes harmonic personalities. Because of this, we may risk saying that, within the walls of the university, Albert Szent-Györgyi, the late Renaissance man, wanted to see the education of the ideal Renaissance man.

Bibliography

- Bisztray Gyula, Szabó T. Attila és Tamás Lajos (ed.): *Az erdélyi egyetemi gondolat és a M. Kir. Ferencz József Tudományegyetem története*. Budapest, 1941.
- Kardos István: Beszélgetés Szent-Györgyi Alberttal. In: Szent-Györgyi Albert: *Az élet jellege*. Magvető Kiadó, Budapest, 1975. pp. 53–117.
- *Négyszemközt Szent-Györgyi Albert professzorral. A Nobel-díjas tudós nyilatkozata a diákegység jelenéről és jövőjéről*. Riport, Magyar Nemzet, 28 February 1941
- Plake, Klaus: Reformpädagogik. Wissensoziologie eines Paradigmenwechsels. Waxmann, Münster-New York, 1991.
- Szent Györgyi Albert: *Egy biológus gondolatai*. Gondolat Kiadó, Budapest, 1970. pp. 120–124.
- Szent Györgyi Albert: *Észrevételek a nevelésről*. In: Szent-Györgyi Albert: *Válogatott tanulmányok*, 1983
- Szent-Györgyi Albert: *Rektori székfoglaló*, 1940. In: Szent Györgyi Albert: *Egy biológus gondolatai*. Gondolat Kiadó, Budapest, 1970. pp. 120–124.

- Szent-Györgyi Albert: *Előadás a hibás és a helyes pedagógiáról*. Magyar Neet 28 February 1941
- *Speech of Albert Szent-Györgyi on the congress of the National Council of Physical Education,* URL: http://www.waldorfsuli.hu/indexphp/waldorf-pedagogia/olvasosarok/396-szent-gyorgyi-albert-az-iskolai-ifjusag-testn-evelese Downloaded: 18 December 2012.
- Szent-Györgyi Albert: *Az élet jellege*. Magvető Kiadó, Budapest, 1975. pp. 53–117.
- Szent-Györgyi Albert: *Természettudományi képzés és laboratóriumi munka az egyetemi oktatásban. Magyar Felsőoktatás. Az 1936. évi december hó 10-től december hó 16-ig tartott Országos Felsőoktatási Kongresszus munkálatai*. Published by: Hóman Bálint, Edited by: Mártonffy Károly. III. Bölcsészeti, Orvosi és Műszaki Szakosztályok. Budapest, 1936.
- Szent-Györgyi Albert: *Válogatott tanulmányok*. Gondolat, Budapest, 1983.
- Tóth Tamás: *Az európai egyetem és a modern filozófiák*. In: Tóth Tamás (ed., 2001): *Az európai egyetem funkcióváltozásai. Felsőoktatás-történeti tanulmányok*. Budapest. URL: http://www.fil.hu/tudrend/Tt/egy-kot/toth1.htm Downloaded: 11 November 2012.
- Vincze Gábor: *A száműzött egyetem*. Szeged, 2006.
- Vitéz Nagy Iván: *A száműzetés évei Szegeden. 1920–1940*. In: Bisztray Gyula, Szabó T. Attila és Tamás Lajos (ed.): *Az erdélyi egyetemi gondolat és a M. Kir. Ferencz József Tudományegyetem története*. Budapest, 1941.

Csaba Jancsák

Albert Szent-Györgyi and the Student Union of the University of Szeged

Introduction

The period we are about to discuss is a short phase of Albert Szent-Györgyi's career in Szeged, barely a year. However, this is a phase with a great moral even for us now. The 1940/41 academic year is an extremely interesting year both for the university and its youth and for the city's history, when events of high ideals and deep dramatic happenings took place at the same time. This was one of those rare moments when youth becomes the main actor on the stage of history, and therefore became victims of historical turmoil, too. The article wishes to keep alive the memory of Albert Szent-Györgyi as a humanist, university leader, Nobel Prize winner scientist, and the students and university citizens of that period.

The article discusses the issue of autonomy in higher education and the issue of the students' democratic pattern of action. We emphasise that universities have their own individual microclimate – a notion familiar to youth research since long time ago. The attention of youth research turned to the active public role of the students due to events at the University in Szeged in the week before the Revolution of 1956, namely, the establishment of MEFESZ (Association of Hungarian University and College Students, AHUCS). However, this youth activity appeared in the higher education of Szeged for the first time on a university level, under the leadership of Rector Albert Szent-Györgyi, more than seventy years ago.

We are time travelling to the world of contemporary university citizens. This lifeworld may also be called the period of campus existence, the university life period, when young university citizens live in the campus. We analyse the issue of student self-activity in the case of the student union at the university in Szeged and Albert Szent-Györgyi's role in it. Juventus ventus! – since antiquity we know youth is like the wind. And what is wind like? It can be destructive, hurricane-like, stormy, icy, cold, bringing frost. But at the same time it can also light, free, happy, a breath of fresh air. Early documents, press releases, oral-history interviews, and Albert Szent-Györgyi's own statements and memoirs – from which we will quote a few – prove to us that Albert Szent-Györgyi considered youth as resource.

Our first Albert Szent-Györgyi citation is a television statement, in which he answers the English reporter's question about the start of his career: *"As a youngster I was very dull and my family was very worried thinking that I was an idiot and I started developing late and my uncle who dominated my family and was a well-known scientist objected most vigorously when I told him I wanted to go into science and then later he softened and consented that I should go into cosmetics. Ah, and then when I made more progress he consented that I become a dentist. And then even he had a very high opinion of me and said I could become a proctologist – he had haemorrhoids and was interested in that part of the body especially. So when I entered university and started research I started research on the structure of the anus and I feel now that I started science on the wrong end actually."*[1] – this statement – in my opinion – shows not only scientist Albert Szent-Györgyi's greatness and free spirit, but also his sarcastic sense of humour, all of which could carry him through the rough times in his own career and when he supported the birth of the student union at the university in Szeged.

Youth research considers the notion of active participation, which refers to involving the youth into decision making process as a benchmark for democracy. We are applying a typology consisting of four steps to determine how seriously the youth is taken from the point of view of their involvement in the decision making process, i.e. the possibility to make decisions in matters regarding themselves.[2] We do not regard involvement in the decision making process when adults put young people are put into the window as a decoration, nor when they choose "smart" opinions they like. The first step is when the adults ask the youth for their opinion but do not involve them in the decision making process, but make the decisions themselves. The second step is when the adults initiate the involvement of the youth and the decision is a result of a joint discussion. These are the first two basic steps. The third step is when the youth initiates decision making and execution – for which they receive opportunity from the adults. Finally, the last step, and the most complete involvement, i.e. the most complete participation is when the youth involve the adults in their initiatives and into the execution of their decisions, and the adults actively take part and support them. As we will see, university citizens in this period, under the leadership of the Rector Albert

[1] http://www.youtube.com/watch?v=DKfssOAGFcY Last download: 10/11/2012

[2] Arnstein, Sherry R. (1969): A Ladder of Public Participation. *Journal of the American Institute of Planners,* (4), pp. 216–224. and Hart, Roger (1992): *Children's Participation: From Tokenism to Citizenship.* UNICEF

Szent-Györgyi, started their movement, the youth of the university in Szeged, at the highest step, at the widest involvement level.[3] Albert Szent-Györgyi's role in all this is huge. It can be read out from József Halasy-Nagy university professor's words, when he wrote about the birth of the Szegedi Egyetemi Ifjúság (SzEI, Szeged University Youth) in the May 1941 issue of the Szegedi Híd and expressed his hope about the future, "*that the gardener, who planted this noble seed will take care of it and support it even when it will not be his official obligation.*"[4] Professor Halasy-Nagy thought that „*our university's future depends on this initiative's success to a large extent.*"[5]

Towards the Szeged University Youth

Albert Szent-Györgyi was inaugurated as Rector of the university on October 24, 1940. He devoted the first period of his mandate to surveying youth organisations at the university. He was surprised to discover that at the Miklós Horthy University there are youth organisations which are not governed by students, but by elderly leaders. What is more, the majority of members are not university students either and the organisations were under political control from Budapest. Following this recognition, Albert Szent-Györgyi asked Ödön Pollner, a university professor, to look into the possibilities of a newly founded university to make changes in the issue of university student organisations. Ödön Pollner concluded that the fact that Miklós Horthy University started to operate in Szeged, as well as the fact that the previous university returned to Cluj-Napoca, means the termination of earlier student organisations at the university in Szeged and includes the possibility of founding new ones.[6]

During Ödön Pollner's investigation and resolution a law was initiated and adopted by the Upper House between December 11 and 18. The act limited the autonomy of higher education and certain education policy

[3] "Organising was initiated by the students and it should be realised together with the lecturers of the university. The aim is to create an educated type of Hungarians who understand the problems of the youth."– stated Szent-Györgyi to MTI (Hungarian news agency) in Pécs, in his presentation of 18 March 1941. SzN 19 March 1941. p. 3.

[4] SzH March 1941. p. 5.

[5] ibid.

[6] CsML VIII. 5. (Horthy Miklós Tudományegyetem Rektori Hivatal iratai [Documents of the Rector's Office of the Mikós Horthy University]) box number 5, 389/1940-41.

issues were brought under the competence of the ministry in four points. It became ministerial authority to determine the number of students to be accepted to universities and colleges; to determine the basic political and moral conditions of acceptance; to supervise the central organisation of student welfare care; to monitor university and college associations; as well as to determine the conditions under which a student may become a member of an association which is not subject to university or college authority. We are interested in the last two factors. Apart from professor Pollner's investigation results, these two last points initiated the establishment of the university students' Union by students and Albert Szent-Györgyi (who was conscientious that they have a very short period of time at their disposal, since his Rector mandate meant barely a year from December, when he was elected). December 13 is the historical date, when the Rector order issued at ten o'clock instructs the university students to assemble at eleven o'clock in the Auditorium Maximum at Szukováthy square (today Ady square) and listen to his speech about the necessity of a student union at the university in Szeged.

We quote Albert Szent-Györgyi: *"There is a new mood developing at this university, the university cathedra will no longer separate the professors from the students. I would like to make an attempt to unify our university's youth. My primary aim and task is to make university belong to the youth and the youth belong to the university. As a patriot my objective is to provide the youth with the possibility to develop spiritually, since a university citizen's primary obligation is to organise a complete overview of education. The failure of the modern age is that it educates masses and not individuals; this is why we need to make ourselves more human. The shortest path to achieve the above is through the development of sense of responsibility. I would therefore like to involve youth in the leadership of the university. Namely, student life was pretty poor until now, since advocacies from Budapest tried to organise the youth, and this was of course a mission impossible. The new student unity does not want to turn against anybody, nor do they want to put pressure on the youth in terms of ideology."*[7] A report from Délmagyarország – with another quote from Albert Szent-Györgyi. *"I would like to create a self-conscientious student unity, which would take part in governing the university, which can educate itself to become a fully responsible person, a personality. This is the patriotic obligation of the student unity: this is how it should define patriotism. It should educate itself to become a personality, an educated, upright human, because*

[7] SzN 14/12/1940 p. 5.

the failure of the modern age is that it does not educate individuals, but masses, which can then be led to any direction and used to any purpose. This is why a student unity is necessary – continued the Rector – to develop a community which would replace various disruptive and divergent associations, and which provides opportunities for further development outside the university, in clubs and in any other respects to make the student become a personality. This was not present till now. There were certain advocacies in Budapest, but they cannot deal with the issues of the province."[8]

After the event the extremists launched an attack against Albert Szent-Györgyi, which evolved into an attack series and followed him through his whole mandate as a Rector. Albert Szent-Györgyi referred to the results of the Pollner investigation in the speech above, when he talked about the youth association governed from Budapest. This reference basically regarded the Turul Association.

The University Council regulated this matter through a regulation under which the Szent-Györgyi issued a Rector's notice[9] on December 18, 1940 determining that "*a university student can become a member of an association, whose leadership is not under university governance (Turul and its divisions – Csaba, Rákóczi, Árpád, Emericana, Gábor Bethlen Circle, Luther Circle, etc.) only with University Council's permission.*" An exception from the above are students who became members of above mentioned associations before the establishment of the Miklós Horthy University, and they could keep their membership. According to the regulation, those who intend to become members of the above associations are obliged to request the permission of the Council, otherwise "*becoming a member of the above mentioned associations calls for a disciplinary action*".

As a result of this, in Turul Association's newspaper, Szegedi Új Nemzedék an attack was launched against Albert Szent-Györgyi and against the student union at the university in Szeged.

This attack was reinforced by another event, in which Albert Szent-Györgyi declared his commitment to an exclusion-free student union. The leaders of the Turul Association, Vilmos Fitor national leader, Ede Babiczky regional leader, Dr. Elemér Veres and Péter Jung primus magisters, as well as Dr. László Halász Szabó, leader of the Szentes organisation appeared before Albert Szent-Györgyi and in a more than hour-long meeting demanded from the Rector to

[8] DM14/12/1940 p. 3.

[9] CsML VIII. 5. (Horthy Miklós Tudományegyetem Rektori Hivatal iratai [Documents of the Rector's Office of the Mikós Horthy University]) box number 5, 208/1940-41.

allow the functioning of the Association at the University. They argued that *"at other universities of the country the Association is not only welcomed, but acknowledged and supported, it is only the university in Szeged that does not even provide a place for them on its premises"*[10]. Szent-Györgyi rejected this by declaring that he wishes to support a student union which is not fractioned, in which students are members due to their status as university students, consequently, they are not divided based on religious, church affiliation, faculty membership and other differences, but are members of the organisation to be founded exactly based on their university citizenship[11].

The next event in the birth of student union at the university in Szeged happened on February 17, when student council elections started at the university in Szeged.[12] In the next three days 22 medical students (years 1-5), 11 student from the Faculty of Arts (years 1-4), 8 pharmacy students and 12 students from the Faculty of Mathematics and Natural Sciences (years 1-4) were elected. With regards to this event two things need to be emphasised: firstly, the students elected representatives on the level of years (i.e. year representatives), and secondly, this election happened without any official candidature, based solely on the students' public trust.[13] This may appear extraordinary having in mind our modern sense of law, when both in the political arena and during student council elections major campaigns strive to obtain representatives and lobbies.[14]

In the days to come, while the students organised the movement[15], the Rector gave several presentations in this topic, out of which the most important is the one held on February 27, 1941 at the Friends of the University open

[10] SzÚN 21/12/1940 p. 8.

[11] MN 21/12/1940 and Journal of Szeged 21/12/1940 p. 3.

[12] SzN 21/02/1941 p. 4.

[13] "The leader is finally not the loudest person, but one whom the youth considers devoted." – wrote István Kristó-Nagy Junior student in the May1941 issue of Szegedi Híd (4.p.)

[14] Jancsák, Csaba: Hallgatói demokrácia és a hallgatói önkormányzatiság Magyarországon (1988 – 2008) [Student democracy and student self-governance in Hungary (1988 – 2008)] In: *Állampolgári kompetenciák kutatása és fejlesztése. Útkeresés és továbbadás az aktív állampolgárságra képzés folyamatában.* Belvedere Meridionale, Szeged, 2008, pp. 39-56.

[15] "*I was not the one who founded SZEI, it was inspired by the students, I only helped them find themselves*, discover their studentship, their sense of community and responsibility, but my principle was always that *students should guide themselves*, so all I am doing now is making sure that all issue concerning the students should be left

university[16], where he stated that organising the independent student youth's plays a central role in his Rector credo due to the functions of the university to educate and create intellectuals. *"The role of a modern university is not only to convey expertise, but to educate in the purest and most complete sense of the word. Namely, contemporary universities are important organisations of the state and public life, especially because the university became the preparatory school for the public life. And we expect both expertise and personal values from a public figure. What means do we have to form personalities? Primarily lectures, if they are not merely a pile of superficial data. Apart from lectures, it is the youth itself that can provide possibilities for a richer life. University youth should not be united only within its own group, but with the university on the whole. The framework for this is already given at the university in Szeged, and it should be filled with content. We can hope the university in Szeged can become a genuine, warm home for the Szeged students. Consequently, graduates from the university in Szeged will have a fuller spirit."*[17] This modern attitude based on idea of free thinking was the most important element of Szent-Györgyi's "pedagogical programme"[18]: he thought acquiring "know-how" type of knowledge is essential, and contrasted it with estranged, inert knowledge, memorising and cluttering the brain with chaffs[19]. We can therefore conclude that Szent-Györgyi, a committed believer in value-filled higher education, considered the university's most important task to convey values – both in formal educational form (lectures and seminars) and in informal educational situations (e.g. free time).

---

in the hands of the students." Albert Szent-Györgyi: A SzEI-ről. [About SzEI (Szeged University Youth)] SzH 02/05/1941. (Italics taken from the original text – the author.)

[16] Szent-Györgyi held several presentations in Szeged about the thought of student unity and its objectives. He devoted his trip to Pécs in March to show his support of the idea of student unity. (SzN 19/03/1941 p. 3.)

[17] SzN 28/02/194 p. 4.

[18] "My activity as a Rector was guided by two convictions. One of them is that the aim of a university is not only to cultivate, teach and improve expertise, but primarily to educate the youth; my other belief is that the university belongs to the students and the students belong to the university." Szent-Györgyi Albert tanévzáró ünnepséget megnyitó beszéde, 1941. június 5-én. [Albert Szent-Györgyi's opening speech at the academic year closing ceremony on July 5, 1941.] In: Újszászi, Ilona (szerk.): *A szegedi felsőoktatás integrációjának története (1981-2010).* Szegedi Tudományegyetem, Szeged, 2010, p. 35.

[19] Szent-Györgyi Albert: *Az élet jellege.* [The Nature of Life] Magvető, Budapest, 1975, p. 91.

The structure of the Szeged University Youth

The students' home: the Club

On March 15, 1941 the home of the Szeged university youth was handed over. Szent-Györgyi notified the Minister about the creation of the organisation in a notice issued March 24 and called for the registration of the organisation under applicable laws. The youth workgroups received rooms partly on the ground floor of the Faculty of Law which moved back to Cluj-Napoca and partly in the basement of the central building. The Rector determined the function of the university club to be a place where the students can *"relax, read, have fun and meet fellow students"*[20]. Later, when he visited Hungary in 1973, Szent-Györgyi[21] reminisced about this event and the microclimate at the time: *"One should not only live, but should enjoy life. People can work well only if they can entertain well. If they can rest. If they work a lot, they cannot rest from work and then cannot work, either. Consequently, I wanted to provide a more colourful life to the students, so we created a club, where – similarly to old clubs – you can sit in these high chairs. It doesn't affect anybody's morality, if you sit on a chair. But it gives a certain colour to things. We were subjects to attacks immediately."*[22]

All this ignited another set of attacks. Szent-Györgyi was assaulted from right-wing press for trying to introduce liberal spirit – not to be confused with the modern sense of liberalism – i.e. the Anglo-Saxon type of liberal

[20] SzH 02/05/1941 p. 2.

[21] Albert Szent-Györgyi came to Szeged, Hungary, to be inaugurated as an honorary doctor. This is when István Kardos filmed a two-part portrait movie about him. An edited version of the text in the movie was published in 1973 as part of Albert Szent-Györgyi's book The Nature of Life (pages 57-116). Medical University of Szeged inaugurated Albert Szent-Györgyi as an honorary doctor on October 12, 1973. An interesting information: the legal predecessor of the Medical University, József Ferenc University, which "emigrated" from Cluj-Napoca and was embraced by Szeged, already inaugurated Albert Szent-Györgyi as an honorary doctor in 1938 (Albert Szent-Györgyi was a lecturer at the institution from 1931 till 1945). József Ferenc University in 1940 moved back to Cluj-Napoca, i.e. part of the university (primarily its Faculty of Law), and a new university was established in Szeged, the Miklós Horthy University, whose first Rector was Albert Szent-Györgyi. From 1945 the name of the university was changed to University of Szeged, and in 1951 the Medical University of Szeged (SZOTE) formed and independent institution. In 1987 the Medical University of Szeged became Albert Szent-Györgyi Medical University (the abbreviation remained SZOTE). In 2000 all higher education institutions were integrated into University of Szeged.

[22] Szent-Györgyi Albert 1975, pp. 96-97.

atmosphere, the world of Anglo-Saxon universities' free thinking intellectual clubs to Szeged. In one of the rooms of the Club created in the central building there were table tennis tables, the other was a reading room and the third a dining room. Szent-Györgyi wrote his thoughts about the Club in the Szegedi Híd magazine.[23] When reading the article, we understand what he attempted to do: *"There is no room for card games, alcohol nor inappropriate talk within the walls of the club" […] "a junior officer serves the students nutritious food and drinks for pennies, while they (both in Oxford and Cambridge) spend their free time there and get educated for a life as intellectuals"*.

Later in the Club one could also buy a SzEI (Szegedi Egyetemi Ifjúság, Szeged University Youth) badge designed by university student Béla Jankó. It cost 2 fillérs (change, Hungarian equivalent of USD cent or GBP pence). The badge represented a candle on a shield and above the shield there was the title Szegedi Egyetemi Ifjúság (Szeged University Youth).[24]

Operational resources and workgroups of the organisation

What income did the student union have? Primarily the membership fee paid by students in the amount of 1 pengő.[25] This was approximately one percentage of the scholarship fee of that time. Szeged' mayor, József Pálfy, supported the foundation of the club by five thousand pengő and Bernát Beck, capitalist from Szeged and an Upper House representative by 1000 pengő. These two donations from the two liberal public figures and the fact that Bernát Beck was of Jewish origin provided fresh impetus for attacks from extremists. Albert Szent-Györgyi and the newly formed youth organisation were attacked in the Nemzetőr (National Guardian) newspaper. In Turul's newspaper, the Szegedi Új Nemzedék (New Generation of Szeged), the following statement appeared: "*The Turul Association does not hinder anybody in forming an organisation provided they do so along Christian values, but we will inevitable confront any formation that accepts Jewish, liberal money.*" [26]

What was the structure of the Szeged University Youth? It is best described in a three level way. First of all, it was layered according to "professions" (or

[23] SzH May 1941 p. 2.

[24] SzH January 1942 p. 9.

[25] CsML VIII. 5. (Horthy Miklós Tudományegyetem Rektori Hivatal iratai [Documents of the Rector's Office of the Mikós Horthy University]) box number 5. 208/1940-41.

[26] SzÚN 27/03/1941 p. 4.

as we would call them today, training areas), which mirrored the faculties of the university. In other words, the faculty-related legal status of students provided the first level – as seen before, student elections, elections of representatives happened in this way, too: Medical Faculty candidates, Pharmacy Faculty candidates, Chemistry Faculty candidates, teacher candidate (Faculty of Arts and Faculty of Mathematics). The second level is an inner hierarchical relationship: the *Council*, comprised of heads of expert groups and work communities, representatives of years comprised the *Election Assembly* and the *Representative Assembly*, there was also an *Audit Committee* for financial audit purposes, *Information Service* responsible for the informing the public, *Liaison Service* liaising with external contacts, as well as *Support Service* dealing with the student-social matters. Note that this structure to a great extent reflects the modern University of Szeged's student self-government. It is also worth emphasising that the Representative Assembly, as the student self-government caucus and the Council, similarly to the student self-government presidency, as well as different audit, informational and other social committees have been founded here at the university already then, in 1941, for the first time in Hungary. The third level is the structure built of activities and specialisations. Members of the Szeged University Youth were involved in the following self-active groups: *Hungarian Cultural Work Community, Choir, Hungarian Word Work Community, Art Lovers Work Community, Photography Lovers Work Community, Sports Work Community, Religious Work Community (Maria Congregation, Gábor Bethlen Circle, Luther Association), Theatre Company.* These eight activity groups basically cover all segments of a student lifeworld. A short note with respect to the Szegedi Egyetemi Atlétikai Klub (SZEAC, Athletic Club of the University of Szeged): we can find similar names in the contemporary university sports life of university cities, which denote the university framework of operation. These associations were hotbeds of not only university (mass) sports, but also of national competitive and elite sport and therefore played an important role in improving the quality of domestic sports life.

In what follows I will elaborate on two working communities. The first one is the *Hungarian Cultural Work Community*, led by Sándor Kiss,[27] a student

[27] Sándor Kiss (1918-1982) after completing Teacher Training Institute of the Reformed Church in Sárospatak, between 1937 and 1941 Hungarian-History major at the State Civil School Teacher Training College. Acquired teacher training institute's teaching qualification at the Apponyi College in 1943. http://www.tortenelmitar.hu/index.php?option=com_content&view=article&id=4705&catid=74:k&Itemid=67&lang=de Last download: 2013.01.07. Cf.: Jancsák, Csaba (2010): Hallgatói élet és ifjúsági szervezetek az Állami Polgári Iskolai Tanárképző Főiskolán. [Student life and youth organisations at the State Civil School

from Apponyi College. Approximately two dozens of students were members of this group. However, many more people attended their events, which were open to the public. This community's work was structured around three themes. One of them was – as explained by them – to make the students realise they want to know more about themselves and Hungary. Make them conscientious about everything that is truly Hungarian in them in every area of life[28]. The other theme is Hungarology scientific research and village research, or as we would call it today, cultural management and rural development. With regards to this group's activity it is important to mention that between January 7 and 22 (1942) they organised the first adult education programme in Hungary initiated by students. At the event, which could be referred to as informal training, university students gave lectures to farming youth. When doing research on the history of the university, we will find that the *Hungarian Cultural Work Community* had an immediate antecedent in the middle, i.e. in the second half of the 1930's. Its name was Szeged Youth Art College and it is considered by quite a few historians and sociologists[29] one of the most important Hungarian youth movement. We can see that between 1937 and 1940 some of the students could transfer this tradition as a value-transfer to their younger fellow students. The Szeged Youth Art College (1930-37) developed partly from the village research movement and partly from Gábor Bethlen Circle of students of the Reformed Church.

Who were the prominent figures of this organisation? I emphasise the following members based on their contribution: Ferenc Erdei[30], Gyula Ortutay[31],

---

Teacher Training College] In: Kiss, Róbert –Tamás Vajda [eds.]: *Az állami Polgári Iskolai Tanárképzős Főiskola története (1928-1947).* Belvedere Meridionale, Szeged, pp. 117-133.

[28] SzH March 1942 p. 9.

[29] Csaplár, Ferenc (1967): *A Szegedi Fiatalok Művészeti Kollégiuma.* [Szeged Youth Art College] Budapest: Akadémiai Kiadó; Vajda, Tamás (2009): Szegedi Fiatalok Művészeti Kollégiuma. [Szeged Youth Art College] In: Olasz, Sándor – András Zelena (ed.): *„Mert annyit érek én, amennyit és a szó" Szegedi Radnóti-konferenciák.* Szegedi Tudományegyetem Bölcsészettudományi Kar, Szeged, 2009, pp. 213-228.; Miklós, Péter (2011): *A szegedi bölcsészkar Radnóti Miklós diákéveiben. Tanulmányok Radnótiról, kortársairól és a szegedi egyetemről.* [The Faculty of Arts when Miklós Radnóti was a student. Studies about Radnóti, his peers and the University of Szeged] Radnóti Szegedi Öröksége Alapítvány, Szeged, 2011

[30] Ferenc Erdei (1910-1971) sociologist, member of the folk writers, academic. After 1945 several times minister.

[31] Gyula Ortutay (1910-1978) ethnographer, politician, akademic. Between 1947-1950 Minister of Religious Affairs and Public Education, from 1958 till his death member

Béla Reitzer[32], Viola Tomori[33] and Sándor Bálint[34]. They represented village research among the contemporary university students, i.e. the ethnographic, cultural anthropological, village sociological aspect. Sándor Bálint was not student at the time, but an Assistant Lecturer without salary at the university[35], but his articles were published in the Szegedi Kis Kalendárium (Szeged Almanac) of the Szeged Youth Art College, and he also gave lectures about the ethnography of the Great Plain and folk tradition in Szeged. It was the Szeged Youth Art College that published certain works of Dezső Baróti[36] and three volumes by Miklós Radnóti[37]. The most significant event of the period was a village research camp organised by Viola Tomori[38] in 1937. This camp basically meant the epilogue of the Szeged Youth Art College. The movement dissolved in the waves of life and history, partly because it left Szeged and partly because its leader, György Buday[39] moved to London (where he developed a successful career as a graphic designer). We emphasise therefore that the *Hungarian Cultural Work Community,* based on the village research activity of the Szeged Youth Art College developed its own life path.

---

of Presidential Council.

32 Béla Reitzer (1911-1942) sociologist, journalist.

33 Viola Tomori (1911-1998) village researcher, sociologist, psychologist.

34 Sándor Bálint (1904-1980) ethnographer, art historian, lecturer at the University of Szeged.

35 „Later on the Szeged Youth Art College developed, from which me, Károly Anzelm Berczeli and Ferenc Erdei were left out. Not even I know how." Bálint, Sándor *Tiszatáj*, 1974/9 cited by Lengyel, András: A Szegedi Fiatalok mozgalma és Bálint Sándor. [The Szeged Youth Movement and Sándor Bálint] *Tiszatáj* August 2004, pp. 57-68.

36 Baróti, Dezső: *Gyula Juhász* (studies, 1933). Baróti was a lecturer at the University of Szeged from 1948, between 1955-57 rector of the university, in 1956 supported the students and the revolution, was arrested after retaliation in 1957 and sentenced to one year six months in prison. He could not return to the University.

37 Radnóti Miklós: *Lábadozó szél* [Recovering wind] (poems, 1933); *Kafka Margit művészi fejlődése* [Artustuc development of Margit Kafka] (PhD thesis, 1934); *Újhold* [New moon] (poems, 1935). Cf. Miklós, Péter (2009): Radnóti Miklós szegedi éveiről. [About the Szeged years of Miklós Radnóti] In: ibid: *„surranva kell most élned itt. Tanulmányok Radnóti Miklósról és költészetéről.* ["now you have to live a hasty life here". Studies about Miklós Radnóti and his poetry] Radnóti Szegedi Örökségе Alapítvány, Szeged, 2009, pp. 33-41.

38 Lengyel András (1986): *Dudar.* [Dudar (a village in Veszprém county, Hungary)] Budapest: Országos Közművelődési Központ

39 Budai György (1907-1990) graphic, wood carver, book artist.

The other significant self-active group was the *Theatre Company*. We highlight this group because its activity is one of the best known among the groups belonging to the university youth organisation. What is more, this community's antecedent can also be traced back to the Szeged Youth Art College, where Ferenc Hont[40] was responsible for the matter. It was also the Szeged Youth Art College that initiated the foundation of the Open Air Festival at Dóm square. On August 26, 1933 they performed The Tragedy of Man by Madách directed by Ferenc Hont. Among university lecturers taking part in this activity we should highlight Sándor Sík's role, who participated not only in professional education of the students, but also in their spiritual guidance and support. The *Theatre Company* of the Szeged University Youth made an introduction on March 8, 1941, in a promotional manner, one month before the planned premiere of Hamlet, in a literary evening where they recited poems[41]. On this event Sándor Sík talked about the company and Dezső Baróti gave a lecture on the poetry of romanticism. Reporting on this event, the journalist of the Szegedi Új Nemzedék concluded[42] that he disagrees with the company having such grandiose plans as to perform Hamlet in one of the city's stone theatres and recommended them not to do so. At the same time, the newspaper published positive criticism of the poetry night, noted István Horváth's "remarkable acting talent"[43] and Károly Szász and Lenke Gyulai's "intelligent and good performing skills, as well as their openness"[44]. The life of the main actors of Hamlet, however, reached a Romeo and Juliet ending.

The Hamlet – the tragedy of István Horváth and Kata Tóth

Hamlet's premiere was on April 1 in the Szeged Chamber Theatre. Hamlet was played by Károly Szász, a student of Faculty of Arts, Gertrude by Kata Tóth, and the director was István Horváth. From reports of contemporary daily newspapers we know the play was a huge success. Magyar Nemzet, Magyar Hírlap, Délmagyarország, Szegedi Napló all praised the performance and the young actors' enthusiasm. Szent-Györgyi's comment in the Délmagyarország: *"Per-*

[40] Hont Ferenc (1907-1979) director, arts organiser, lecturer and director of theatre and film arts college.

[41] SzÚN 08/03/1941 p. 7.

[42] SzÚN 09/03/1941 p. 13.

[43] ibid.

[44] ibid.

forming our Hamlet it is not only about loving arts. It is about a bunch of young people coming together and learning how to work selflessly, and in a disciplined manner undertaken voluntarily, the love for drama and respect for acting is born in them, they get to know the pure language of the theatre, the depth of literature is opened to them and so students taking part in Hamlet will leave the university with a value in their soul not conveyed by any lecture. Teacher trainees participating in performing Hamlet cannot become bad teachers…"[45]

The extremist Új Nemzedék started a weird battle at this point – we already mentioned how they attacked liberal perspective and Albert Szent-Györgyi as not being Hungarian enough, at least in the sense the extreme right would want him to be. In their review of the play of April 2 they repeat their opinion that this play is a great challenge and therefore not the best choice, however, they acknowledge that this performance was a nice, good and interesting one, and "it was good to see a Hamlet performance with a correct knowledge of the role" [46].

At this point of our study we need to diverge a bit from our narrow topic and for purposes of better understanding of the subject matter quote at length professor Sándor Sík, who wrote a recommendation from a literary historian's, professor's and mentor's point of view for the brochure edited[47] by the students for the premiere with the cast, information about the play and the director's concept. *"Those righteous boys and girls, who in the past weeks spent late night hours stolen from resting to identify themselves with János Arany Hamlet translator's classical sentences, to live through his way of thinking and his rhythm, have received the highest education in the most sacred sense of the word, not only from a human, but also from a nation's point of view. They themselves hence became apostles and educators of our biggest national sanctity and glory: our Hungarian language. But they will also be apostles of that often mentioned unity, the lack of which all people who are actually concerned with our society painfully feel; which is mentioned in upsetting tones, and which is urged by our leaders, and the foundation of which has excited the best of the university and college youth of Szeged for years.[…]Those of you who do not know what community work is, take part in an evening rehearsal of our young actors and you may get a hint of the energy at work in the souls' deep, which determines the life or death of a nation. Those who like the youth – and to love the youth means working on the future of the nation – will see that this joint work, this devotion*

[45] DM, 02/04/1941

[46] SzÚN 02/04/1941 p. 7.

[47] Paku, Imre (ed): *Az Egyetemi Színjátszó Társaság ismeretterjesztő füzetei 1.* [Educational booklets of the University Theatre Company Volume 1] Szeged, 1941

meaning sacrifice and tiredness, this holy enthusiasm is all about the love of art and spirit. Today, when the majority of people are mainly concerned with material goods and wellbeing, career and coarse pleasures, when masses see physical force and success as the highest ideal, here a not so small elite of the Hungarian youth considers the most practical idealism, art and poetry the most important things, devotes the best they can give to this. […] At the moment we are the starting point, we do not have, and probably will not have our own theatre, acting school, drama playwright, like the great nations' student artists have. We cannot even make our own scenography. But a treasure promising something big is present in this small group already at the beginning: enthusiasm, love of arts, serious education, work and young morality. This all makes it enough to attract the whole country' attention, but at least the love of the Szeged's society, which is currently more important than anything else in the world."[48]

The next picture in history's ghost train is the Duna Corso in Budapest, Carlton Hotel, where this particular Hamlet performance ended tragically. That summer, on August 8, 1941, the Hungarian Parliament adopted a law[49] which modified a resolution on marriage right almost fifty years old and narrowed the possibility to wed by racial protection provisions. This law prohibited mixed marriages, or even sexual relationship between Jews and non-Jews, which was considered miscegenation. According to the law everyone who had two grandparents who were born as Israelite church affiliates was regarded as Jewish

The relationship between Kata Tóth, who played Gertrude in the Hamlet, a 21-year old, third year chemistry student, and the director of the play, István Horváth Junior, a 22-year old 2 year Faculty of Arts student, had a tragic ending. On October 17, 1941, Kata and her love, István, took the train to Budapest and checked in to a hotel as a married couple and there, in the hotel, in the dawn of October 18, took cyanide to end their lives. This dramatic outcome was partly due to the historical context and partly due to the social context. Namely, Kata's father, a watchmaker and jeweller from Szeged, sympathised with fascist views and forbid his daughter to see István, let alone become his wife.[50] This caused these two young people's death. The city was shaken by the event: "*there were obviously obstacles before the planned marriage* – can be

[48] Sík, Sándor: Hamlet. A szegedi bemutató századik évfordulójára. [Hamlet. Centenary of the Szeged premiere] In: Paku, Imre (ed.): *Az Egyetemi Színjátszó Társaság ismeretterjesztő füzetei 1.* Szeged, 1941. 12-15.pp.

[49] Act XV of 1941 (08/08/1941) on amendments and modifications of Act XXXI of 1894 on marriage law, and necessary racial protection provisions related to it.

[50] Szent-Györgyi 1975, p. 97.

read in Délmagyarország – *which were impossible to be overcome and which prevented them from getting married. They could not violate the law which came into force recently. When they saw this obstacle before them, before their love, they must have decided to become each other's in death if they cannot be so in life. Cyanide was at the disposal of the miss and they knew the poison would bring death in minutes. And in the evening their bodies were found in the hotel room."*[51] The city of Szeged has been touched by the tragic ever since.[52]

On this day another event happened, which I believe highlights the tragic nature of the dramatic event described above and Albert Szent-Györgyi's sadness about it – which he wrote about in his memoirs. Namely, this same October 18 was the day he entered marriage with his second wife, Mária Borbíró, in his private apartment, with two professors as witnesses. Exactly on the same day these two young people, whom Szent-Györgyi liked, loved and respected, committed suicide. *"If only they had come to me with their problem, I am sure I would have found a solution."*[53]

Newspaper of the Szeged University Youth

In what follows I will present the student newspaper of the Szeged University Youth. It had two newspapers, both founded and published by students. One of them was published under the name Flogiston, and was the newspaper of the students of the Faculty of Natural Sciences. It disappeared after a short period of great enthusiasm, as is characteristic of the majority of university papers. The other magazine, Szegedi Híd – primarily due to its quality and good ideas – may be considered significant. Szegedi Híd started off as a newspaper published every two months. Gábor Szabolcsi and István Kristó-Nagy were the editors. Under Rector Szent-Györgyi's mandate only one issue was

[51] DM 21/10/1941 p. 5.

[52] Ferenc Temesi writer described this story in the Romance part of his work entitled Dust, which is about the city. "'This close to passing away, it is only my love and by belief that lives. My belief, that there is no death, only life and life again', written in his farewell letter by István Horváth" Ferenc Temesi: Por. [Dust] Magvető, 1986, 1987; volume No. 2, pp. 33. This topic was elaborated in 2011 in Gyula Radó's docufiction film entitled The Legend – the history of Hamlet from Szeged. The ten-year old University Theatre of Szeged held the premiere of its play entitled "Something is rotten in the state" on November 7, 2012, to commemorate the love of István Horváth and Kata Tóth. The play was directed by Norbert Varga.

[53] Szent-Györgyi 1975, p. 98.

published, in which they formulated their mission statement and advertised their programme. *"Szegedi Híd (Szeged Bridge) is the title of the newspaper of the youth in Szeged. The bridge is a symbol. A bridge connects religions, communities, people, social classes, nations. […] It is a symbol not of loud patriotism, but patriotism of deeds, of building a nation. […] The Szeged University Youth wishes to be a bridge. […] The university in Szeged is already a bridge between the different groups of university students, faculties and years, and it is also a bridge between the students and the professors. […] It wants to become a bridge between the teacher training college and all universities in Hungary. […] It became a bridge between social classes, because it supports the idea of a state without conflict between them."*[54] Szegedi Híd was thought of as a symbol – they pictures themselves, the Szeged university youth organisation as a bridge and the newspaper was meant to be a bridge between the lecturers and the students, between the city and the university. The following programme statements were written for this first issue: István Kristó-Nagy Junior The new spirit in Szeged[55], József Halasy-Nagy The Unity[56], István Nyikos Hic et nunc[57].

[54] SzH May 1941 p. 1.

[55] "We should not be interested in where, how and in what movement the modern intellectual leaders of Hungarians are fighting against each other. We want synthesis, we want to bridge conflicts, if the common intellectual ground is given. […] The majority even today is not interested in anything else besides their own convenience and entertainment, their own future. […] However – and this is what counts! – those who can and like to think, had to come to this place as a result of the books read, disagreements and disappointments. We hope to welcome even more of the Szeged youth. They represent the majority already today, even if not in numbers, but quality wise. Their belief is that they are concerned in everything, nothing is irrelevant, be it an issue regarding the university, the country or a "private matter". And though they are no interested in enforcement, they are leading the Szeged University Youth. This is not a dictatorship, this is merely the victory of the better. The leader is finally not the loudest person, but one whom the youth considers devoted." (SzH May 1941. p. 4.)

[56] "Our student unity in this respect stands for blooming of a unique university life. It does not wish to rip anyone from the national community, but it reminds every university citizen that during their university years they have obligations to the university, too. Namely, the university is the hotbed of the future of a nation, so it is not without interest to the nation, what kind of seeds sprout here. […] It is therefore desirable not to leave this Szeged student unity to die, but to help it blossom into a rich fruit-growing tree." (SzH May 1941 p. 5.)

[57] "We started by establishing the unity of our youth. We are not continuing the babel tower game anymore, where everybody talks and wants different things. Then came the elections, which was perfectly clean and put right people to the top. Community life – student life started – contrary to individual life present so far." (SzH May 1941 p. 5.)

The first issue also published Albert Szent-Györgyi's writing in which he assessed Szeged University Youth's activity: *"If you want the students to fulfil the great national profession, you need to make them proud to be students, to make them feel the unity in which they can form and lead their own lives, in which the students can live in a small closed society and learn the rules of human cohabitation, as well as expand their spirit and knowledge. When the students form a unity and are strong enough to fight for their rights, they are ready to be unified with their professors and the university as a whole. This unity has been established in Szeged. The university in Szeged is truly an alma mater, a friend and a home to its youth."*[58]

From centre to periphery

Youth research considers the world of university students as a special class of young people, whose characteristics are primarily determined by the university campus life and the microclimate resulting from the university citizenship. Starting from the end of Szent-Györgyi's mandate as the Rector the university youth slipped from the centre to the periphery. The Szeged University Youth organisation, and the lifeworld of university youth dissolved in the whirl of history[59].

We pointed before that extremist pressure on Rector Albert Szent-Györgyi and the representatives of the Szeged University Youth was gradually stronger and demanded from them to admit whether they are functioning according to the laws and to declare if there are Jews among the members of the organisation or those who can be regarded as Jews according to the law. I would like to note that this infiltrating and intensifying anti-Semitism was also present at other Hungarian universities. What is more, there were examples of prosecuting with bats, but here, Albert Szent-Györgyi closed and protected the university from attacks from the press and in the political public talk. This however caused more and more criticism of Rector Albert Szent-Györgyi. At this time Szegedi Új Nemzedék reported[60] on the Szeged University Youth not declaring what part of the organisation is Jewish, nor whether they are going to prohibit students of Jewish origin from attending the university.

---

[58] SzH May 1941 p. 2.

[59] On April 3 1941 Pál Teleki Prime Minister committed suicide, on 11 the Hungarian troops headed to the South, on June 27 Hungary entered against Soviet Union, from December 7 state of war existed against England and the USA.

[60] SzÚN 30/03/1941 p. 8.

"…It is well known that a storm has been raging around Szeged University Youth even since its foundation. The association, which is operating under the Nobel Prize winner Rector's highest support, has been attacked by right newspapers. As a reaction to this, the Jewish and liberal newspapers of the capital rushed to give a friendly tap on the shoulder of the student organisation dissolved in club life. Newspapers in favour racial protection complained that Szeged University Youth does not prioritise the national aim, such as the Jewish question, for example."[61] At the same time, in another article[62] they wrote about Albert Szent-Györgyi ordering a closed meeting in which only students of the university in Szeged took take part and no representatives of political organisations, who would have wanted to express their critical opinion at the event.

In May 1941 Szent-Györgyi responded to this hostility: *"We were expecting the attacks, since a self-conscientious, independent body of students violates many interests. Sadly, none of the persons who are attacking us have come down to us to see what we are doing, although we welcome everybody who is truly interested in youth. However, to bear these attacks without comment was probably the most difficult part of my mandate as a Rector. But only he who does not ride a horse does not fall from it: only people who do nothing are not attacked. I weighed all this into the sacrifice I made for the university and for the youth, when I substituted the laboratory for the Rector's chair. But I had my reward: when I look at the students I do not see "humble respect" any more, but they greet me with love and I know this made me contribute a pebble to building a better, more honest and more Hungarian Hungary."*[63]

The legal background changed, however, the Minister of Religious Affairs and Public Education regulated in a decree the issue of university youth organisations (35144/-Regulation No. IV of 1941). As a consequence of the regulation the university had to modify Szeged University Youth's Statute. The text was amended to allow only Christian students to be accepted. *"Only those proper students of Christian origin enrolled to the Hungarian Royal Miklós Horthy University may become proper members of the organisation, who cannot be objected neither from national, nor from Christian moral aspect."*[64]

In late Autumn, they tried to answer the attacks at the Szeged University Youth's newspaper. In the May 7 issue of the Szegedi Híd they published their

[61] ibid.

[62] SzÚN 01/04/1941 p. 5.

[63] SzH May 1941 p. 2.

[64] CsML VIII. 5. (Horthy Miklós Tudományegyetem Rektori Hivatal iratai [Documents of the Rector's Office of the Mikós Horthy University]) box number 7, 870/1940-41.

opinion, that they do not turn to the future of their country and the youth with the type of patriotism pressured by the Turul Association. *"Since we did not post this on every corner of every street and did not shout the loudest we can heroically, we have been denounced not to be Hungarian and not to be Christian, whereas it is exactly our Christianity that stopped us from shouting out loud. This is what we have learnt from the Gospel: '[…] sound no trumpet before you, as the hypocrites do in the synagogues and in the streets, that they may be praised by others.'[…]And this is what we have learnt from one of the greatest Hungarian teachers, Mihály Vörösmárthy: 'Love your country instead of talking about it!' But we could quote from any great Hungarian prophet. Even Ady restrained from shouting out loud to the four cardinal points of the world that what the shouters understand well."*[65] Albert Szent-Györgyi's answer to the attacks: *„Patriots with empty spirit and intellect, but with loud voice are of no use to the country."*[66]

Szent-Györgyi's mandate as a Rector ended with the Autumn semester. Károly Kogutowicz was not a devoted supporter of liberal organisation of the university youth, which lead to restructuring of the organisation. Both in the life of student organisation and in the leadership of the university a right turn took place.[67] On June 15, 1942 the newspaper of the youth organisation reported about it: "The Szeged University Youth is proud to be the one who received *numerus nullus iudeorum*, which a year ago was labelled Jewish-friendly."[68] This was possible because in June last year students graduated and according to the law the university did not accept students of Jewish origin for the first year, hence the "numerus nullus iudeorum" was realised. One year after its foundation, by Spring 1942, the organisation was infected by the illness of the age.

Summary

At the end of our study we consider it necessary to devote a few sentences to the afterlife of Szeged University Youth. The historical thread can be taken in two directions. We can emphasise the student democracy experiment

[65] SzH May 1941 p. 7.

[66] SzH May 1941 p. 2.

[67] Miklós, Péter: *Szent-Györgyi Albert politikai szerepvállalása*. [Albert Szent-Györgyi's political engangement] In: ibid.: A szegedi bölcsészkar Radnóti Miklós diákéveiben. Radnóti Szegedi Öröksége Alapítvány, Szeged – Szabadka, 2011, pp. 109-122, p. 112.

[68] SzH June 1942 p. 15.

and follow it until 1956, when the first autonomous student movement was founded after the WWII, the Magyar Egyetemisták és Főiskolások Szövetsége (MEFESZ, Association of the Hungarian University and College Students, AHUCS)[69] on October 16, 1956. It ignited the Revolution of 1956 and continued to function until Autumn 1988, when the Szeged student self-government was established and became the supporter of the social, political and university political regime transition.[70]

The other direction can be carried all the way through modern times, its focus is on the character and role of student self-activity and cultural value creation, conservation. Based on these parameters and starting from Szeged Youth Art College (1930-37) and Szeged University Youth (1940-45), we arrive to university groups operating today. Currently there is the Szeged University Choir, founded in December 1924[71] and gave its first concert on February 25, 1925. Under Rector Szent-Györgyi's mandate it was transformed into a mixed choir (previously it was a male choir). The other group is the theatre company, started by Ferenc Hont in the 1930's, having István Horváth and his fellow students as members in 1941, and continuing its activity as the Szeged University Theatre. In the life of this group we can talk about two successful periods, one was between 1961 and 1974, under the leadership of István Paál and its Petőfi-rock period, and the other one was from 2000 when the University of Szeged was integrated and Zoltán Czene took over as organiser and director.

In this study we analysed the relationship between Albert Szent-Györgyi and the Szeged university student unity. We surveyed the documents found in the university archives, the articles of contemporary newspapers, and memoirs of the actors. Based on all of them we can assess that in the period under investigation, under the Rector Albert Szent-Györgyi's mandate, in the 1940/41 semester, a student democracy experiment was developed, which derived from an autonomous atmosphere in the higher education. Climaxing in university students' self-activity coming from university citizens' campus life and free

[69] Cf. Jancsák, Csaba: A magyarországi hallgatói mozgalom bölcsője – a szegedi MEFESZ. [The cradle of the Hungarian student movement – the MEFESZ (Association of Hungarian University and College Students, AHUCS) from Szeged] In: *A szegedi szikra. 1956 MEFESZ Szeged* Belvedere Meridionale, Szeged, 2011, pp. 63-87.

[70] Cf. Jancsák, Csaba: A perifériáról a centrumba: '89. és a felsőoktatás világa. [From periphery to the centre: 1989 and the world of higher education] In: *Rendszerváltozások Kelet-Európában*. Szegedi Társadalomtudományi Szakkollégium, Szeged, 2010, pp. 33-42.

[71] SzH December 1941 p. 14.

spirit it resulted in transferring the university youths' thinking from periphery into the centre. All this thanks to a Renaissance person, a Nobel Prize winner and active university leader, Albert Szent-Györgyi.

Bibliography

- Arnstein, Sherry R. (1969): A Ladder of Public Participation. *Journal of the American Institute of Planners,* (4): pp. 216–224.
- Csaplár, Ferenc (1967): *A Szegedi Fiatalok Művészeti Kollégiuma.* [Szeged Youth Art College] Akadémiai Kiadó, Budapest.
- Hart, Roger (1992): *Children's Participation: From Tokenism to Citizenship.* UNICEF.
- Hegyi, András [ed.] (1982): *Fejezetek hat évtized történetéből.* [Chapters from six decades' history] JATE, Szeged.
- Jancsák, Csaba (2008): Hallgatói demokrácia és a hallgatói önkormányzatiság Magyarországon (1988 – 2008). [Student democracy and student self-governance in Hungary (1988 – 2008)] In: *Állampolgári kompetenciák kutatása és fejlesztése. Útkeresés és továbbadás az aktív állampolgárságra képzés folyamatában.* Belvedere Meridionale, Szeged, pp. 39-56.
- Jancsák, Csaba (2010a): A perifériáról a centrumba: '89. és a felsőoktatás világa. [From periphery to the centre: 1989 and the world of higher education] In: *Rendszerváltozások Kelet-Európában.* Szegedi Társadalomtudományi Szakkollégium, Szeged, 2010, pp. 33-42.
- Jancsák, Csaba (2010b): *Hallgatói élet és ifjúsági szervezetek az Állami Polgári Iskolai Tanárképző Főiskolán.* [Student life and youth organisations at the State Civil School Teacher Training College] In: Róbert Kiss –Tamás Vajda [eds.]: Az állami Polgári Iskolai Tanárképző Főiskola története (1928-1947). Belvedere Meridionale, Szeged, pp. 117-133.
- Jancsák, Csaba (2011): A magyarországi hallgatói mozgalom bölcsője – a szegedi MEFESZ. [The cradle of the Hungarian student movement – the MEFESZ (Association of Hungarian University and College Students, AHUCS) from Szeged] In: *A szegedi szikra. 1956 MEFESZ Szeged* Belvedere Meridionale, Szeged, pp. 63-87.
- Kiss, Róbert Károly (2007): Humanista tudós a diplomácia porondján. [Humanist scientist in the arena of diplomacy] *Szeged,* 2007/11, pp. 18-20.
- Kiss, Róbert Károly (2012): A Szegedi Egyetemi Ifjúság egységszervezet létrejötte. [The founding of the Szeged University Youth] In: Vajda,

Tamás – Róbert Károly Kiss [eds.] (2012): *Egyetemi ifjúsági egyesületek Szegeden 1919 és 1944 között.* SZTE, Szeged, pp. 101-115.
- Lengyel, András (1986): *Dudar.* [Dudar (a village in Veszprém county, Hungary)] Budapest: Országos Közművelődési Központ.
- Lengyel, András (2004): A Szegedi Fiatalok mozgalma és Bálint Sándor. [The Szeged Youth Movement and Sándor Bálint] *Tiszatáj* 2004/ augusztus, pp. 57-68.
- M. Kiss, Sándor (1995): *Szent-Györgyi Albert és a Szegedi Egyetemi Ifjúság.* [Albert Szent-Györgyi and the Szeged University Youth] MTA Szociológiai Kutatóintézet, Budapest.
- Miklós, Péter (2007): „A politika behatolt az életembe". Szent-Györgyi Albert politikai szerepvállalása. ["Politics envaded my life". Albert Szent-Györgyi's political engangement] *Szeged*, 19 (2007). 11. sz. pp. 21-23.
- Miklós, Péter (2011): Szent-Györgyi Albert politikai szerepvállalása. [Albert Szent-Györgyi's political engangement] In: Péter Miklós: *A szegedi bölcsészkar Radnóti Miklós diákéveiben.* Radnóti Szegedi Öröksége Alapítvány, Szeged, pp. 109-122.
- Miklós, Péter (2011): *A szegedi bölcsészkar Radnóti Miklós diákéveiben. Tanulmányok Radnótiról, kortársairól és a szegedi egyetemről.* [The Faculty of Arts when Miklós Radnóti was a student. Studies about Radnóti, his peers and the University of Szeged] Szeged: Radnóti Szegedi Öröksége Alapítvány.
- Sík, Sándor (1941): Hamlet. A szegedi bemutató századik évfordulójára. [Hamlet. Centenary of the Szeged premiere] In: Paku, Imre (ed): *Az Egyetemi Színjátszó Társaság ismeretterjesztő füzetei 1.* Szeged, pp. 12-15.
- Szabó, Tibor – Andor Zallár (1989): *Szent-Györgyi Albert Szegeden és a Szent-Györgyi Gyűjtemény.* [Albert Szent-Györgyi in Szeged and the Albert Szent-Györgyi Collection] (Tanulmányok Csongrád Megye Történetéből XV.) Csongrád Megyei Levéltár, Szeged, pp. 9-102.
- Szent-Györgyi, Albert (1975): *Az élet jellege.* [The Nature of Life] Magvető Kiadó, Budapest.
- Temesi, Ferenc (1986, 1987): *Por.* [Dust] Magvető Kiadó, Budapest.
- Újszászi, Ilona (ed.) (2010): *A szegedi felsőoktatás integrációjának története (1981-2010).* [The history of higher education integration in Szeged] Szegedi Tudományegyetem, Szeged.
- Vajda, Tamás (2009): Szegedi Fiatalok Művészeti Kollégiuma. [Szeged Youth Art College] In: 213-228 pp. Olasz Sándor – Zelena András (ed.): *„Mert annyit érek én, amennyit és a szó" Szegedi Radnóti-konferenciák.* Szegedi Tudományegyetem Bölcsészettudományi Kar, Szeged.

Newspapers

- SZN = Szegedi Napló [Journal of Szeged]
- SZÚN = Szegedi Új Nemzedék [New Generation of Szeged]
- SZH = Szegedi Híd [Szeged Bridge]
- DM = Délmagyarország [South Hungary]
- MN = Magyar Nemzet [Hungarian Nation]

József Pál

From the Unity of Life to the Coequality of the Forms of Consciousness. Worries of Albert Szent-Györgyi in Times of War

Szent-Györgyi studied the internal connections between the different forms of cognition, the secret threads that bind public life, historical knowledge and artistic creations with nature and natural sciences on many occasions. He was surprised to see that his "Master," Kuno von Klebelsberg found, with great intuition, a rule that applied to Biology and which he, the researcher, found only as a result of one and a half decades of research.[1] Later, after the presumable end of the age considered as the "Revolt of the Masses" (fascism), he saw a new, historical opportunity only for the human mind and soul that draws from three sources. Ethics, science and arts (literature), he said, were the forms and areas of the search for truth. All three teach us that we should seek the truth, and not try to justify our truth, that all three are communications of divine wisdom.[2] In relation to university education, he greatly regretted the phenomenon of the presence of a spiritual proletariat: students are designated to one area only (*homo unius libri*) although they should leave the university with the love of culture and the completion of comprehensive education. The classical majors of arts and humanities should not be sharply divided from natural sciences and vice versa; this would become destructive to both, moreover, would ruin the former one.[3]

On Scientific Cognition

"The only aim of natural sciences is to learn the deepest truths, the deepest wisdom: to experience God."[4]Whoever wishes to study the laws of nature, tries to understand the uttermost wisdom, the wisdom of God. Szent-Györgyi's

[1] *Gazdám emlékezete*. Gróf Klebelsberg Kuno emlékezete. [My Master Remembered. Count Kuno von Klebelsberg Remembered.] Budapest, Egyetemi Nyomda, 1938. 338–340.

[2] *A tudomány* [Science], "Irodalom és Tudomány," 1945, 97–101.

[3] *A természettudományi oktatásról* [On the Education of Natural Sciences], "Phlogiston," 1941, 1–2. 94.

[4] ibidem

theoretical stance functionally matches the mainstream of the two-thousand-year-old Christian episteme. "For the invisible things of him since the creation of the world are clearly seen, being perceived through the things that are made, even his everlasting power and divinity" (Paul, Rom. 1:20). To learn Existence, to learn God, the clear act of existence, of the paramount exceeds the human mind. In Szent-Györgyi's words, "Therefore, natural sciences cannot give an answer to the questions of 'What is life?' or 'Does life exist?' What natural sciences can do is to merely examine the individual phenomena of life," i.e. (in theologian's terms) seek cause from the effect, essence from the phenomenon. In nature, the same great and eternal laws rule that give the unity of the universe whose validity is also retained in the living organism.[5]

Jewish and Christian monotheism, as opposed to the pluralist approach of Greek philosophy, built each component of God's universe into a system which showed the unity of truth, the *one* divine intention with unbroken success. A biologist's task is to find these in living organisms. "The leitmotif of the author's research has always been the conviction that there is but one life and one living matter in this world. (…) This life is based on a very limited number of basic principles – and the author's endeavor is to understand them."[6] "…The unit of all living matter is the cell," the more complex organism multiplies these units. The same way the cells perform a coordinated action, so do humans form a society, and thus, alter their ways of living. As he wrote in the *Chemistry of Muscular Contraction*, there is not much difference between the lawn and the one who mows it. Muscles need potassium and phosphate, the same substances we spread on the lawn as fertilisers.[7]

"Within a complex organism, the cells are fed and sheltered. In return they carry out some special activities for the community." A considerable part of the the living matter is built into a corresponding machinery.[8] The relationship between the constituents shows some relevance, things work as "mechanisms" to create and sustain life. The loss of order brings destruction. As opposed to the principle of final cause mocked by Voltaire and others, the scientist has no conceptual objection. In this aspect, Szent-Györgyi seems to fully agree with Thomas Aquinas, who believed that the transcendent relevance of Providence

---

[5] *Az élet tudománya*. [Science of Life] Ed. Albert Szent-Györgyi. Budapest: Új idők, 1943. 8–9.

[6] Albert Szent-Györgyi, *Chemical Physiology of Contraction in Body and Heart Muscle.* New York, Academic Press Inc., 1953, 1.

[7] Szent-Györgyi, *Válogatott tanulmányok* [Selected Papers], Budapest, Gondolat, 1988, 107.

[8] In *Chemical Physiology of Contraction in Body and Heart Muscle,* 1.

created the existence of order together with the existence of arranged things. The question 'Who created the order of functionality that can be felt everywhere?' Szent-Györgyi asks only indirectly.

Let us shade this statement: while Thomas (like the ancient philosophers, from this aspect) came to the above conclusion only through speculation, Szent-Györgyi followed the route paved by the great Italian physicist, writer and literary historian Galileo Galilei from the 16th and 17th centuries, and put empirical aspects forward. (Incidentally, Galilei wished to understand the world written in the language of mathematics as a world created by God.) This young man from Pisa, as Szent-Györgyi wrote, went up the Leaning Tower of Pisa, carrying two stones, a big and a small one and asked his companions to observe which of the two hit the pavement first. Galilei, the first outstanding figure of empirical science, "distrusted not only the perfection of his mind but also that of his senses."[9] He built telescopes and discovered the satellites of Jupiter.

Science and Ethics

Szent-Györgyi began writing his work of philosophy of history and of science, *La paix, sa biologie et sa morale*, on 11 November 1938 in Liège, after receiving his honorary doctorate degree from Sorbonne University. It is a great fortune that this book could survive. The book could never be published in France. The reason may be the lack of financial resources and the author's orientation. Szent-Györgyi viewed that the main reason behind the serious tensions in international politics was the unjust peace treaty concluding World War I; this treaty considered exclusively the interests of the victorious nations, and prepared the rise of Hitler.[10] (2001:81) He started to write this book deliberately on the twentieth anniversary of the French–German armistice. Two years later, exactly on the same day, Szent-Györgyi had his inaugural speech as rector of the University in Szeged. This latter event was close to another anniversary as well: on 10 November 1872, with Rector Áron Berde's speech, university education in Hungarian could begin at the University of Kolozsvár (Cluj).

---

[9] Szent-Györgyi, *The Crazy Ape. Written by a Biologist for the Young.* New York, Philosophical Library, 1970. 14.

[10] The study was published much later, in a bilingual French and Hungarian edition, in Szeged, by László Péter. (Hungarian title: *A béke élet- és erkölcstana*, translated by János Rakonczai, publised by Bába és Társai, Szeged, 2001). In the Afterword of the book, László Péter described the history of the manuscript.

This short volume focuses on the following principal ideas: historical development, double ethics, morality based on Biology, peace, science, education and the tasks of the future. The author's worries for future generations can be clearly seen from these; however, we can also see his intention: he shows a way to recover from the present crisis based on (natural) scientific and biological grounds. There arose some very strong, highly influential ideas of Europe between the two world wars had a great impact on the Hungarian intellectual elite as well, and were also present in Szent-Györgyi's reasoning, although unspoken. These were the Revolt of the Masses by Ortega y Gasset, Oswald Spengler's vision on The Decline of the West, on *finis Europae*, and Julien Benda's warning about the Treason of the Intellectuals.

The first, marked contrast stands between the individual's code of ethics and the social man's political and ethical laws (a *cosmopolite* will serve as a solution). The taxonomic error lies in the political or the national code of ethics. The individual learned through the development of humanity not to steal and not to kill so as not to be killed. There is a natural aversion to aggression and murder in the human being, as the ex-soldier professor quoted his own example. "This is the individual's code of ethics, and that of humanity's, which is the totality of individuals" (2001:13). However, nationalism is part of it, the code of ethics formed by the collective, national interest inciting unrest between peoples. As Szent-Györgyi thought, "as an individual, he is sensible, fair and equitable; however, as a citizen of a nation, he is ruthless, unreasonable and a predator" (2001:15). The human being, having created his own individual ethics, forgot to create collective ethics. If this situation was bearable for thousands of years, then why should we worry about it now?

The answer is in connection with the development of science. A radically new situation arose when it became clear that with the advancement of technology, with the new inventions, with these technical advancements the entire world could be easily destroyed. The world became a gigantic machinery and the parts became dependent on one another. The society, however, is not a cooperation of restrictive, intelligent and ethical individuals working together for the public good, but a mass of people following ancient, wild instincts. The man of today, he claims, has no ethical responsibility nor is intelligent enough to give up the dreadful opportunity for total destruction. Several of the ideas of this study were further elaborated on in *The Crazy Ape. Written by a Biologist for the Young* in 1970, in which paper he explained the dilemma as follows: "We are forced to face this situation with our caveman's brain, a brain that has not changed much since it was formed. We face

it with our outdated thinking, institutions and methods, with political leaders who have their roots in the old, prescientific world…"[11]

We cannot expect much from our present leaders: their sole aim is to gain or maintain power, i.e. to win the next elections; however, the situation is the same with the media serving the power or popular taste for money (for circulation) as well.

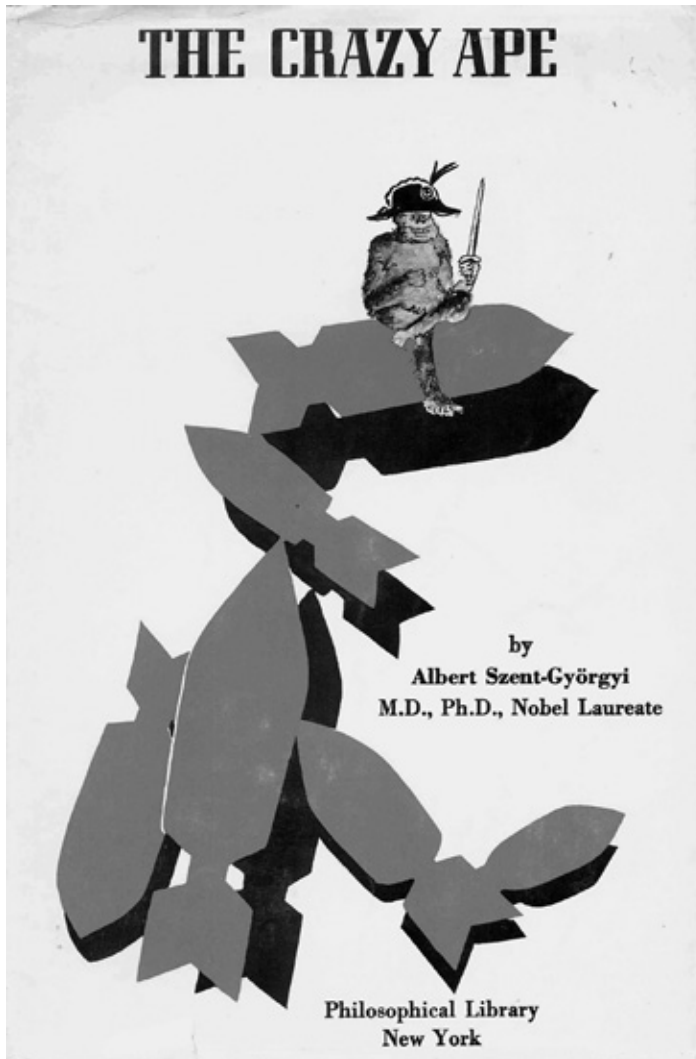
Szent-Györgyi's pessimism was further fuelled by the unjust peace concluding World War I which projected another forthcoming "burning of the world." As he saw it, the French could not treat the defeated properly. The peace treaties merely caused a shift from an armed war to an unarmed one. Germany and Hungary could not have been held solely responsible, responsibility lay in human nature and the ethics of today. "Our country was the biggest loser of the war" (2001:77). There is no way for reconciliation since two and a half million Hungarians were deprived of their right to self-determination, of their most basic rights as human beings in Romania. The revision of borders needs to be realised for permanent peace and tranquillity for the Danube countries. The state of opposing a war is not a state of not shooting, but a state of mutual trust, fairness and cooperation. (2001:37)

Nevertheless, the author believed in some kind of historical development. He opposed certain, not named, historians who were talking merely of recurring cycles; he assumed a direction in history that evoked the characteristics of a (Hegel's) spiral, in which, of course, there are recurring elements, but which, on the whole, advances forward (2001:39). In Szent-Györgyi's opinion, it is the Middle Ages, the constant negative example (2001:41, 43), compared to which any kind of development would be detectable. Unfortunately, the author had only very superficial or no information on the first millennium of European civilisation. The chastity belt women had to wear in certain situations, which was often referred to as *horribile dictu*, simply did not exist, and so, could have no hygienic consequences either. (There is no evidence for its use prior to the age of renaissance humanism; this was simply a tale made up by prejudiced "historians" of later ages.)

The development of the great historical processes, their main directions were not the results of intra-societal tensions, but the advancements of scientific and technical knowledge. An objective standard of advancement is the relationship between the human being and the world around him.

---

[11] Albert Szent-Györgyi, *The Crazy Ape. Written by a Biologist for the Young.* New York, Philosophical Library, 1970. 17.



The Crazy Ape

In this aspect, radical changes occurred in the past. Until the 18th century, man was a mere observer of nature. As a result of the evolution of empirical science, man became aware not only of the fact that "there is a physical order in the Universe" (2001:41), but also that scientists are not mere spectators of the powers of the Universe, but are able to seize and govern them. The story of man, as he wrote in *The Crazy Ape,*[12] or is composed by two parts, divided at

[12] Szent-Györgyi, i. m. 14–16.

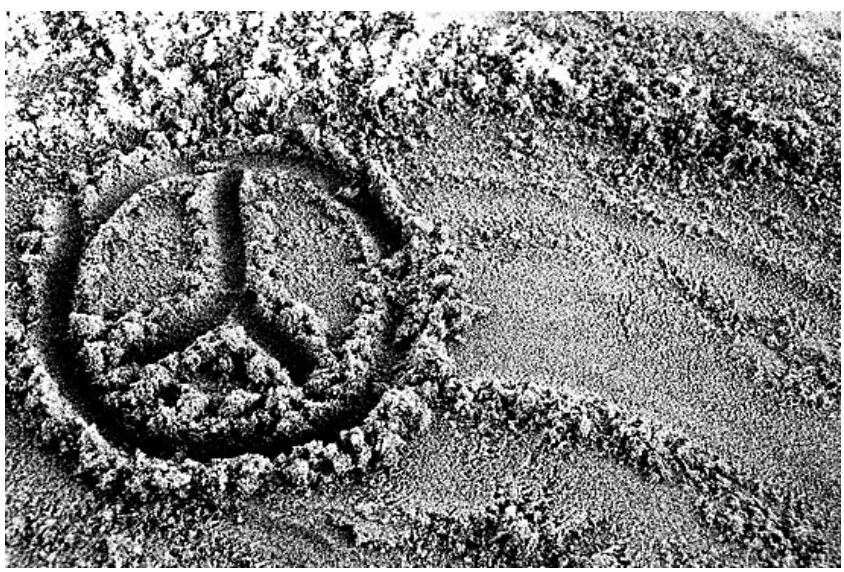
the turn of the 19th and 20th centuries by the appearance of modern science. In the first period, our species lived in a world to which his senses were adapted over thousands of years. In the second, our species stepped into a world to which he was a complete stranger. In this world even the cosmic powers forming the universe are at man's disposal, powers that cannot be experienced by the senses (X-ray, electron, radioactivity, quantum, theory of relativity) and this situation, without being aware of the ethical responsibility, is extremely dangerous. Man is sitting on a "volcano." And this volcano will erupt if he does not learn the new method to control the new mechanism (2001:43).

The "eruption" of a war is preceded by a long process and its starting point is not the visible cease of diplomatic relations; its starting point hides deeper, in our instincts. The biologist explains the above-mentioned defect of collective ethics with the two most fundamental callings. Vertebrates, as opposed to insects, are necessarily selfish for the aims of self-preservation and procreation. The basic element of the nervous system is reflexive: it builds up of sensory and motor neurons. The human brain capable of automatisms and, in case of humans, abstractions, is above the unconditional and conditional (acquired) reflexes. This developed brain offers two more possibilities for man: to create a connection between phenomena not directly connected otherwise, and to act in a way that cannot be explained by external impressions. It is able to create impressions and reflexes in a theoretical way (2001:47). In other words, it is not necessary to speak of the devil to deter one from killing or stealing. Earlier impressions are stored deeper in our subconscious: they shape our inhibitions, thoughts and acts. It is a natural instinct to kill; moreover, occasionally, it would be highly reasonable and logical to kill. Nevertheless, we do not kill, our "inhibiting reflexes do not allow such an act, let alone think of it" (2001:51). In the clash of logic (which is not a suitable tool to divert one from killing) and reflex, it is the latter one to surmount. Such inhibiting reflexes form the biological basis of individual ethics.

However, it can be stated that no such collective ethics exists at the level of humanity, there are no signs of one developing. Individuals formed groups and behave as groups with other, similar communities formed elsewhere. The cooperation of the different groups and societies cannot be based on contracts or logic (that would entail the defeat of the other party). It can be established exclusively on the grounds of "some kind of code of ethics, some kind of inhibiting reflexes." However, no such thing exists. "The creation of such a code, such reflexes would result in a revolution of ethics: the greatest revolution man has ever seen." (2001:57) As opposed to the previous one, at the level of society, it seems hopeless to reach our goal empirically because

war propaganda, which many people turn for their own good, and other factors make it impossible. No such revolution can be envisioned although every moment is calling for new dangers.

On facing this dilemma, Szent-Györgyi seems to accept, at least, psychologically, the conclusion of Kant's "Perpetual Peace," which is filled with doubt as well as encouragement. *Zum ewigen Frieden* was written at exactly the same time as the professor from Königsberg was discussing the conflict of the faculties. The former study with its addenda had a great impact on the Hungarian intelligentsia between the two world wars. The literary-political periodical entitled *Nyugat* [The West] also wrote about it. In 1918, Mihály Babits translated it and wrote a study full of subtle references entitled *Kant and Perpetual Peace*, which the contemporary Hungarian intellectual elite felt to be their own. In the subconscious of the biologist, Kant's ideas, as well as Babits's thoughts appeared: in his words, "… no matter how much we doubt the realization of perpetual peace, we are forced to allow for its (faint or distant) *possibility.* However, as long as this possibility exists, no matter how little and insignificant it may be, anyone expressing and claiming doubts regarding this possibility will inevitably weaken it, which is a sin against humanity hard to forgive."[13]



[13] Babits: *Babits Mihály művei. Esszék és tanulmányok. Kant és az örök béke* (1918) [Works by Mihály Babits. Essays and Research Papers. Kant and Perpetual Peace (1918)]. Budapest, Szépirodalmi Könyvkiadó, 1978. I. 535–536.

In Szent-Györgyi's views, this *possibility* depends on the principles and qualities followed in the education of the young. A child is not bad inherently. He/She will become one principally by the failed approach of the adult society. Deep-rooted skills may develop only in childhood; therefore, we must strive to allow for the youngest generations' reception to the family and to institutionalised education in order for them to be able to culture the conception and universalization of a new ethical scale of values. Initially, a child must become aware of the fact that the sense of belonging to humanity is far more fundamental than membership of a group. "They must be persuaded that every nation is built up by honest, good-willed and peace-loving people; furthermore, that our most precious possession is human culture and civilisation and this common treasure is the fruit of all nation's peaceful work." (2001:61) War is the failure of culture. Culture is composed not only of technology and science, but also of arts. If a visitor from out of space, from a strange planet would arrive here, Szent-Györgyi would first take it to the Louvre. The appealing works of art exhibited, such as the Venus de Milo, tell us more about humanity than the torpedoes, poisonous gases and cannons do. (2001:93)

Children must adopt a scientific way of thinking. These future adults only this way can become the actual masters of the world transformed by natural sciences only this way. An unprejudiced, objective and scientific approach to problems may be the key to success. "In spite of all appearance, I can see the development and formation of a new cosmic spirit on the basis of human solidarity: the idea of a *cosmopolite*" (2001:91). A spirit which is built equally on culture, science and a supranational approach.

Szent-Györgyi remained faithful in his entire life to the fundamental principles expressed in this volume. He intended to base the possibility for a change and development opening naturally after the war on a pillar of three closely linked columns; the columns of natural sciences, of ethics and of arts and philosophy, referred by him collectively as humanity. Natural sciences create effective tools; however, their constructive or destructive use depends on our ethical values. The greatest danger lies in the time drift of these two areas. The relationship between natural sciences and humanity is defined by their common subject. The subject of natural sciences is man himself it intends to change. "A happier and more balanced world we can build only on the pillar of these three columns. Natural sciences and scientific thinking teach us how to find our way in and use the powers of the vast nature around us. Ethics teaches us to be able to live together and to use the powers of nature for good. Finally, Humanity teaches us to

fill this short and, in itself, insignificant life with beauty, substance and spiritual dignity.[14]

Struggles of a Cultural and Scientific Politician

The great transformation of the Hungarian intellectual life after World War II provided an excellent culture medium for Szent-Györgyi to "transplant" his theoretical principles and put them into practice. At full throttle and, owing to his Nobel Prize, with enormous influence, he was ready to participate in the reorganisation process. The politicians were more and more confident in him as he was consistently against Hitler. He was well-informed and acknowledged internationally in the era called "Coalition Times," between 1945 and 1950. Besides his positions at the university and the Hungarian Academy of Sciences (the Academy), Szent-Györgyi became president of the National Public Education Council in 1945. He invited Sándor Sík, the famous professor and poet from Szeged, to become his vice-president. Szent-Györgyi was also formally requested to become honorary president of the Hungarian Soviet Cultural Society. Here, his first colleague was writer Lajos Zilahy. They co-edited the journal of the Society entitled "Irodalom és Tudomány" [Literature and Science], which had six issues between December 1945 and August 1946. This periodical, in its field, was exemplary in realising the spiritual unity of the two forms of consciousness.

For the Emancipation of Natural Sciences at the Hungarian Academy of Sciences

In the spring of 1945, the Hungarian Academy of Sciences, at the beginning of its re-organisation, had three sections. Besides Section I Linguistics and Literary Studies, and Section II Historical Studies, all fields of natural sciences were grouped in one third section under the name of Natural Sciences Section. This structure of sections was cleary not able to fulfil the needs of natural sciences that started to advance rapidly. One of his fights, Szent-Györgyi started for this very purpose.

Linguist János Melich, the Oldest Member of Section I convened the General Assembly of the Hungarian Academy of Sciences on 26 April 1945. As a result,

[14] Albert Szent-Györgyi, *Természettudományos világnézet, morál és humanizmus* [Scientific Worldview, Ethics and Humanism], „Tudomány", 1946. 97–102.

Archduke Joseph August of Austria, biologist Ferenc Orsós and historian and former Minister of Culture Bálint Hómann were fired. Szent-Györgyi vigorously objected to awarding Grand First Prize to Pathologist Ferenc Orsós who had investigated the date of the Katyn massacre for his political involvement. Meanwhile, for the 50 vacancies, 20 honorary and full members and 30 corresponding members were chosen. Piarist philosopher Gyula Kornis from Section II, who was both exiled and persecuted by the Nazis and the Communists likewise, was the temporary president and later, in May, was elected to be President.

Szent-Györgyi, in his speech, suggested that, except for the best thirty members (ten from each Section), everyone should resign, and the "Thirties" should present their proposals on the new ones. This idea was supported solely by Zoltán Bay, and so, the General Assembly rejected it. In response, both Szent-Györgyi and Bay submitted their resignation, which, however, the Presidium of the Academy did not accept.

On the Great Assembly of 28–30 May, both officers and academicians were elected. Kornis remained President, geologist Aladár Vendl (from Section III) became Vice-President, and Literary Historian Géza Voinovich (from Section I), Secretary General. Some of the new members were Gyula Illyés, Lajos Zilahy, József Turóczy-Trostler, Gyula Ortutay and Zoltán Kodály. Szent-Györgyi, along with the other Nobel Prize winner György Hevesi became honorary members. There were no substantial changes in the structure of the Academy, and natural sciences remained under-represented.

In June 1945, Szent-Györgyi, as a member of the Academy's delegation, travelled to the Soviet Union, where he learnt the structure and operation of the Soviet Academy of Sciences, which must have been appealing to him.[15] On arriving home, he wished to realise a new organisation. He wanted to establish "an internal, smaller academy with a Science Saving Committee of 50 members, which would be set up by 25 members of liberal arts and 25 members of natural sciences.[16] He recommended the former to be presided

[15] Albert Szent-Györgyi, *Nyilatkozat moszkvai útról* [Statement on a journey to Moscow], Délmagyarország, 7 July 1945. (The Soviet model shall be realised in the Danube Basin, the academicians are outstanding scientists, they are in ministerial positions); *Szovjetoroszországi utazásom benyomásai* [Impressions on My Travels to Soviet Russia], Szabad Nép, 2 August 1945.

[16] Lóránt Tilkovszky, *A Magyar Tudományos Akadémia a felszabadulás után 1945–1948* [The Hungarian Academy of Sciences after Liberation 1945–1948]. In *A Magyar Tudományos Akadémia másfél évszázada 1825–1975* [One and a Half Centuries of the Hungarian Academy of Sciences 1825–1975]. Ed. Antal Vörös. Akadémiai Kiadó, Budapest, 1975. 347–361.

by historian Gyula Szekfű and the latter one by physicist Zoltán Bay. Szent-Györgyi proposed himself to become leader of the Committee.

Szent-Györgyi believed that the Academy could not remain (financially) an entirely independent institution. External powers shall be involved in order for science to receive more budgetary support. Therefore, he suggested that the Mathematical and Natural Sciences Section unite with the Hungarian National Scientific Council. With the support of the Hungarian government, Szent-Györgyi established an independent Academy of Natural Sciences and Minister of Culture Géza Teleky requested the President of the Hungarian Academy of Sciences to integrate it into the structure of the Academy. As a result, two equally strong academies would have been realised: an academy of liberal arts and one of natural sciences. The unity of the Academy could have been seen in the joint use of the buildings and the appointing of a joint president alternately from the two academies.

However, the Academy rejected this proposal, and wished to preserve its genuine unity and the old structure. Nevertheless, it conceded to the request of Section III, and raised the number of members, i.e. favoured the Section of Natural Sciences over Sections I and II. Furthermore, it proposed membership to the 20 representatives of the Academy of Natural Sciences who were not yet members of the Hungarian Academy of Sciences. With this solution, Szent-Györgyi was not satisfied. He resigned once more, and this time, his resignation was accepted. He turned to the government for support, and in his article entitled "*The Academy is Highly Responsible for the Disaster of Our Nation*" published in the daily paper of the Communist Party, "Szabad Nép,"[17] he violently attacked the Academy, which initiated an action of libel against him.

In this aggravated situation, the new minister, poet and literary historian Dezső Keresztúri made a compromise sufficient to all (including the Reform Committee the Academy previously requested). This compromise was more victorious to Szent-Györgyi than to the Academy. The main points of this compromise were the followings:

Election of all members of the Academy of Natural Sciences to Section III.

Division of Section III into two: the Mathematical, Physical, Chemical and Technical Sciences shall form Section III; Biology and Medicine will form Section IV.

[17] Szabad Nép, 6 December 1945. He called upon all academicians to resign, the same way as he did.

The total number of members in Sections I and II will be equal to the total number of members in Sections III and IV.

Szent-Györgyi was elected secondary President to President Zoltán Kodály.

On the Assembly of 22–28 July 1946, several of his former colleagues from Szeged became members of the Hungarian Academy of Sciences. Sándor Sík (Section I), István Bibó, Károly Kerényi (Section II), Győző Bruckner, Miklós Jancsó, Brunó Ferenc Straub, István Rusznyák, György Ivánovics and others. The Grand First Prize was awarded for 1945 (retroactively) to Frigyes Riesz, and for 1946 to Albert Szent-Györgyi.

What should the scientific institutional system be like?

Predecessors of Szent-Györgyi in this aspect were Immanuel Kant and Ortega y Gasset once more. They and their followers determined contemporary public thinking of the field. In order to increase the significance of scientific research, Szent-Györgyi used certain elements of their ideas. In *The Conflict of the Faculties* (1794–1798) Kant was writing about two classes. The higher and greater unit was formed by the faculties influenced by the government, which provided training programmes allowing for ruling over the people. The aim of the government with the Faculty of Theology was eternal salvation; with Law, the aim was the transfer of knowledge on civil, and with Medicine, that on physical well-being. These programmes were offered as "open lectures." The other unit was a lot cheaper and independent from the government. It was free, there was no higher command. This unit was formed, on the one hand, by historical areas (classics, languages, natural history), and on the other hand, clear rational knowledge (Mathematics, Metaphysics, Philosophy). (It must be noted that in 1872, when the University of Cluj was re-opened, there was no Faculty of Theology opened due to religious diversity; instead, almost uniquely, a Faculty of Natural Sciences was founded.

In Ortega y Gasset's views,[18] a university shall primarily educate learned and well-trained professionals. The *world views* of the different disciplines shall be taught; i.e. general information on Physics, organic life, mankind, society and the universe. A university's main task is not to educate scholars of a specified field, but students shall also learn about scientific research. The tendency of

[18] Ortega y Gasset, *Az egyetem küldetése*, [Hungarian translation of The Mission of the University] (1930). In *Ész, élet, egzisztencia*. [Intelligence, Life, Existence] Ed. Cejtei–Dékány–Simon, Szeged, 1990.

the prevalence of 'research' at the university proved disastrous.[19] However, culture, general contemporary problems, the spirit of the age shall (or should) be in the focus of attention. Culture is the system of ideas on which an age cultivates. Today, culture draws mostly on science. People believe mostly in science. The greater and most decisive element of an age is culture which is able to embrace and simplify knowledge, and which also extracts from science whatever it may need. Only talented students growing from the 'humus' of the university shall be offered the possibility of scientific research.

In the Special Collection of Social Theory at the Klebelsberg Library of the University of Szeged, under notation 3435 there are two manuscripts written on a typewriter.[20] On both the date shown is December 1945. One of them is Szent-Györgyi's mission statement, which was written in a spirit of reform, characterised by determined, unequivocal and sharp statements. The other is István Bibó's reply to this paper. Political scientist and law professor Bibó reacted more delicately to the issues brought on in the mission statement, and in principle, did not share Szent-Györgyi's views. This purely intellectual debate is kept from being personal. Bibó, with acknowledged respect though, contradicts his fellow professor.

His work, *Az egyetem, az akadémia és a tudomány válsága* [The Crisis of the University, the Academy and Science] begins with a statement: we are standing at the cross-roads of being and not-being. The old building has collapsed; we must now decide if we wanted to use some stones of the old buildings or not. There is no middle way, we need to say 'yes' or 'no.' An academic reform conception shall first clarify the social role of the university now in crisis.

A university was originally a society of scholars, and graduation from it did not give an entrance ticket to life. Universities used to guard their material and spiritual independence austerely. The crisis was the result of the sudden development of science and society in the middle of the 19th century. Until then, there were only one major and one minor science: Theology being the major, and Law and Philosophy being the minor. These programmes required no special tools. Consequently, empirical science needed a lot of society-funded money and so, the prestige of expertise grew. From then on, students did not attend universities to gain knowledge in general, but in order to learn the necessary skills to succeed in public life. However, science cannot be taught in masses. In such a way,

[19] Ortega y Gasset, i.m. 329.

[20] András Lengyel, *Bibó és Szent-Györgyi vitája a tudományos intézményrendszer válságáról.* [A dispute on the Crisis of the Scientific Institutional System between Bibó and Szent-Györgyi] In, *Utak és csapdák*. Tekintet, Budapest, 1994. 281–292.

it will die (as there are no flowers growing in the middle of the highway) (2). Research fails because of compulsory school attendance. The professors must adapt themselves to the political streamlines, and striving to keep their respect, they join political parties. In his opinion, a university is a mass producer of public life. Students need to gain marketable knowledge, not "science."

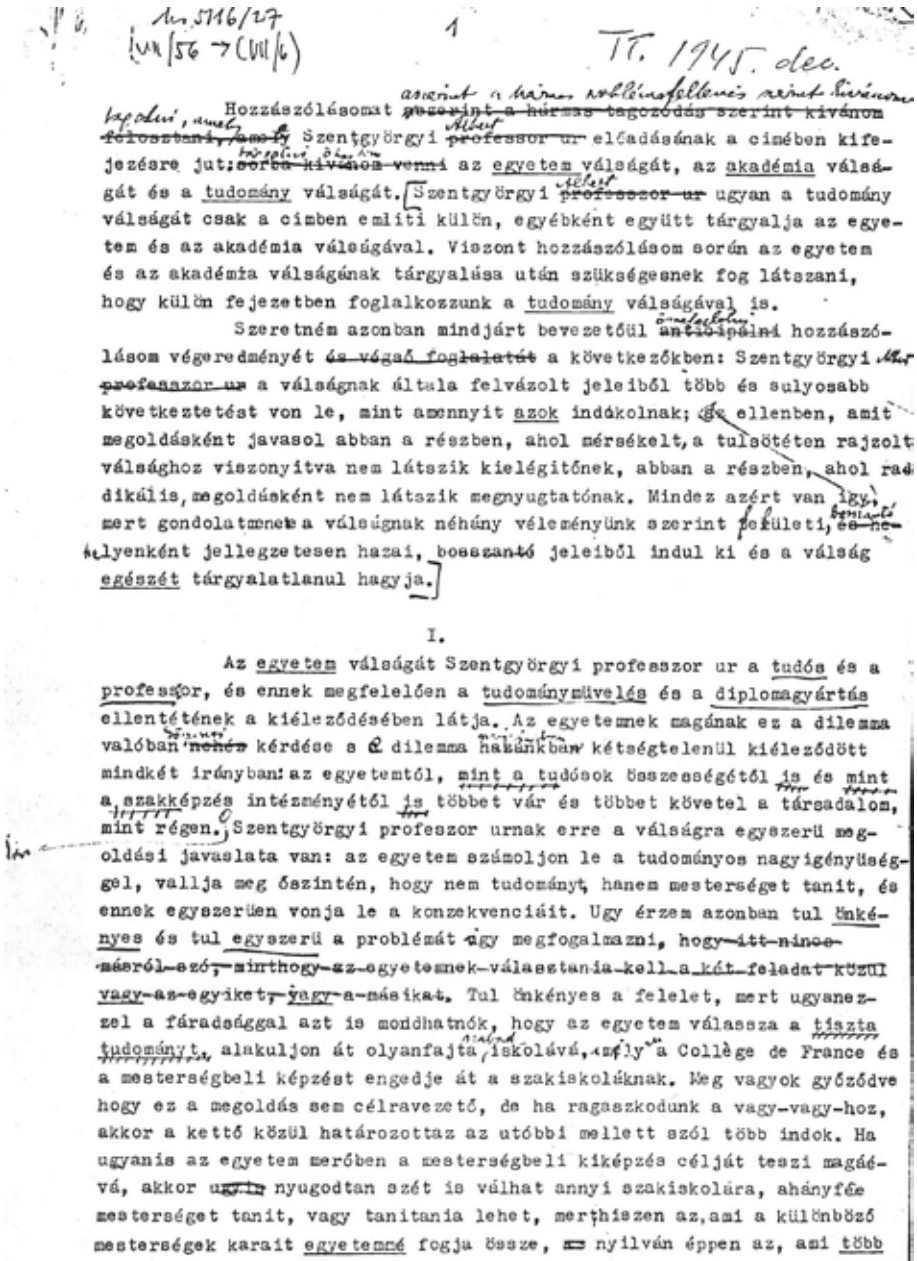
This situation is unsatisfactory to everyone: students are burdened with knowledge they do not need; teacher candidates who wish to teach the parts of a flower in an interesting way to children must study Algology for three years. Even scholars are losing ground, are unable to find their place in a university which turned into a "tomb of researchers." He said the following: "If I allocate 25 per cent of what little I earn for shouting from the teacher's desk one to two hours on a daily basis, 10 per cent for faculty meetings and 20 per cent for administration and the copying of invoices, the amount left is not enough for anything…" (4)

The situation is similar in the case of the Academy. Earlier, scholars used to unite in societies to share and discuss their experiences. Today, this is the task of the professional journals. "Public debate is pointless. During my long scientific career, I have participated in all important congresses. However, I have not seen any useful debates." (3)

The Hungarian Academy of Sciences was initially established for the Hungarian language reform, and this battle was won. To the question, "Who is predestined to lead and organise science?" Szent-Györgyi gives the following answer: "a body: an assembly or real scholars, real scholars who represent living science." (5) This society of scholars shall be set up. The university is the place of education, the Academy (on the basis of the Soviet model) is the place of research. A real professor is a scholar as well: as a teacher, he belongs to the university, as a researcher, to the Academy.

Bibó, partly with reference to Ortega, rejects this entire concept. In his words, "Professor Szentgyörgyi [sic!] provides a simple solution to this crisis: a university shall give up its great demands and admit honestly that it teaches the mastering of a trade and not science…" (1). In Bibó's views, scientific research must not be taken from the university. Preferably, a college faculty should be established along with the university faculty to provide vocational training. Bibó intended a different role for the Academy than Szent-Györgyi. Bibó thought its major task would be the identification and efficient representation of *values*. With the "abolishment" of the church, there evolved no organisation that would be able to fulfil this important role in Europe. The Academy became a forum, and so, through its intellectual respect, it could represent pluralistic, multi-centred systems of values. As a team, it could embrace the different (intellectual) efforts. It is typical of Szent-Györgyi to compare a member

of the Academy, based on the Soviet model, to a representative of state power, to a minister; whereas, a social philosopher would give our academic scholars and mass educators the same independence our judges enjoy.



Ms 5116/27
(VII/56 → (VII/6)

1

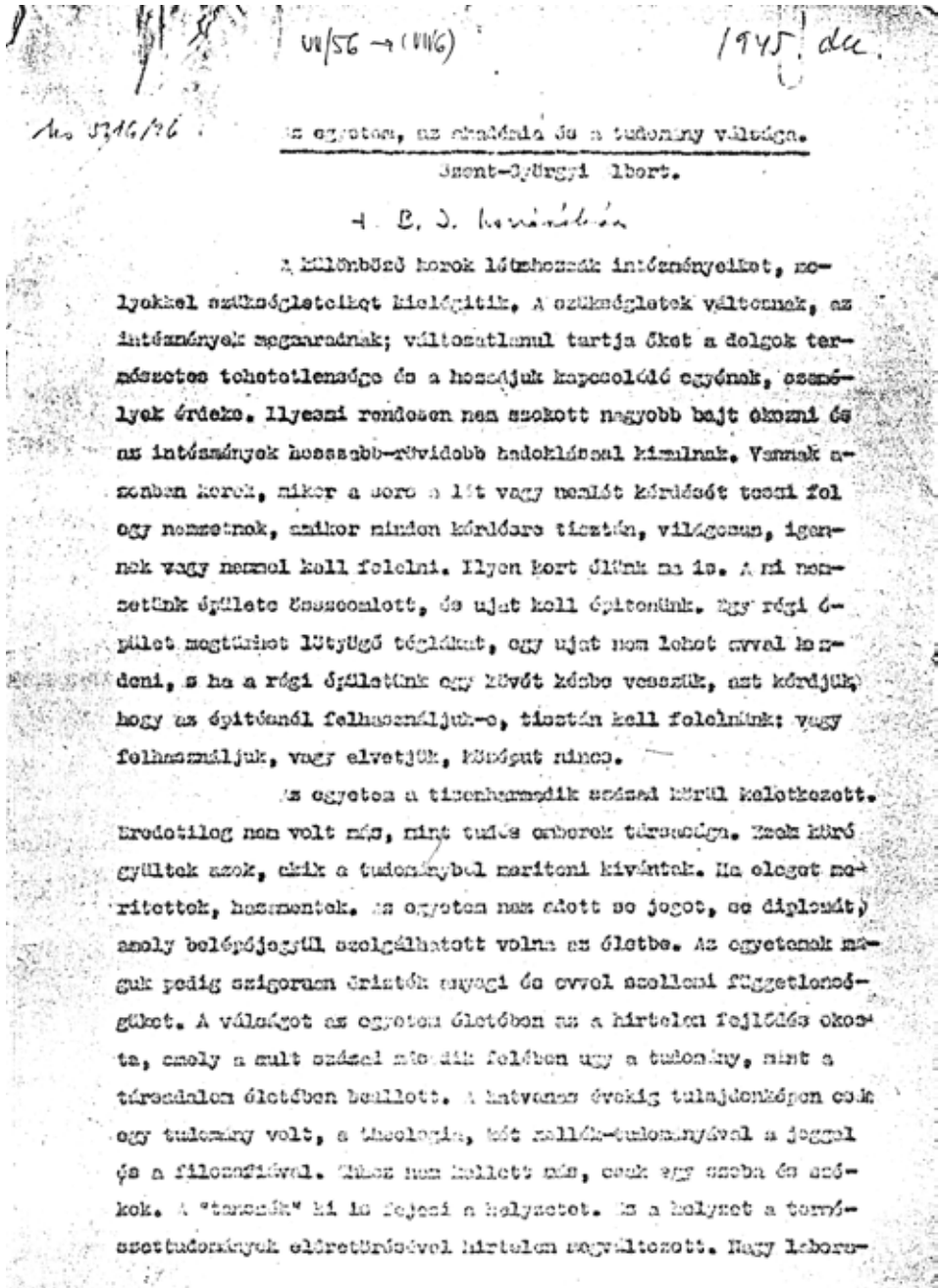
TT. 1945. dec.

Hozzászólásomat ~~aszerint a hármas tagozódás szerint kívánom~~ ~~felosztani, amely~~ Szentgyörgyi ~~professzor ur~~ előadásának a címében kifejezésre jut: ~~sorba kívánom venni~~ az egyetem válságát, az akadémia válságát és a tudomány válságát. Szentgyörgyi ~~professzor ur~~ ugyan a tudomány válságát csak a címben említi külön, egyébként együtt tárgyalja az egyetem és az akadémia válságával. Viszont hozzászólásom során az egyetem és az akadémia válságának tárgyalása után szükségesnek fog látszani, hogy külön fejezetben foglalkozzunk a tudomány válságával is.

Szeretném azonban mindjárt bevezetőül ~~anticipálni~~ hozzászólásom végeredményét ~~és végső következtetését~~ a következőkben: Szentgyörgyi ~~professzor ur~~ a válságnak általa felvázolt jeleiből több és sulyosabb következtetést von le, mint amennyit azok indokolnak; ~~és~~ ellenben, amit megoldásként javasol abban a részben, ahol mérsékelt, a tulsötéten rajzolt válsághoz viszonyítva nem látszik kielégitőnek, abban a részben, ahol radikális, megoldásként nem látszik megnyugtatónak. Mindez azért van igy, mert gondolatmenete a válságnak néhány véleményünk szerint felületi, ~~és nem~~ helyenként jellegzetesen hazai, bosszantó jeleiből indul ki és a válság egészét tárgyalatlanul hagyja.

I.

Az egyetem válságát Szentgyörgyi professzor ur a tudós és a professzor, és ennek megfelelően a tudományművelés és a diplomagyártás ellentétének a kiéleződésében látja. Az egyetemnek magának ez a dilemma valóban ~~nehéz~~ kérdése s ~~a~~ dilemma ~~hazánkban~~ kétségtelenül kiéleződött mindkét irányban: az egyetemtől, mint a tudósok összességétől is és mint a szakképzés intézményétől is többet vár és többet követel a társadalom, mint régen. Szentgyörgyi professzor urnak erre a válságra egyszerü megoldási javaslata van: az egyetem számoljon le a tudományos nagyigényüséggel, vallja meg őszintén, hogy nem tudományt, hanem mesterséget tanit, és ennek egyszerüen vonja le a konzekvenciáit. Ugy érzem azonban tul ~~önkényes~~ és tul egyszerü a problémát ~~úgy~~ megfogalmazni, ~~hogy itt ninces-másról szó, mint hogy az egyetemnek választania kell a két feladat közül vagy az egyiket, vagy a másikat.~~ Tul önkényes a felelet, mert ugyanezzel a fáradsággal azt is mondhatnók, hogy az egyetem válassza a tiszta tudományt, alakuljon át olyanfajta iskolává, amely a Collège de France és a mesterségbeli képzést engedje át a szakiskoláknak. Meg vagyok győződve hogy ez a megoldás sem célravezető, de ha ragaszkodunk a vagy-vagy-hoz, akkor a kettő közül határozottan az utóbbi mellett szól több indok. Ha ugyanis az egyetem merőben a mesterségbeli kiképzés célját teszi magáévá, akkor ~~ugyis~~ nyugodtan szét is válhat annyi szakiskolára, ahányféle mesterséget tanit, vagy tanitania lehet, merthiszen az, ami a különböző mesterségek karait egyetemmé fogja össze, ~~az~~ nyilván éppen az, ami több mint mesterség.



UU/56 → (UU6) 1945. dec.

Ms 5316/96

Az egyetem, az otthonság és a tudomány váltsága.

Szent-Györgyi Albert.

A különböző korok létrehozzák intézményeiket, melyekkel szükségleteiket kielégítik. A szükségletek változnak, az intézmények megmaradnak; változatlanul tartja őket a dolgok természetes tehetetlensége és a hozzájuk kapcsolódó egyének, csoportok érdeke. Ilyesmi rendesen nem szokott nagyobb bajt okozni és az intézmények hosszabb-rövidebb haladékkal kimúlnak. Vannak azonban korok, mikor a sors a lét vagy nemlét kérdését teszi fel egy nemzetnek, amikor minden kérdésre tisztán, világosan, igennek vagy nemmel kell felelni. Ilyen kort élünk ma is. A mi nemzetünk épülete összeomlott, és újat kell építenünk. Egy régi épület megtűrhet lötyögő téglákat, egy újat nem lehet ezzel kezdeni, s ha a régi épületünk egy kövét kidobjuk, azt kérdjük, hogy az építésnél felhasználjuk-e, tisztán kell felelnünk: vagy felhasználjuk, vagy elvetjük, középút nincs.

Az egyetem a tizenharmadik század körül keletkezett. Eredetileg nem volt más, mint tudós emberek társasága. Ezek köré gyűltek azok, akik a tudományból doktori kívántak. Ha elegat doktorítottak, hazamentek. Az egyetem nem adott se jogot, se diplomát, amely belépőjegyül szolgálhatott volna az életbe. Az egyetemnek maguk pedig szigorúan őrizték rangját és ezzel szellemi függetlenségüket. A válságot az egyetem életében az a hirtelen fejlődés okozta, amely a múlt század második felében úgy a tudomány, mint a társadalom életében beállott. A hatvanas évekig tulajdonképpen csak egy tudomány volt, a theologia, bár mellette-tudományával a joggal és a filozófiával. Ezeken kívül más, csak egy szoba és szók. A "társadalom" ki is fejezni a helyzetet. És a helyzet a természettudományok előretörésével hirtelen megváltozott. Nagy laboru-

Ildikó Tasiné Csúcs

The science-rescuing activity of Albert Szent-Györgyi and its roots in Hungary after 1945

In the Hungarian language the word 'master' – according to some of our writers[1] – is one of our most beautiful words. Perhaps the 'responsibility' included in this word's meaning which gives this phrase a special patina. When the researcher at the peak of his career calls his former boss a master, it means there must have been some mutual trust between them, and actually it refers to a sincere respect for the named person. Our Nobel Prize winner scientist, Albert Szent-Györgyi wanted to picture this respect – when he was the only one of the speakers who called the former Minister of Education[2] his master.

My aim is to show the home roots of the science-rescuing activity of Albert Szent-Györgyi after 1945 and to make you see how his experience from abroad contributed to his activity. I want you to picture how his environment and his close friends were able to have an effect on this Nobel Prize winner, who was always willing to accept and take in a great deal of different ways of thinking creatively. In my research I used Albert Szent-Györgyi's so far bibliographically not adapted statements, original archives, documents relating to the subject, and I also adapt scientific literature dealing with the Soviet scientific model in Russian language and a contemporary American Congress report.

Klebelsberg, who was a broad-minded politician, wanted and was able to bring Hungary nearer to Europe not only in the field of education, but also on the road of science policy. His main idea was that it is not the sheer number of population that can make a nation big[3]. (This deep historical thought was one, which could save the nation in the common talk of our country, mutilated by

---

[1] In Magda Szabó's novel the charwoman called Emerenc Szeredás calls the writer's husband Tibor Szobotka her master, as her employer. See in Magda Szabó: The door, Magvető, Budapest, 1987 p. 25.

[2] Albert Szent-Györgyi: The memory of my master. The memory of the count of Kunó Klebelsberg [Memorical speeches and mementos about the Count of Kunó Klebelsberg], Egyetemi Nyomda, Budapest, 1938 pp 338–40. Albert Szent-Györgyi fondly emphasized the almost intuituve intellect of Klebelsberg; with the help of this talent Klebelsberg was able to see through and understand the problems of natural science.

[3] Kuno Klebelsberg: Research and education [A lecture at the general assembly of the Association of Higher Education] also published in Kuno Klebelsberg: The Last Accords, Atheneum, Budapest pp 191–201.

the Treaty of Trianon.) "A nation can only become big, if there is independent research in the country." – that is not only truth discovered by other nations is taught – but the nation itself works hard to come up with independent results[4]. Humboldt, who was held in high esteem by Klebersberg, had a conception of the university, which is an institution where education and research coexist and have an improving effect on each other. But by the beginning of the 20th century, capital financed institutional research was formed in the USA, also in England and in France. And as his emperor requested him, Harnack wrote in his memorandum that Germany should lay stress on establishing research institutes. As a result of this memorandum the Emperor William Society was formed from the industrialist and merchants of Germany and this society created a lot of research institutes in Dahlem.

Klebelsberg adopted Humboldt's model to the Hungarian conditions when he undertook the task of building up three universities in the countryside[5] in Pécs, Szeged[6] and Debrecen where education and research went on at the same time. The science policy of Klebelsberg had three keystones: the first of them was the university[7] which united the basic functions of education and research, the second was the college, whose function was only education, the third was the research institute which dealt with research only.

To catch up with other nations in the field of research Klebelsberg established the Hungarian Biological Research Institute in Tihany[8], he got the sup-

[4] Klebelsberg considered the Prussian science policy a role model, because it served as a strong basis for Germany's future. According to Klebelsberg there are three basic institutions which determine science: academy, university and research institute. This idea of his comes from Leibniz who was the founder of the Academy in Germany and Humboldt finished his heritage. Klebelsberg op. cit. p. 3.

[5] Klebelsberg might have his inspiration from the other great character of science policy, Althoff, who thought the right location for the university was in the countryside – it was an Anglo-Saxon model (Oxford, Cambridge). Klebelsberg op. cit. p. 5.

[6] According to the XXV. article of 1921, the Hungarian Royal University of Arts and Science named after József Ferenc from Cluj was provisionally placed in Szeged. See Péter Hencz: The count of Kuno Klebelsberg, the builder of the University of Szeged. Szeged, 1998 pp. 26–30.

[7] Klebelsberg created the concept of the Collection University, because in his opinion at the public collections it was also very important to have the research, as a principle beside the basic function of preservation, because this way they could become scientific institutes. Klebelsberg op. cit. p. 7.

[8] Klebelsberg called home Géza Entz and Olga Sebestyén from abroad to do research work in the Research Institute just the same way as he did call Albert Szent-Györgyi

port of the Rockefeller Foundation for Szeged, established the Council of Natural Science with separate financial basis of supporting science, he organized The Széchenyi István Society for the private sponsors, he classified the badly-financed Science Academy into the status of the Collection University so that way he was able to finance the research work there[9]. "because in this country yet there will be research and because we will have research we will not end up in the status of small nations"[10] – this was the encouraging promise and this promise was proved by the Nobel Prize won by Albert Szent-Györgyi.

The scientist, Albert Szent-Györgyi came back home after living 11 years in Western Europe. He left Oxford and the world-famous Professor Hopkins behind after Klebelsberg asked him to return home with the support of the Rockefeller Foundation[11]. Albert Szent-Györgyi, who was highly respected by other researchers, came home.

Klebelsberg appointed Albert Szent-Györgyi's best friend, Zoltán Bay the position of the university's public lecturer of the Department of Theoretical Physics, University of Szeged the same year. Zoltán Bay said about Albert Szent-Györgyi's years, spent in Szeged: "In spite of being a young man, Szent-Györgyi – who in addition looked a lot younger than his age – achieved significant scientific results. He was open-minded and he expressed his sincere opinion…"

Albert Szent-Györgyi's research work compelled greater and greater professional admiration of the international scientific life, due to his open-mindedness to different ways of thinking – this originated from the Anglo-Saxon environment – and he was a good lecturer, too. Albert Szent-Györgyi, who knew Europe well, and already visited the USA, in 1935 visited Leningrad and Moscow together with his colleagues, when the 15th International Physiological Congress was held. The fact, that the Soviet Union organized such a scientific symposium of importance came as a surprise to the international scientific communities. This is how Albert Szent-Györgyi remembered the event:

---

back home in 1930. http://www.blki.hu/BLKI/history-foundation_hun.htm the date of download 15 May 2014.

[9] Klebelsberg op. cit. pp. 11–12 Of course at the clinics, founded by him, the research was supported.

[10] Klebelsberg op. cit. p. 12.

[11] The protracted building of the laboratory (in Dóm Square) was speeded up by the foundation which gave 1 million pengős as financial aid. The negotiator was Zoltán Magyary. See in: Albert Szent-Györgyi by Ralph W. Moss published by Typotex, Budapest, 2003 p. 80.

"When Pavlov convened the congress in the name of the Soviet Union in 1932, it was a surprise for all of us. We could not imagine how the Soviet Union felt confident to organize such a big scientific event so shortly after the revolution. For this occasion they needed not only hotels and conference rooms, but big laboratories, good scientific equipment and independent results as well."[12]

The scientific public opinion had reservations about the faraway almost exotic country because of its social changes and huge underdevelopment. As this big country was closed for foreigners and the scientists of that era did not have on-hand experience, this congress meant some kind of burst into the scientific life. It is reflected in the contemporary American medicinal journal's report[13], too. The participants in the congress were amazed not only by the luxurious high level cultural entertainment, catering, the engineering punctuality of the organization, but by the deep respect they gained among the inhabitants of the two cities. The congress had two more special attributes, which made it really different from other congresses. The first one was that science was reputable[14] and popular[15] with the society and the other one was that it was significantly supported by the state. These two – we can say – national attributes could have a great influence on the young Albert Szent-Györgyi. It is reflected in his comment, which he made when Gyula Kállai paid him a visit in 1942. They were talking about the possible outcome of the war and both thought the Soviet Union had a chance to win

[12] Albert Szent-Györgyi: My experiences related to the Soviet Natural Science. In: The thirty-year-old Soviet Union. 1917–1947 published by Corvina, Budapest, pp 164–167.

[13] A. C. Ivy M. D.: The Fifteenth International Physiological Congress, Leningrad and Moscow, August. 8–18. 1935. The American Journal of Digestive diseases Vol. 2 Iss. 11. (November 1935) 692–695. http://link.springer.com/article/10.1007%2FBF03000983#page-1 date of download: 15 May 2014. The participants in the conference - among them the correspondent also – arrived in Leningrad equipped with chocolate and dried fruit, but they received a sumptuous hospitality and lived in luxurious circumstances.

[14] In the Soviet Union „(The keynote of these adresses was) The high regard for and the great attention given science by the workers and the goverment." said Professor Karpinsky, the president of the Soviet Academy of Sciences. The American correspondent absolutely agreed with this. Ivy A. C. op. cit. p. 692.

[15] The correspondent emphasized that there were a lot of enthusiastic people who took part not only in the plenary but also in the section meetings (he calls them faithful attendants). There was even a section lecture where the attendance was as much as 1500 people. (Altogether 1200 scientific researchers took part in the conference). Besides, the whole conference, the plenary meeting went on in an enthusiastic atmosphere. See Ivy A. C. op. cit. p. 693.

the war, Albert Szent-Györgyi emphasized the important role science played in the Soviet Union[16].

As a well-known antifascist[17], Albert Szent-Györgyi was forced to hide, so in January of 1945, the Red Army was a real liberator for him as they actually put him and his family in a safe place[18]. After 1945 the Hungarian public opinion wanted to prove, that the culture of Hungary is valuable and it is also the integrated part of the Cultural Friendship culture. There was an enforced explanation: Hungary was only embroiled in the war and the Hungarian nation cannot be characterized by massacres but we are constantly looking for friendship. That's why the Hungarian-Soviet Education Society was founded and there was a good example of wishing to near the different cultures: the journal called Irodalom-Tudomány which was edited by Albert Szenty-Györgyi and by his friend Lajos Zilahy, the writer. In the first issue of the magazine, December 1945 in one of his articles Albert Szent-Györgyi proclaimed a science-rescuing thought: he wanted to give a possibility for scientific articles to be printed for the first time, because otherwise they had no chance for publication due to the interruption of the press after the war[19].

It was almost natural, that Albert Szent-Györgyi became the honorary president[20] of the Hungarian-Soviet Education Society which was formed in

---

[16] Gyula Kállai: The law of my life. 2nd volume published by Magvető, Budapest, 1980. A visit to Szent-Györgyi pp 136–140. „The science will be needed there as well. I hear the science has such an important role in the Soviet Union." quotation from Albert Szent-Györgyi.

[17] Sándor M. Kiss: From playing politics to the opposition. About the history of the oppositional group and political movement lead by Albert Szent-Györgyi Mozgó Világ 9th volume (1983) No. 11. pp. 113–128. The author describes the working of the SZESZ (Organization of Szent-Györgyi) with the thoroughness of a historian and stresses the activities of the group led by Várnai: starting from the trip to Istanbul up to the end of the war.

[18] R. W. Moss op. cit. chapter 13. Caviar for breakfast.

[19] „…We offer the scientists the pages of Tudomány, so that they could immediately publish their works summarized" that was the editor's promise. „We must not close ourselves in the ivory tower, we have to show as often as possible, that we exist, we work and we are just as valuable as others. „We have to take on the task of the popularization of science, briefly and popularly." Letters to „Tudomány" Irodalom-Tudomány, 1 (1945) 1st number p. 143. It is probable, that his own life experience was the source of this idea, as we know that in the fascists' era he was hiding in the Swedish Embassy and he was collared because of a scientific publication sent to Sweden. Compare Moss R. W. op. cit. p. 160.

[20] MNL. OL. XIX-B-1-h Ministry of Interior, Head Department of Association sz. n. 83. d. The minutes were taken on June 9, 1945, Budapest of the Hungarian-Soviet Cultural

June. A very wise thinking of the Nobel laureate and his friends lead to this conclusion: after the hell of the Second World War there was no other possibility just to make peace with the given situation[21] and the only peaceful way of doing that was building up friendship and cultural connections with the Soviet Union.

Hungary was Hitler's last satellite state in the war nevertheless Szent-Györgyi was the first who could cross the Soviet frontier (some other Hungarian scientists followed him) while the Red Army had not returned back from the battlefield. Szent-Györgyi arrived at the 220th anniversary of the Russian Academy of Sciences in June 1945 and he was the guest of the Soviet Union a lot longer, than the others. He wanted to see how the minorities lived in the Soviet Union so, as he requested, he was shown around Armenia and Georgia by the Association of International Cultural Connections. Just like his friend Lajos Zilahy, the writer, Albert Szent-Györgyi who was a humanist thought that the two nations were close to each other, because they had very similar souls, and according to him this was the most important criterion for their friendship: The Soviet people are helpful, open to accept other cultures[22] "We love our culture without treading on other nation's culture and we love our homeland without hating other countries" – this way he tried to make peace. The congress – as the first scientific world meeting went on in the spirit of goodwill and the Soviet Union tried to be the initiator, to integrate the world of science, "because as Professor Kapitza emphasized – there was only one real world of science."[23]

His first experience was just made stronger 10 years later when he visited the Soviet Union for the second time. He was amazed to see the scientific-technical development which took place during the ten years, the scientific-technological staff was excellently equipped and both the young and older generations of the researchers were enthusiastic. He also visited schools and

---

Friendship Society's General Assembly. The author, Zilahy Lajos, became the president of the association, who was called upon the task by Barulin embassy councilor, knowing his antifascist activity.

[21] „Hungary became a neighbouring country to the Soviet Union… The old political and social system of Hungary collapsed and we Hungarians have to rebuild our own homeland. Szabad Nép 2. (2nd August 1945) no. 106. p. 2.

[22] Szent-Györgyi about the Soviet people. Magyar Nemzet 1 (8th September 1945) no. 106. p. 1

[23] Szent-Györgyi said that the scientific conference held in Moscow was highly important. Magyar Nemzet (6th July 1945) No. 53. 2.

children's homes to study the education, the instruction of the future generation. He was happy to see that wide scientific interest which was – according to him – almost unique in the world. You could buy academic journals at the newsagents. He emphasized the fact, that the Soviet Union used 1% of its national income for scientific research. Many times he spoke of the big, organized scientific institutional system in terms of highest praise, this system encompassed all the country and was spread across the specialization of natural sciences, the head of this was The Soviet Academy of Sciences[24].

In the daily newspaper Délmagyarország he firmly talked about his further plans: "I saw a real model in the Soviet Union what we wanted to achieve here in the basin of the river Danube"[25]. The friends of Albert Szent-Györgyi, who also had some good experiences abroad, were ready to work for Hungary. His best friend, Lajos Zilahy, the writer, visited the USA. There he saw how successful the New Deal was, so as soon as he arrived back home, he exercised all his influence to support the rural sociologists financially[26].

From the very beginning Albert Szent-Györgyi urged radical changes in the Hungarian Academy of Sciences[27], which itself wanted to be reorganized. First his efforts were not very successful, although these efforts were supported by his faithful colleague, Zoltán Bay. After his visit to Moscow, Albert Szent-Györgyi decided to take a firm step (Zoltán Bay encouraged him to do so) they founded the Hungarian Academy of Natural Sciences[28]. The journal Irodalom-Tudomány which was edited by Albert Szent-Györgyi and Lajos Zilahy talked about this event of September 1945 in the fullest detail.

---

[24] The impressions of my travels in the Soviet Russia. Szabad Nép 2 (August 2, 1945) No 106. 2. Magyar Nemzet, see ibid. My experiences related to the Soviet Natural Science. In: The thirty-year-old Soviet Union. 1917–1947 published by Corvina, Budapest, pp 164–167.

[25] The statement of Dr. Szent-Györgyi about his trip to Moscow. Délmagyarország 2. 7th July 1945.

[26] Katalin Varga: Our operation is quite serious – the letters from Zoltán Szabó to György Buday. Forrás vol. 44 (2012) no. 6. pp 75–92. In one of his letters, Buday writes about Zilahy that he only believes Roosevelt about the importance of sociology. He did not believe them before, when they were talking about it. The operation included Zoltán Gáspár, Lőrinc Szabó and Géza Féja.

[27] Lóránt Tilkovszky: The Hungarian Academy of Sciences after the liberation 1945–1948 pp. 349–361. In: One and a half centuries of the Hungarian Academy of Sciences 1825–1975, published by Akadémiai Kiadó, Budapest, 1975.

[28] József Cavallier: The Hungarian Academy of Natural Sciences. Irodalom-Tudomány 1. (1945) no. 1. pp 117–123.

In the historical introduction the author emphasized the model of the Russian Academy and he identified with pain, that in our homeland "except for the era of Kunó Klebersberg there was almost no care about natural sciences and very little care about social sciences."[29]

When he looked through the European ancestors (Academic Françoise, Royal Society of London) the author stated that the Hungarian initiative closely resembled the Academy of Peter the Great and the modern Russian Academy of Sciences. The Hungarian Academy of Natural Sciences "on one hand provides jobs for scientists and on the other hand it is an advising and leading forum which helps to use the discoveries of natural science professionally and economically". Albert Szent-Györgyi found an investor to deal with the economic questions and finance them, it was István Ráth Dr, an entrepreneur.

There were 40 members in the General Assembly on September 6, 1945, who founded the Hungarian Academy of Natural Sciences, the following were the most famous among them: mathematicians: Lipót Fejér, Frigyes Riesz, physicists: Zoltán Bay, György Békésy, Pál Gombás, chemists: Győző Bruckner, Kálmán Laki, Brunó Straub F., Tibor Erdey-Grúz, István Náray-Szabó, Béla Issekutz, biologists: Aladár Beznák, Miklós Jancsó, Kálmán Sántha, Albert Szent-Györgyi.

Members from abroad: György Hevesy, Mihály Holényi, Tódor Kármán, Pius Koller, János Neumann, Marcel Riesz, József Tomcsik, Jenő Wigner, Frigyes Verzár, László Zechmeisrter. The officers of the Academy consisted of the following: the president was Albert Szent-Györgyi, the vice-president Zoltán Bay, the financial director was István Ráth[30], the secretary-general was Pál Gombás, and the secretary was József Cavallier.

---

[29] József Cavallier ibidem The two different groups of science can never work to harm or take advantage of each other. Compare József Pál: From the Unity of Life to the Coequality of the Forms of Consciousness. Worries of Albert Szent-Györgyi in Times of War. Szeged, vol. 24. (2013) no. 12. pp 7–10. See the same volume.

[30] István Ráth was Szent Györgyi's friend too, but soon the communist leadership found him conspicuous because of his financial influence. So in the summer of 1947, when Albert Szent-Györgyi stayed in Switzerland he was arrested and "interrogated". Albert Szent-Györgyi had to bring every influence to bear to get him free. Supposedly, this personal insult of his was the last thing to make him stay abroad and never come back to Hungary. Compare Moss R. W. op. cit. p. 180; Zoltán Bay: The life is stronger. Csokonai-Püski, Debrecen-Budapest, 1990. p. 200. There are some people, who mention the arrest of Lajos Zilahy too, but there are no documents about it whatsoever. Compare: Tibor Szabó-Andor Zallár: Albert Szent-Györgyi in Szeged and the Collection of Szent-Györgyi. Archives of Csongrád County, Szeged 1989. p. 79.

This Academy, organized by Albert Szent-Györgyi had members from abroad, too – this way it was a unique experiment in uniting the homeland Hungarians with the ones living abroad. It was the unity of natural sciences of that era on institutional level as well as on the level of intelligence[31]. This way Albert Szent-Györgyi formed a Hungarian workshop without walls, which was the best of the world's natural science, Albert Szent-Györgyi also informed the press about the reason why it was necessary to establish this institution. "Without modern science it is not possible to rebuild this country… and the present Academy neither modern nor scientific enough."

Albert Szent-Györgyi considered the matter of intellectual and cultural renewal as important as the problem of bread and the shortage of coal. We ought to put experts in important positions, not "the knights of the era."[32]

The Hungarian Academy of Natural Sciences planned to edit an international scientific journal, after some disputes this journal was first issued in the summer of 1946. There were mathematical, physical, chemical, physiological actas in two languages: English and French. Their titles were: Hungarica Acta Physiologica, Hungarica Acta Mathematica, Hungarica Acta Chimica, Hungarica Acta Physica – the publisher was: Academiae Scientiarum Naturalium Hungaricae 1946. They were regularly printed only for two or three years and when Albert Szent-Györgyi left the country, they did not appear any more. In 1948 István Rusznyák published the journal Hungarica Acta Medica, the publisher was the institute Academiae Scientiarum Hungaricae.

The Soviets were very interested in the Academy even during the peace negotiations - then the cultural connections were not so close – they asked the Hungarian Ambassador Gyula Szekfű about reaching the Academy organized by Albert Szent-Györgyi.[33]

---

[31] Ferenc Nagy: Albert Szent-Györgyi and the Hungarian Nobel Prize winners. Műszaki és Természettudományi Egyesületek Szövetségi Kamarája, Budapest 1993. 31.

[32] Albert Szent-Györgyi urged the earliest possible success of experts. Magyar Nemzet 1st volume (6th December 1945) no. 179. 1.

[33] MNL OL P 2148. entry 2: The minutes of the meetings held in the National Centre, reports, summaries about the functioning of the Organization of Hungarian Standards Institution, suggestions, positions about social, economic and political questions etc. Signature: Gyula Szekfű. The developing communist power was not interested in the Nobel Prize winner scientist's key position in the Hungarian-Soviet connections. c. f. Tasiné Csúcs Ildikó: "I am afraid, that the gentlemen made the wrong choice." Notes from the operation of Hungarian-Soviet Education Society under the presidency of Lajos Zilahy – 10. under publication.

Albert Szent-Györgyi had some supporters in the fights at the Academy for example Zoltán Bay – who had the very first and everlasting friendship with Lőrinc Szabó[34] – and the journalist and Prime Minister Ferenc Nagy[35]. (The Hungarian history of science did not write about the effects of human relationships between our greatest natural scientist yet.)[36]

In the summer of 1946 as a result of the determined fights by Albert Szent-Györgyi and his colleagues and the blessed work of Dezső Keresztury the Hungarian Academy of Sciences was reformed. It had four sections: the 1st and 2nd had human character, the 3rd was about the lifeless natural sciences and the 4th dealt with the living natural sciences[37]. The 3rd section was led by Zoltán Bay, who was a theoretical physicist, Albert Szent-Györgyi was offered the position of the president but he did not accept it, Zoltán Kodály became the president, Albert Szent-Györgyi was the vice-president.

The modern people want to ask the following question: whether the great respect of science in the Soviet Union is an achievement of the new system or it has deeper roots in the society. To be able to answer this question we have to outline – at least give a rough outline of – the history of the Russian Academy of Sciences and the history of the Russian science and to stress the momenta important to us.

In the beginning of the 18th century there were no scientific institutes in Russia[38], but at the same time the country was in sore need of professional knowledge. The European (not Russian) science was concentrated at the universities, but these institutes were under the influence of clerical circles.

---

[34] Zoltán Bay had a great friend László Németh, their correspondence improved László Németh's scientific knowledge. Zoltán Bay, László Németh and Lőrinc Szabó were the students of the Reformed College of Debrecen.

[35] Bay remembered about this: "We sat around him (Ferenc Nagy) just like scientists around Gábor Bethlen." The career and example of Zoltán Bay in documents. Compiled by Ferenc Nagy. Better – OMIKK – Püski, Budapest. 1993. 96. Ferenc Nagy, the Prime Minister was a big patron of scientists and artists (Zoltán Kodály) ibid p. 97.

[36] József Pál: The poetry of Albert Szent-Györgyi. See the same volume. No. 7 за 2002 г. http://magazines.russ.ru/oz/2002/7/2002_07_24.html

[37] L. Tilkovszky op. cit. pp. 353–354 and József Pál: From the Unity of Life to the Coequality of the Forms of Consciousness. Worries of Albert Szent-Györgyi in Times of War. Earlier there was no biological-medicinal department, no technical department. See the same volume.

[38] Гавриил Хромов Российская академия наук: история, мифы и реальность. «Отече-ственные записки»

Perhaps it was Leibniz[39] who suggested establishing a scientific center to Peter the Great. As Peter the Great did not have good relationship with the church[40], he may have found appealing the idea of a secular, merely researching institute, financed by himself, the emperor. This institute had self-government and was based on the idea of the republic of science[41]. It was not an independent society of scientist, as in Europe, but it was centralized state scientific institute, its prestige was due to the financial help coming from the government and coming from the tsar. The task of this institute was "to teach and improve science so that the whole nation could profit from these teachings and improvements."[42] The edict – which was partly written by Leibniz and Wolf – was to rule the operation of the Academy and had three targets to meet by the body of the best scientist

- to study and improve sciences
- to educate the youth, who were suitable for education (this later became the education of candidates)
- to train some people, to make them able to teach the youth the basic elements of all sciences.

So this Academy united 3 tasks, the task of a research institute, the task of higher education, as well as the task of the education of candidates. In addition all the members of the Academy were obliged to write down the system of their specialized branches of science in Latin language and to teach a lesson of their subjects in public every day. All the Latin speeches were translated

---

[39] Ágnes Hangodi: The plan of Leibniz about getting science and culture to Russia Ponticulus Hungaricus vol. 15. no 7–8 (July-August 2011). Leibniz considered Russia some kind of tabula rasa, where he could send the European culture without its wildings. He summarized his plan in 8 points about the most important actions and he suggested that Peter the Great established 10 advising institutes and one of these institutes dealt with scientific cases. http://members.iif.hu/visontay/ponticulus/rovatok/hidverok/hangodi-leibniz.html, letöltés dátuma. 2014. máj. 16.

[40] The Eastern Church considered all foreign cultures contagious. They prevented Boris Godunov from founding a university 100 years before, they protested against the guest professors, because they bought foreign cultural influence in the country. Peter the Great became the head of the church; he did away with the post of the patriarch and introduced the Saintest Synod, which was led by the tsar. http://members.iif.hu/visontay/ponticulus/rovatok/hidverok/hangodi-leibniz.html date of download: April 23, 2014.

[41] Гавриил Хромов op. cit. p. 2: "The idea of a pure, secular institute, supported by the monarch, the so-called revolution of scientists was that time modern, even revolutionary."

[42] S. L. Vavilov: The role of the Academy of Sciences in the progress of our science. In: The history of Science in the Soviet Union. Akadémiai Kiadó, Budapest, 1950, pp. 33–48.

into Russian and published. So the Academy also had the task of popularization of scientific knowledge which was necessary to make the people see the benefits of their work. Peter the Great wanted to compensate the huge social underdevelopment "because if we consider, that there are no elementary schools, secondary grammar schools or seminaries, where the youth could start learning and – what is impossible at the moment – could go on for higher education to get a scientific training, we can see that in these circumstances universities are no use at all"[43] that's how the edict of foundation (28 January 1724) described the special role of the Academy and the malfunction of the university at that time.

While in Europe the system of science and education was built up by starting from the basic education, in Russia it happened exactly the opposite way. First they established the highest institute (the Academy) and it had all the functions for a while, then built up under itself the other dependent institutes, such as universities[44], secondary grammar schools[45], elementary schools. In Europe for a long time, only the Pope had the right to establish universities, in the Russian Empire it was the right of the Emperor. At the Russian University in Moscow there was no theological faculty, the theological education took place in different institutes.[46]

The secular character of the Academy and respectively of the University was proven when on an occasion the Moscow Secondary School was not able to send enough students to the university and the Senate gave the theological seminars in Néva and Novgorod permission to send their students to the university[47]. The education was so important, that the leaders of the Academy

[43] S. L. Vavilov: op. cit. p. 33.

[44] First Peter the Great founded a university in Saint Petersburg, but it fell short of his expectations, so after the suggestion of Lomonosov they established a university in Moscow in 1755. Normally, they date back the Academy to this year because the university gave the supply. C. f. Гавриил Хромов op. cit. 2. see М. И. Радовский: М. В. Ломоносов и Петербургская Акабемия 1961. Ленинград. 123.

[45] The denotations of the scientific literature refer to this too, academic university or academic secondary school see also М. И. Радовский op. cit. Учебное Дело 115–164. passim.

[46] М. И. Радовский op. cit. Educational matters, p. 122. "the academic university did not have to have a theological faculty", c. f. http://hu.wikipedia.org/wiki/Moszkvai_%C3%81llami_Egyetem date of download: April 23, 2014. These institutes were seminaries (of the church).

[47] М. И. Радовский op. cit. Educational matters, p. 116. Later in March 1748 some more seminarists could get in the university but they had to take their entrance exams in the history section ibid. p. 121–122.

appointed M. V. Lomonosov as the secretary of public education, because they wanted that "at the university and at the secondary grammar school everything was in good order."[48] It was a well-known fact that M. V. Lomonosov was the greatest supporter of improving Russian scholarship. In the beginning the secondary grammar school had some tens of students and the university had even less. There was a breakthrough when they introduced the instruction in the mother tongue, Russian language (instead of Latin language) in the education and also in the popularization of Scientific Knowledge. Lomonosov, the polymath and his Russian Grammatica played an important role in achieving this breakthrough.

According to the above mentioned, the Academy of Sciences in Saint Petersburg had all its first scientists coming from abroad. Most of all they were Germans like Leibniz or Swiss like the mathematician Leonhard Euler, who considered Russia to be his second homeland. There was the Dutch Daniel Bernoulli and the Russian scientists appeared only after a quarter of century later, for example Lomonosov and Trediakovsky[49]. The fact that the Academy of Saint Petersburg became Germanized[50] caused a huge problem. In the beginning the students of the Academy were only foreigners, too. Lomonosov tried to solve this problem by making obligatory the general instruction in the mother tongue, Russian.

The Academy was responsible for printing books all over the country, the classics of the world literature in Russian and respectively the popular scientific literature also in the mother tongue[51]. Catherine the Great established an Academy in Moscow, it was made after the model of the French Academy[52]. This new Academy was a purely human institute, dealt with only the Russian

---

[48] М. И. Радовский op. cit. 115. "So that at the university and at the secondary grammar school everything was in good order." (translated from Russian into English)

[49] For a while even the Vice President of the Academy was a certain Schumacher and Lomonosov very often came into conflict with him because of his bureaucratic attitude. See also М. И. Радовский op. cit. p. 115–116.

[50] The independent Academy of St. Petersburg became a poorly German institute in short time, where the Russians were tolerated as annoying necessity. See Гавриил Хромов op. cit. p. 2.

[51] S. L. Vavilov op. cit. p. 37.

[52] András Hevesi: The 300 year old French Academy. Nyugat, 1935. Volume 9. http://epa.oszk.hu/00000/00022/00596/18839.htm date of download 24 April 2014. The main objective of the French Academy also was the promotion of the French language. The criteria for the membership of the Academy were in addition: "pleasant voice and appearance and as a private individual an honourable lifestyle."

language and literature. This new Moscow Academy made the Academy of Science in Saint Petersburg livelier. Later this Moscow Academy was incorporated into the Russian Academy of Sciences as the section of Russian language and literature to complement the already existed history-philology and physics-mathematics sections[53]. By the first half of the 19th century the whole system of public education[54] was developed and 8 institutes of higher education (similar to universities) existed in the empire. When the universities were formed and became stronger and a number of scientific societies were founded, the role of the Academy lessened and its importance was also smaller, but it could keep its state prestige, the rank of the member of the Academy was as high as of the member of the council of state[55].

In the strategy of the new soviet state science became an indispensable base (sic) [56] and the state wanted to receive the high prestige Academy's support as well. Before the revolution in the operation of the Academy, the most successful was the research of human disciplines and the applied sciences (прикладная наука) were almost totally absent. The new strategy of the soviet state changed this condition because it was very generous when supporting the scientific institutes morally and with the organization. Between 1918 and 1930 the number of the scientific institutes increased fivefold (800), and in those institutes the scientists of the applied sciences appeared in great numbers.

The Academy was reluctant to identify itself with the requirements of the controlled economy, but in the end in 1931 joined the five-year plan[57]. Meanwhile the soviet state enlarged the system of the scientific researches again, so by 1933 there were 1300 different scientific institutes in the Soviet Union. (At the same time the higher education was enlarged at a faster rate). In 1933 the Academy

---

[53] See Гавриил Хромов op. cit. p. 2.

[54] Alexander I. issued a decree in 1803 according to this the church had to open a school in every village, and provide teaching free even for the children of the feudal tenants. http://hu.wikipedia.org/wiki/I._S%C3%A1ndor_orosz_c%C3%A1r date of download 24 April 2014. Lomonosov initiated the provision of the equal opportunity in secondary education and eventually it was made obligatory in elementary education by a statute of the tsar.

[55] Гавриил Хромов op. cit. p. 4. Before the revolution 11.000 lecturers and scientists worked in the Russian higher education, at the institutes of Academy 212 people of whom 47 were members of the Academy (mostly elderly people)

[56] Vavilov op. cit. p 43. c. f. Гавриил Хромов op. cit. p. 5.

[57] The members of the Academy were strongly against the direct planning of science they considered this step as an unpardonable intervention by non-professionals. See Гавриил Хромов op. cit. p. 6.

became the part of the Commissar's Soviet and the reason for this was: "to draw near the Academy to serving the building of socialism[58]. The members of the Academy became the commissars of the not industrial science, they depended on the government, and as the authorities of the people's economy they divided the budgetary means granted by the state. In the soviet system they formed the Supreme People's Economic Soviet which gave the orders to the Academy and the Commissar's Soviet decided how to finance the Academy. The government regulated the operation of the Academy by statutes and proposed the specialization of natural sciences, so new institutes of physical-chemistry, of analytics, of physical-mathematics were created since the 1920s[59].

Approximately at this time Albert Szent-Györgyi visited the Soviet Union for first time (he was not a Nobel Prize winner yet). He must have experienced the same as the American correspondent: the high social prestige of the science; that science was organized and concentrated and got big support from the state. He could not have noticed the faults of this system – due to the short time he spent there – the disregarded scientists, the enclosure etc. But all these could have remained faint impressions if he didn't get the invitation from the Soviet Academy of Sciences to visit the Soviet Union again.

According to the researches the Academy and the research system did not suffer as huge losses as the Soviet people. During the war the Academy and its institutes were carefully preserved "the number of the scientific staff did not decrease, but by 1945 it was higher than before the war."[60]

So during his second visit, after the war[61], in spite of the difficulties due to the war Albert Szent-Györgyi found a more flourishing scientific system and as he was an experimental researcher he wanted to see everything, including the local Academies of the different Republics, the education, the national cultures.

Szent-Györgyi was able to see the practical use of modern scientific discoveries and wanted to adopt this method reasonably to the Hungarian conditions.

---

[58] Гавриил Хромов op. cit. p. 7. Vavilov emphasizes the time, the statute of the executive committee on the 14th of December 1923 which put the Academy under the leadership of the Council of the People's commissar. The year of 1934 was also significant when the Academy was moved to Moscow (25 April 1934) and it was also amalgamated with the Communist Academy. See Vavilov op. cit. p. 45.

[59] Vavilov op. cit. p. 45.

[60] Гавриил Хромов op. cit. p. 8.

[61] In a telegram, Stalin thanked the president of the Soviet Academy of Sciences, Komarov for the scientific cooperation of scientists with the soviet power during the war. See Vavilov op. cit. p. 47.

He saw that the whole rebuilding process was under the control of the Academy, so he thought the movement should be into this direction in Hungary, too. (Tibor Erdey-Grúz also believed that it was necessary for the science to be under central control. In addition, the state of the Hungarian Academy of Sciences after 1945 strongly resembled the condition of the Russian Academy of Sciences after 1917. The human sciences were dominant and the applied sciences were completely disregarded. The latter – mainly the technology – was indispensable condition of the rebuilding. So the historical, social constellation included the need for change, even better, it gave way to the possibility of outstanding scientific progression. Anyway if we examine the members of the Academy of Natural Sciences we can state that they were in the forefront of the world.

Albert Szent-Györgyi was the heir of Klebelsberg's idea and he saw a real possibility of a great advance in science in Hungary, too. That time there were two models of science: the American model and the Russian model – and Albert Szent-Györgyi considered the latter more suitable for us to follow. He had two reasons for that – the geographical conditions and our social underdevelopment too. He, as a scientist of experimental science, was convinced by the experiences he gained in the Soviet Union. The results that were achieved there in the Soviet Union – according to him – were the results of the Soviet science policy. He was not able to see that this widespread social respect for the science had very deep roots originating from the tsars' era, but the communist power tactically considered it to be their own. Albert Szent-Györgyi, behaving as a good master – tried his best to make the Hungarian scientific life as modern as the contemporary scientific life was. Eventually, the Hungarian communist power adopted the Soviet scientific model, but not with the help of the Nobel Prize winner scientist[62].

In his autobiographical and detailed documentary novel titled: The life is stronger, Zoltán Bay precisely described those political, social, changes which took place between 1945 and 1948 in Hungary. Even based on this novel, it is still difficult to find that starting point when Albert Szent-Györgyi and the developing communist power started to drift apart. But, maybe it is not an exaggeration – according to my researches so far – to talk about the first Congress of the Hungarian-Soviet Cultural Society (7th July 1946) from this point of view.

[62] See Sándor Kónya: The suggestion of Ernő Gerő about the reorganization of the Academy. Magyar Tudomány Volume 161 (2000) No. 2. pp. 240–243. They established the Hungarian Scientific Council to transform the institutional system of the scientific research, and they let The Hungarian Scientific Council to transform the institutional system of the scientific research, and they let The Hungarian Academy of Sciences die.

The communist Hungarian leadership under the guidance of József Révai dismissed the leaders of the society (including Lajos Zilahy) before this congress, the Soviets were not told about this change[63]. As we can see from the minutes: the society was supposed to do some communist propaganda, but Lajos Zilahy and Albert Szent-Györgyi were completely against it[64]. Maybe from this point it became clear for Albert Szent-Györgyi too, that the developing communist system did not need a Nobel Prize winner scientist, European level science, but it needed party members who were eager to fit themselves to the new system, just like Zoltán Vas, Ernő Gerő. To prove that Albert Szent-Györgyi was deeply concerned about the Hungarian science here we have an extract from the book by Zoltán Bay, containing their conversation before his journey to Switzerland: (Zoltán Bay): "Tell me, Albi, you will not cheat me and it is for sure you are coming back? I do not want to hear from others, that you are not coming back home."

Albi gave him his hand and answered: "I am coming home you can be sure about that. Then we are going to decide together what to do about us and about the Academy."

A világ nagy tudósai a Szovjet Akadémia 220 éves ünnepségén.

[63] Barulin, counsellor of legation had the next reaction to the dismissal of the leadership after this event at the general assembly: „There is no need for reelecting the whole management." According to him it is not even necessary formally, to select the whole management. MNL OL P 2148. I. entry. Minutes 1. d. [52/6] no. document. Minutes.

[64] „We cannot expect neither from Zilahy nor from Háy to do propaganda. I believe it would be easy to increase the number of the members for example from 1 million to 1.5 million, using a little propaganda, these actions should be connected to the different worker's unions, to the party of Smallholders" - the words of Árpád Szakasits ibidem. Compare Tasiné Csúcs Ildikó op. cit.

József Pál

About Albert Szent-Györgyi's Poems

I started to read Albert Szent-Györgyi's intellectual as well as emotional poetry when I was preparing for a lecture as part of the Open University programme series at the University of Szeged. Szent-Györgyi, the natural scientist, was also well-read in philosophy and in several fields of humanities. He knew the ruling ideas of the age, he read all the outstanding works of contemporary literature and the relevant research papers on them. A further research could study the intellectual relationship between Szent-Györgyi and Mihály Babits, Antal Szerb, who completed his habilitation at the University of Szeged, and others. Fundamentally, his ethical stance had very close connections with the generation of the literary-political periodical called Nyugat [West]. This connection was so strong that there seem to be some kind of harmony between even the sentences used by the scientist and the generation of Nyugat. This also brings forth the question how Szent-Györgyi was able to be so well-read in the 20th century and why philosophical literature, *humaniora studia,* was so important to him. The comparative form in Latin suggests that philosophical literature makes a human more human, brings him closer to his own ideal.

Philosophical and Ethical Issues

One of the most serious problems Szent-Györgyi's generation had to face was the crisis of the Western culture. One aspect of this crisis was the underdevelopment of human being as an ethical factor in an age when sciences advanced rapidly but without any appropriate "monitoring" mechanisms. The ethical practices of man were at the level of primeval times and a gap was widening between this ethics and rational knowledge which may pose a serious threat to the entire of humanity. Szent-Györgyi's trust in the human intellect and his emphasising the fundamental importance of the arts are apparent not only from his writings on these topics, but from his correspondence and his discussions on the theory of science. In these discussions, he often conceals important references which are not about knowing the animate or inanimate nature, but about unequivocal philosophical questions. These references and remarks appeared quite frequently in Szent-Györgyi's life although he aired his intellectual tension in different ways in the 1930s, in the years around World War II and in the 1960s, in different ways.

In photocopies, the Klebelsberg Library of the University of Szeged collected all of Szent-Györgyi's research papers not published in a separate volume. Through a chronological reading of these works, we can see the intellectual development of a moralist scholar and his sensitive response to the changes of the historical situation. Apart from incidental remarks, introductions and research papers collected in festive volume, he discussed philosophical and ethical issues systematically also in his monographs entitled *La paix, sa biologie et sa morale* and *The Crazy Ape*. While the former volume was written in French before World War II, the latter one, which expressed very similar views, was written a lot later, in a consolidated age and environment (it was published in 1970).

The characteristics of Szent-Györgyi's intellect, his response to the intellectual crisis was in perfect harmony with an approach that was represented by the generation of Nyugat. This field has not been elaborated on in the Hungarian science of literature. Professor and poet Sándor Sík became a mediator in this process, naturally. He was close to him in a geographical sense also. They both lived and worked in the same block and, presumably, they frequently met. When Szent-Györgyi was Rector of the University, the Piarist professor and colleague had the greatest impact on him. He unselfishly assisted his "boss" with his expertise in editing and dramaturgy.[1] Szent-Györgyi's commitment to *humaniora studia* can be seen in his consent to become chairman of the Hungarian–Soviet Cultural Society (in 1945). The famous writer, Lajos Zilahy, became his joint chairman. Together, they co-edited a journal. (Incidentally, the biographies of the two ran parallel at certain points in their lives.) Such a special venture was and has been quite rare not only in the Hungarian science of literature, but also in the entire Hungarian history of science. The title itself indicated the aim of providing the fields of intuitive and of rational cognition a common platform. *Irodalom és Tudomány* [Literature and Science]: the two phenomena separate and united at the same time. The first part, comprising approximately two-thirds of the journal, on nearly one hundred pages, was discussing literature, on works of art, translations and research papers. The remaining one-third of the journal was about science. The part on literature was edited by Lajos Zilahy. (Ildikó Tasi Csúcs, working in Klebelsberg Library, is conducting a comprehensive study of the published issues and the history of the journal. For further information, see her research paper published in the present volume.)

[1] This assistance was also expressed in the professional support of the university's acting company. As a result, a dramatic historical performance of Hamlet, the "Hamlet of Szeged" could appear on stage directed by István Horváth, Jr.

Szent-Györgyi saw ethics, science and culture as interdependent phenomena. He saw them as separate realisations, separate aspects of a deeper, common unity or of essence. He wrote about this in the programme paper of the part of the journal he edited. He published it in August 1945, in the first issue of the journal. In his words: "*All three areas are seeking the truth in different forms. Each of them teaches us that we should seek the truth, and not to try to justify our truth; all three areas are communications of divine wisdom.*"

Intellectual completeness can be desired for only by someone who is highly intellectual, who has tried multiple ways of thinking, who analyses the ethical relevance of actions from several aspects and who is full of emotions. Being a narrow specialist is a very sad phenomenon. Someone who is trained only in one area is an intellectual proletarian, as Szent-Györgyi quotes, *homo unius libri* (timeo). One, whose one-sided, polarised views shall be feared. The three areas of ethics, science and culture collectively form divine wisdom through which one can gain firm knowledge. "The only aim of natural sciences is to know the deepest truths, the deepest wisdom, to experience God." And God is Being itself. Szent-Györgyi wrote about this as follows: "Therefore, nature cannot give an answer to the questions of 'What is life?' or 'Does life exist?' What natural sciences can do is to merely examine the individual phenomena of life."[2] Thus, research is focused on the laws of nature, for example, oxidation, a most relevant example in this respect.

Researcher of God's "creative power"

One is trying to understand the invisible (divine) "creative power" even if, on the surface, one seems to be analysing exclusively the substance. It was highly characteristic of Szent-Györgyi that, as father of empirical sciences, he often referred to the Italian writer, literary historian and physicist Galilei, who was considered by some as a pre-materialist, and who often said (in works cited by Szent-Györgyi as well) that we can and shall learn the world only as a creation of God. (It is a different issue that the Italian scholar, who – although only to himself – shared Dante's ambitions, turned to oppose the church the same way as did his outstanding humanistic predecessors wishing to deepen and clarify knowledge.)

[2] See "From the Unity of Life to the Coequality of the Forms of Consciousness." Worries of Albert Szent-Györgyi in Times of War.

A fundamental principle of Christian theology is that man is an analogue of God, who is continuously fighting for physical and intellectual being to find and understand God in nature, history and human soul. In a radio interview Szent-Györgyi was asked to talk about his belief in God and he replied the following: "I am not a religious [man], but I am a *pious* man. … A religious man says 'God is this,' 'God is there,' 'God is that. Your God is not my God.' But a pious man looks up with awe and says, 'What is God?' And I'd like to know what this 'creation' really means! A pious man is really touched by the greatness of nature and of the creation." [3] The scholar in constant battle with himself and the limits of knowledge cannot really avoid not connecting in a way or another with something or someone that is beyond the 'knowable.' He sings psalms as King David did once.

Especially, in the most critical moments in his life. The poems were born in the summer of 1964 in response to the serious mental crisis the scholar was going through as it was only a few months after her second wife, Márta, had died. *Psalmus Humanus* is a pious man's psalm. Its number of rows reminds us of a sonnet. It is a lonely dialogue without responses with a "hiding" God. After the initial addressing of 'My Lord!' the first part is trying to find a name for God. The question, '*Who are You?*'[4] is followed by a series of nouns to find a name for 'You' and ends the list with question marks: 'my loving Mother,' 'my stern Father,' 'the Universe,' 'the Law which rules it [the Universe]?' We cannot get answers to the '*Why's*' either. Are we born to destruction? Did we create God or did God create us? Then the scholar-poet is seeking God's help to save him from his grave doubts. Among these, some of them are mentioned. One of them is rooted in his private life – his wish to be freed from loneliness. The other is about his social responsibility as a scholar. The lonely man is speaking with an assuring tone of his dilemma that was developing in him as a result of incomprehension.

If we consider the typology of genesis in Goethe's *Faust*, Szent-Györgyi preferred the evolutionist approach[5]and not the 'volcanoist' that linked the beginning of life to a moment, to an eruption. Moreover, continuous advancement both by the laws of nature and by the knowledge gained about these laws is in

[3] Ralph W. Moss, Free radical: Albert Szent-Györgyi and the battle over vitamin C. New York: Paragon House,1988. 213.

[4] In St. Thomas's views, the best term to refer to God is *Qui est*.

[5] In the above-mentioned interview, he also said that, as opposed to the Bible, God did not create life from nothing with his word but life was continuously developing from the physical world itself.

contrast with the approach that both man and the world are God's finished products (even though at times, God was forced to re-construct these products). The approach or idea of development allows more room for human activity and creativity (this was Goethe's opinion too); this approach is obviously holding favourable opportunities for a creative man. To become God's 'colleague' is a highly attractive role to take especially if we imagine a superior being free from the errors that characterise us and which feature we foolishly confer to Him. Human knowledge recognising God's autonomy, i.e. aligning our activities to the absolute, may prove the most useful for a community.

The Prayers

First Prayer: God

My Lord!
You are greater than the world You created,
And Your house is the Universe.
I shaped You to my own image
Thinking You vicious, greedy and vain,
Desirous of my praise and sacrifices,
Revengeful of my petty trespasses,
Needful of the houses I build you
While my fellow men I let go without food and shelter.
God! Let me praise You by improving my corner of Your Creation
By filling this little world of mine
With light, warmth, good will and happiness.

After *Psalmus Humanus* this was the first of six prayers. The way Szent-Györgyi composed these poems is deeply interesting. Literary tradition originates in the psalms of the Bible, to which the biologist remained faithful. These are questions of a man seeking a connection with God, questions about the relationship between God, man and the world, about divine expectations, a man's duties and gnawing doubts.

The prayers can be broken down to three parts: all six begin with an assertion that are generally positive in attitude. Therefore, these initial assertions are all positive statements at the beginning of each *prayer*. Consequently, a reader may think that these introductory lines show God's real intent, the possibility of the realisation of the good in a context which cultures problems. These

are the following: The Heart and the Mind, The Leaders (our politicians and priests), Energy and Speed, Children etc. The Parent, the Universe, Love in the heart and Thought in the mind (Third Prayer), Service (of the Lord and of the man, Fourth Prayer), Science, Beauty and Children are addressed in the 'overture' of the prayers.

However, after the introduction, there is a break in each prayer; the original good intent cannot be preserved. It is as if in the creation process the light had broken up, or at least, had been unable to position well. And so, it becomes impossible to create a perfect world that aligns to the absolute. The second part of each prayer lists the negative features; this part is the place and time for evil to succeed. Human pride is behind this crisis (the greatest sin in the Middle Ages): man believes himself to be God. "I shaped You to my own image / Thinking You vicious, greedy and vain, …" After pride the work of evil manifests in Lust for Power (Second Prayer), Hatred, Destruction (Third Prayer), Devastation, Misery (Fourth and Fifth Prayers), bad Education (ethical, moral stagnation: Sixth Prayer). To God's claim, destructive denial is the response. This second, 'intermediate part' raises the immediate possibility of complete destruction. However, the poems mediate gravity and responsibility, and not desperation or lethargy.

The good and the bad, the creator and the destructive powers are not equally powerful and the outcome of the fight depends on the man: it is the task of the *I* to emphasise (to himself, in particular, then to his environment) the success of the good, and this is the only way he can become similar to his creator. The third part, in Hegel's terms, is some kind of a synthesis. Although through creation, good opportunities arise; nevertheless, it is not consensus and goodness, but it is disharmony that rules. What shall be done now, what is to be desired and what is to be rejected? When shall we turn to God for help to be able to form our world actively? The third part in the poems are prayers for (God's) understanding, for making the world nicer and better (First Prayer), for peace (Second Prayer), for the cleaning of the heart (Third Prayer), for the elevating of life (Fourth Prayer), for co-operation with God (Fifth Prayer) and for the saving of the children (Sixth Prayer). In this formation process, acting in harmony with the absolute is the most important motive.

The topic of the Third Prayer or psalm[6] is the conflict of the heart and the mind. This is a very ancient question in the history of thinking and it is

[6] With reference to the Book of Psalms in the Bible, the author kept the name in the title: 'psalmus.' However, in the title of the other six poems, he uses the expression 'prayer.'

a very ancient idea to confront them. Earlier, in trying to define the relationship between the heart and the mind, the opinion was that the heart and the good originated from God, and the mind was their downright opposite. However, this view was more complicated in the scientist's mind. Lucifer himself was called the 'Light-bearer;' he was directly linked to the mind, to cold rationalism which was in contrast with naïve belief, the 'religion of the heart' (Rousseau, Kazinczy). The antagonist of the Three Angels is the 'ancient spirit of denial.'

In Szent-Györgyi's views, the mind loses its negative connotations (naturally), but he also recognises the limited nature of the mind's use and relevance (this is the reason for his worries about the immensely destructive nature of the latest scientific inventions). However, in his opinion, this is more of an ethical issue than a metaphysical or an epistemological one. In other words, it is ethics that must control the destructive consequences which might easily stem from the inventions of science. It is not the rebellious mind but the hateful heart that poisons the intellect.

Third Prayer: THE HEART AND THE MIND

My Lord!
You have given me a heart capable of love and thirsty for love,
You have given me a mind capable of clear thought and creativeness,
And I have filled my heart with fear and hatred,
And my heart corrupts my mind and makes it build monstrous instruments of murder
To destroy Your world, myself and my fellow men,
And damage the sacred stuff life is made of.
God! Clean my heart, lift my mind,
And make me my brother's brother.

In 1964, an eternal and agonizing problem Szent-Györgyi was struggling with emerged to the surface through his poems. The improvement of public

---

While the former is about the direct relationship between God and the poetic *I*, the latter one has a determinant element, the *world* which has been misdirected. To be able to make order once more, Szent-Györgyi turns to God for help. David's psalmic attitude was replaced by that of a priest's. It is notable how *the Lord* and *God* alternate.

ethics cannot keep abreast with the science he was fighting so fiercely for. A dangerous consequence of this situation may be the destruction of the most important value, of life ("*damage the sacred stuff life is made of"*). The different pace of development of the different forms of consciousness threatens with the destruction of the *whole*. Learning something new does not always entail only the good and the useful but also the dangerous: while man was busy building his 'societies,' he lost his genuine, 'divine' goodness. Moreover, ethics has remained unchanged for the millennia of man's existence. Even civilised societies have remained unchanged from this aspect: barbaric killing, the right of the strongest i.e. unlawfulness have prevailed.

To these dangers, Szent-Györgyi reacted in, essentially, two ways. One way is the changing of the society's structure, the bringing of the idea of a cosmopolite into existence; and the other way, from the individual's point of view, is elevation to a higher ethical level. For the moment, either way is a *pium desiderium*.

Consequently, the content of the Second Prayer is quite obvious from the above. The first part (the thesis) narrates the present situation: the order of the world and the system of electing politicians to deal with public duties and spiritual leaders to serve God. However, in the second part of the prayer, he writes that all, even those who should act in the name of God, are driven by one desire: lust for power instead of working for peace. The representatives of the church provoke killing instead of practising their original duties. He is asking for God's help to send leaders, both physically and spiritually, who can lead humanity to achieve the most important value: peace.

The fourth and fifth prayers are focussing, continuing with the three-part arrangement, on scientific research, on the scholar struggling with conducting these researches. The thesis and antithesis of either poem is similar: we were given a beautiful, rich land and a human sense able to understand and influence this land; however, with our guns, we have brought misery and destruction to our fellow creatures ("*build them into formidable machines of destruction*") – the antithesis. The *We* is unable to reconcile this conflict, to perform the task. On the one hand, he turns to God for help to forbid destruction for humans ("*Let me not destroy the temple of life,*" Fourth Prayer), and on the other hand, he needs God to allow us to become companions to him in the building of life ("*Let us be Your partners in creation*," Fifth Prayer). A man can become God's *analogue* by activity and not by remaining in our given situation. The opportunity given by this *resemblance* can be fulfilled only if man becomes a *companion* together with all the dangers this distinguished status poses.

The final prayer is for the children. Some positive characteristic features already cited (pleasure, wealth and harmony) are emphasised once more; moreover, two fundamental Christian values are placed above them: *peace* and *love*. This new salvation must be based on these values. These thoughts remind us to Mihály Babits' World War I poems entitled '*God, Our Father*' and '*Before Easter.*' Babits wrote the gospel paraphrase for a *print* on war orphans. The poem's intention is to make us believe that suffering and the death of the relatives were not in vain, because, as the poem says, "sooner or later dominion and glory will be his (God's)." In Szent-Györgyi's poem, this same wish is formed.

Babits' Hungarian words, "…*gyermekeinket / növeld békére: ha bűn, hogy lábunk / ma vérbe csuszik: értük az!*" can be translated as "*… our children / enhance peace in them; if our feet / shall imbue with blood, it is for them.*" In Szent-Györgyi's poem in English, the same wish is expressed in the following way:

"Save their lives
That the weapons I forge against others may not destroy them,"

Albert Szent-Györgyi: *Psalmus Humanus*

My Lord, Who are You?
Are You my stern Father,
Or are You my loving Mother
In whose womb the Universe was born?
Are You the Universe itself?
Or the Law which rules it?
Have You created life only to wipe it out again?
Are You my maker, or did I shape You,
That I may share my loneliness and shun my responsibility?
God! I don't know who You are
But I am calling to You, for I am in trouble,
Frightened of myself and my fellow men!
You may not understand my words,
But comprehend my wordless sounds.
First Prayer: God
My Lord! You are greater than the world You created,
And Your house is the Universe.
I shaped You to my own image
Thinking You vicious, greedy and vain,

Desirous of my praise and sacrifices,
Revengeful of my petty trespasses,
Needful of the houses I build you
While my fellow men I let go without food and shelter.
God! Let me praise You by improving my corner of Your Creation

By filling this little world of mine

With light, warmth, good will and happiness.
…

Fourth Prayer: Energy and Speed
My Lord!
You have revealed to us the secret energies of matter
To ease our toil and elevate life,
You have taught us to travel faster than the sound we make
That distance should no more separate man from man.
We toil to press these energies into shells
In which to send them to the distant corners of the earth,
To bring misery and destruction to our fellow men,
Leaving the earth scorched and barren of life.
God! Let me not destroy the temple of life,
Let me use my knowledge to my advantage, to elevate life,
Lend dignity to the short span of my existence.
Lend dignity to the short span of my existence.
Fifth Prayer: The Earth
My Lord! You have given us this lovely globe to live on,
Hidden untold treasures in its bowels,
Enabled us to comprehend Your work,
Ease our toil, ban hunger and disease.
We are digging up those treasures to squander them,
To build them into formidable machines of destruction,
With which to destroy what other men have built
Which will turn against me, destroy me and my children.

God! Let us be Your partners in creation
By understanding and improving Your work,
Making this globe of ours a safe home
For wealth, happiness and harmony.

Gábor Szabó

The passage of Szent-Györgyi to biophysics: a journey from the blur of the boundaries of disciplines through the instruments used for research with a stopover at the *paprika* centrifuge and arriving at the super lasers.

Ever since I became a Rector, I have had to get used to the fact that other people direct my everyday routine. In fact, by now, I have also had to get used to the fact that other people give the titles to my lectures. Originally, I thought that now I would start with excuses because I have never held a presentation with such a complex title. Then, I have decided not to be apologetic because I have heard it from a great colleague of mine that he had only came here because he had never seen such an interesting title. So, all I have to do is to make an attempt to fill this content page looking title with substance. To begin with, and to some extent provide an explanation, we should listen to the words of a truly authentic person from an early 1940s radio coverage.

"My uncle on my mother's side Mihály Lenhossék was also a professor, a very famous histologist who dealt with microscopic anatomy and he set the intellectual trend in my family. I had a little problem with my uncle, as he was once a very precocious child, he believed that excellence is always very precocious, but I started to develop very late, so the family looked at me in general as if I were a fool. And when I was fifteen years old and told my uncle that I want to pursue a scientific career, he protested in every possible ways, and told me that I could only become a beautician. Later on his view improved a little, and he agreed to my becoming a dentist. Then when I finished high school he allowed me to go to his laboratory to work. Then I worked in anatomy for three years, but it did not satisfy me. I wanted to see life and what it was, so I went to physiology than worked with bacteriology – those bacteria are very small. Then I realized that the whole world was like that bacterium: for me it was overcomplicated; then I started to work with molecules, and in this way I started to become a chemist. Then I realized that for me even a molecule is overcomplicated. So then I started to work with electrons, which are very small parts of the molecule, and it is a huge separate discipline: quantum mechanics or wave mechanics which studies electrons. And I was quite mature when I started to work with these disciplines, so I went from science to science and I've felt that life is the totality of this all."

These are the words of Albert Szent-Györgyi. His thoughts provide the spine and outline of this lecture. I would also add that he is on a similar view with several world-renowned researchers. One of the sovereignties of our profession *Arthur Schawlow*, an American researcher who belonged to the greatest spectroscopists of the late 20th century, and who in 1987 received the Nobel Prize partly for the discovery of lasers, had the following witty saying: "*my problem with diatomic molecules is that in those there is one atom more than there should be*." For a physicist a rabbit is an incredibly complex universe, while the diatomic molecule is on the edge so that we may just dare to work with it. From what we have just heard, this line of thought had formulated in Albert Szent-Györgyi long before that. In the following, first I want to talk broadly about the thoughts that led Albert Szent-Györgyi towards simplicity. Then we look at what lasers have to do with the sub-molecular world that Albert Szent-Györgyi has actually talked about as a goal that he wants to reach. As a closing session, I shall make an attempt to connect two timely subjects. In this year, quite reasonably, we have talked a lot about Albert Szent-Györgyi and the laser facility that is being built in Szeged. These two are seemingly fully separate issues. I hope that by the end of the presentation, I can convince you that one doesn't really have to force it to link these two matters together.

Already in 1941, four years after he received the Nobel Prize, (at this time Albert Szent-Györgyi still works here in Hungary), Albert Szent-Györgyi said that among the molecules it is the protein molecules, those very large and bulky things, of course, now we have to think on an atomic scale, that cannot in themselves explain the subtleties of the vital signs of life.[1] He said this when others had just wondered on the protein molecules since at that time molecular biology was very very immature and one major step in this direction, through the discovery of vitamins, was actually made by Szent-Györgyi. Szent-Györgyi also raises the idea that in certain circumstances proteins may act like conductors. A little naively, he imagined proteins as small wire particles in which the mobile electrons do something important and the basics of the vital signs of life should be researched in this area. In 1947, he wrote the following: "*The findings are all the more accumulating and suggest that the biological reactions are the disorders of the common electron systems which may not just allow us to understand these reactions, but also describe them with a quantum mechanical formula*.[2] I emphasize that this idea was so ahead of

[1] Szent-Györgyi, A. Nature (London), 148, 157–159, (1941)

[2] Szent-Györgyi Albert, *Az élő állapot* (The Living State) Kriterion kiadó, Bukarest (1973) page 67

its time that at the time, even if it was put politely, it seemed to be nonsense: not many people thought that it was a useful theory.

From 1947, Szent-Györgyi is in the United States and engaged by then primarily with muscle research. (He had already started muscle research in Szeged, in fact, he achieved his fundamental results here. In the early 1940s, the publications by the Department of Medical Chemistry at the University of Szeged were the internationally authoritative sources for muscle research. Papers[3] published by Szent-Györgyi, Straub and Banga are still cited.[4,5] It is important to see that Szent-Györgyi, even at the beginning of his research career, liked to cross the boundaries of disciplines. Although he was a biochemist, he had the strange habit of inviting physicists to his own laboratory. For example there worked, on the field of ultrasound generation, *Sándor Szalai* who later became the founder and legendary director of the Institute of Nuclear Research in Debrecen. So the fact that for his research Szent-Györgyi has relied on co-sciences is, in fact, noticeable from the beginning of his research career.

After his departure to the United States, Szent-Györgyi began to work for the Marine Biology Laboratory in Woods Hole where he was somewhat disappointed. This was possible partly because the people who had invited him did not really keep their promises. However, it is likely that another fact also played a role, namely, that previously in Hungary Szent-Györgyi had a kind of celebrity status. In addition to his Nobel Prize, this status was also owed to the fact that during the Second World War, Szent-Györgyi played a little bit of a James Bond role: he went to Istanbul to negotiate an Anglo-Saxon- oriented peace treaty, which on the one side made him a wanted man by the Gestapo, while, on the other hand, by offering his Nobel Prize in support of the Finnish war, Szent-Györgyi became a wanted man by the Soviets. (I think that it is a proof for the fact that someone is on the right track, when he is seen as an enemy by all extremists.) In spite of all this, after the war, the Soviets actually wanted him to get involved in Hungarian public life. At first, he was

[3] a) Banga, I. & Szent-Györgyi, A. Studies from the Institute of Medical Chemistry University of Szeged, Vol. 1 (ed. Szent-Györgyi, A.) 5–15 (S. Karger AG, Basel, 1941–1942)
b) Szent-Györgyi, A. (ed.) Studies from the Institute of Medical Chemistry University of Szeged Vol. 1 17–26 (S. Karger AG, Basel, 1942)
c) Straub, F. B. in Studies from the Institute of Medical Chemistry University Szeged Vol. 2 (ed. Szent-Györgyi, A.) 3–15 (S. Karger AG, Basel, 1942)
d) Straub, F. B. in Studies from the Institute of Medical Chemistry University Szeged Vol. 3 (ed. Szent-Györgyi, A.) 23–37 (S. Karger AG, Basel, 1943)

[4] Celler, K. et al. J. of Bact. 195 pp. 1627–1636 (2013)

[5] Braun, P. et al. Proteomics 12, 1478–1498, (2012)

committed and enthusiastic, but later realized that the Soviet system is not going to do much good for the country. Then Szent-Györgyi started to make enquiries on how he may relocate to the United States. As I have mentioned, in Woods Hole things did not go into the right direction. So much so that Szent-Györgyi had practically ran out of research money. It was then time for a major role of a financier who had Hungarian origins: *Stephen Rath*. He was able to provide good financial conditions. This was a very successful period in Szent-Györgyi's life as in 1954 he received the Lasker Award and in 1956 he was elected to become a member of the American Academy of Sciences. By this time, in addition to muscle research, Szent-Györgyi had been very busy with the idea of what role particles, that are smaller than molecules, play in the fundamental vital signs of life.

At the beginning of the 1950s, Szent-Györgyi announced that the formation of cancer is somehow explained by the behaviour of electrons. That was when he became interested in free radicals. Free radicals are molecules with an unpaired electron. In terms of our topic for today, it is sufficient to know about these electrons that they are only peaceful when they are in pairs. If there is an atom or a molecule in which an electron does not have a pair, it will look for one. It has to find another electron, therefore, these free radicals are highly reactive. Free radicals also occur naturally in our bodies, but enter the body through different external influences as well. Free radicals may indeed cause many problems in the body thus some sort of protection is needed. Antioxidants serve for this purpose. Antioxidants are molecules that are able to neutralize free radicals. Such an antioxidant is vitamin C that had been discovered by Szent-Györgyi, hence, from the beginning, he had attached great importance to the interaction between free radicals and antioxidants. In his thinking, this also suggested that the matter related to the electrons should also be looked into.

Szent-Györgyi started to learn quantum mechanics after the age of 70. Around the age of 60, he was only just talking to people who could inform him a little more about quantum mechanics. Then, in 1960, Szent-Györgyi published a very important book with the title: *Introduction to a Submolecular Biology*. This work was in many ways very decisive, even though some of the things have since already been outdated by science. However, it is still certain that there are a lot of important ideas in it. I cite two parts from this book. The first idea: "*something very important a whole dimension is missing from our line of thinking, without which*, [*the problems* Sz. G.] *cannot be managed*", the other idea is the concept of *charge-transfer*. At that time, many people denied the existence of charge-transfer, as at first sight, protein

molecules are typical insulators and in insulation charges do not usually move. Protein molecules are quite tricky things because a protein molecule behaves very differently depending on whether it is dry or wet. Protein molecules are already very complex structures, and in addition to that, comes the nightmare of experimental scientists, physicists and chemists: water. Water is actually a very good thing when you're thirsty, but in a lab it is terrible because it is always line of where it shouldn't be present. All substances that we meet either absorbs or excretes water, but at a time when they should not. There is always water in a vacuum system. It simply crawls in. I say to this all the time that there is perfect vacuum everywhere, for example, in this room only that it is filled with air. In addition to that, in the vacuum of lab equipment there is also water. Seriously again, whether something is wet or not wet changes the properties of a material very much. However, the original assumption of Szent-Györgyi that dry protein molecules act as insulators and become conductors with moisture is a more complex issue which is very difficult to determine experimentally. In addition to that, the more complicated mechanisms of conduction processes may also play a role.[6] These complications come, in no small way, from the fact that in a macroscopic protein sample, during a moisturizing process, water molecules may be present in three forms: as free water, as tied to the distinct sites of the chains formed by the binding protein molecules and inside the (protein) molecules. However, the really important idea is not the role of water, but the charge-transfer itself: the process that in an atomic sense charges may transfer to longer distances consequently there may be a molecular-sized "power line system".

By 1970, Szent-Györgyi ran out of money, in fact, he was in a very desperate situation. It seemed that his research would completely come to an end. Partly, this was due to the fact that Szent-Györgyi was unwilling to write conventional applications, and, by that time, those gallant times were over when an easy proposal worked such as the single line submitted by Warburg in 1921: "*Ich benötige 10 000 mark*" (I need 10000 marks).[7] Fortunately, in 1971, a major US daily newspaper made an interview with Szent-Györgyi, where he said that he actually had an idea on how to cure cancer. Szent-Györgyi was a good communicator and able to present his ideas in a convincing way and, at the same time, he also added that he has no money to carry out such research. As a result of the interview, he was called by *Salisbury*, a Washington-based lawyer, who asked Szent-Györgyi where money can be sent, if he

[6] Rosenberg, B. Nature, 193, 364–365, (1962)

[7] Koppenol, W.H., Bounds, P.L., Dang, C.V. Nature Rewievs Cancer 11, 325–337, (2011)

wants to donate 25 dollars to Szent-Györgyi's research? Szent-Györgyi told him to send the money to the Institute and Salisbury did just as he was told. This act was followed by Szent-Györgyi sending the lawyer a thank you letter. The fairly rich Washington-based lawyer was so amazed by this fact that he began to wonder how it was possible that he gives 25 dollars, such amounts are very often donated by the people in the US, and a Nobel Prize winner says thank you to him in a long letter. By looking into the matters, he found out that the situation was indeed very difficult. Therefore, he launched a professional fund-raising campaign and founded an organization called the National Foundation for Cancer Research where, until his death, Szent-Györgyi had been working. The Foundation financed the research of Szent-Györgyi and others. It can be stated that the research that took Szent-Györgyi from biology to physics was funded at that time solely by that organization. Salisbury himself also took part in the work as he was the president of this organization.

Since the mid 1970s, Szent-Györgyi has established contact with *János Ladik.* János Ladik is an excellent quantum chemist. It has almost run out of my mouth to say physicists. (This is a good example for the fact that the blur between scientific fields is nothing new. The Schrödinger equations were invented by physicists and they are the ones who solve it, but if someone wants to calculate the structure of a molecule the Schrödinger equation is needed and this is usually already called quantum chemistry. Moreover, this varies in line with the traditions of university campuses. In Szeged, when I was a student, the subject was called molecular physics, while at the University of Technology it had the title of quantum chemistry because the person responsible for the subject named it in such a way. János Ladik was an excellent quantum chemist who started early to refine the thoughts raised by Szent-Györgyi. The original suggestion that molecules conduct electrons as if they were tiny pieces of wires is a rather naive one. Of course, on proper foundations based on physics, the problem may be investigated and a theory may be worked out. For example, on the slide illustration a letter is shown that was written by Albert Szent-Györgyi to János Ladik in which he requests János Ladik to write a few pages of summary for a semi-scientific book on the so-called band model of electric conductivity on which theory they used to work together. Here is another letter. I like this one very much because it starts with the following: "*I shall begin with a question that may seem a dumb question*". With all due respect, I must say that Szent-Györgyi was right in his suspicion. The question also demonstrates that the learning of quantum mechanics did not go smoothly because surely Szent-Györgyi had misunderstood the uncertainty principle which he refers to here. However, Szent-Györgyi was also aware of

this aspect. In 1960, he wrote the following: *"Previously, each time I have begun a new line, I have always had the hope that I could learn all aspects of the field. With quantum mechanics, this is not the case …"*.[8] However, what is truly remarkable and honourable is the fact that someone actually sets out, at the age of 70, to learn a completely new and not easy discipline from the beginning just because he thinks that it is needed for the solution of his proposed problem. Even if in the details Szent-Györgyi had to face failures, he did deduce a very important thing here. In 2003 a conference was organized in Szeged by Professor Csizmadia and his colleagues. In the conference booklet of the conference the organizers quote a saying by Szent-Györgyi, certainly not by accident, that sums up the-above mentioned facts. Essentially, Szent-Györgyi says the following (right in his previously mentioned book on submolecular biology): "*The distance between those abstruse quantum mechanical calculations and the patient bed may not be as great as believed*". I believe that, in a sense, this is an essential criterion for modern sciences. Very often we work with very abstract and esoteric calculations, but more and more often these are getting close enough for practical applications. The distance between new scientific evidence and the tools for everyday life is very much shortened.

Let's look to see where Szent-Györgyi's suggestion is now. A recently published summary article[9] concludes that yes, there is such a phenomenon, although different in detail from Szent-Györgyi's initial idea, but founded on essentially the same basic idea. There is indeed charge-transfer in the DNA. The DNA helix is linked by base pairs and according to measures these electrons may travel up to 100 base pairs which means that the sections in the DNA can communicate with each other via electron signals. Furthermore, this form of communication is very sensitive to whether there are defects in the base pairs. It appears, therefore, that the DNA does indeed behave as a conductor and if the molecules are a little defected, they do not conduct well. In addition to that, the phenomenon is also sensitive to those proteins that attach themselves to the DNA and cause it to somehow twist. Via the electron transfer process, the DNA somehow performs scans within itself and this basic process may have a very large role in the DNA's self-repair mechanism i.e. in the correction of genetic defects which is one of the wonders of life (and for the understanding of which, a lot of research is still necessary). In the light of these results, it indeed seems that Szent-Györgyi did think of a very basic function

[8] Szent-Györgyi Albert, *Az élő állapot* (The Living State) Kriterion kiadó, Bukarest (1973) page 6

[9] Sontz, P.A. et al. Accounts of Chem. Res. 45, 1792–1800, (2012)

Let's return to the experiments. With experiments there is a critical parameter: fast temporal resolution. Here we talk about phenomena that happen fast, but we can only understand these phenomena if we follow them in time. (If someone asks me why we need fast temporal resolution, my favourite example is pole vault. If we assume that our brain works like a camera and takes a picture every 1 second then pole vault would probably be the most boring sport because we would usually see two things: a jumper with a big stick is getting ready for something and then lies on his back on the sponge. The fact that it is a complicated process and quite interesting things happen during the process, for example, the pole bends then straightens and pushes the jumper over the bar remains unnoticed because these details are blurred on one picture. This can only be seen if there is fast temporal resolution, for example, if we can take photos using fast shutter lens and create still images of each section.) This is needed in the case of electric molecular processes. How can this be done? This is mainly done by lasers. Back in 1984, together with *Géza Groma* and *György Váró*, we carried out a test which was about the charge motion within a long protein molecule (rhodopsin). This in its time was the world's fastest experimentally detected bioelectric signal.[10] I could say now that we started to research what Szent-Györgyi had suspected and that would sound good in this presentation, but it would have nothing to do with the truth, as at that time it did not even cross our minds to think about Szent-Györgyi. (In retrospect, I regret this since Szent-Györgyi was still alive and we could have sent our results to him.) The true story of the project is perhaps more interesting from the point of view that its production process characterized Hungary in the late 1970s.

The Biological Research Centre (BRC) was an internationally renowned workshop for rhodopsin research. Among other tests, the electrical behaviour of molecules was extensively studied.[11] During the course of the tests, it came up that a partner should be found who could perform much faster measurements. Back then nobody knew our laser team in Szeged, especially not in Hungary. Professor Keszthelyi, who was at that time the director general at BRC, and came from Budapest, went, of course, to the laser team at the Central Research Institute for Physics (CRIP) and told them that he needs help to measure fast temporal signals. At the KFKI, professor Keszthelyi was told: "Lajos why don't you go over to the other side of the Tisza where we go to do measurements because there they have the type of dye laser such tests can be done with."

[10] Groma, G. Szabó, G. Váró, Gy. Nature, 308, 557, (1984)

[11] Keszthelyi, L. Ormos, P. FEBS Lett. 109, 189–193, (1980)

Professor Keszthelyi learned that we exist by going first to Budapest. I would add that Géza Groma was one year my senior at the University of Szeged, and lived in the next door room at the student's hall, but somehow, until then, it had not turned out that they have a problem that we may be able to solve. I make a notice here saying that although the measurement was at that time a world record, we were convinced that the phenomenon itself is much faster than how we detect it. Later it turned out that this proposition was indeed true.

With the development of lasers, temporal resolution improved further. In the second half of the 1980s, femtosecond lasers appeared. We have also worked on this subject. In part, we have developed such lasers and partly tried to exploit the new possibilities that were provided by the femtosecond laser. There was an issue actually which was a kind of dream from the discovery of lasers: selective photochemistry. Through an example, the basic idea is the following: take a molecule which has one atom at the end and connected to the atom through typical binding energy. This bond is to absorb the light with those wavelengths that are characteristic to the bond and which are different from what the rest of the molecule may be able to absorb. Let's tune the laser here and shoot a big one into the molecule and we can be sure to break the bond we have chosen. With this process, the molecules could be cut to our liking. When this was tried, it turned out that this is absolutely not the case. Within the molecule, energy spreads under ten femtoseconds, and the molecule always breaks and the same place, in fact, where it is the weakest. It's like as if we wanted to cut a chain at a specified location without scissors and we can only pull the chain, which, of course, breaks where it is the weakest.

For over 15 years, this very nice idea resulted only in failure because if energy really spreads, and the molecule breaks where it usually breaks, then that is no different from what can be achieved through heating, only that it is slightly cheaper to powerfully heat a material than playing around with laser. Nevertheless, there is a solution even though it is not that simple. It is called the optimal control of quantum systems. Now we take femtosecond lasers into consideration and with these lasers energy is delivered in such a way that the spread of energy within the molecule is taken into account. Thus, the molecule is not considered to be a ball, but a real quantum system i.e. with its microscopic properties taken into account (I usually say that we teach the atoms to dance). For his work in the field of femtochemistry: chemistry made with femtosecond impulses, *Ahmed Zewail* received a Nobel Prize in 1999. I would like to elaborate on this topic because, on the one hand, it is technically very close to what we are talking about, and secondly, it illustrates the changes experimental science has gone through in little more than half a century.

The title promised a discussion on the *paprika* centrifuge, but I do not want to talk about that. I want to discuss however how the complexity of the experimental systems has changed. It is true that in the 1930s, during Szent-Györgyi's first experiment a good technician could produce all experimental devices, only that, if the person was a chemist, they may needed a good glass-technician as well. Two or three good professionals could produce all experimental devices and technically operate a world-class laboratory.

Now let's look at the device that we had used for a quantum control experiment in Jena.[12] This experiment was one of the most complex experiments I have ever devised, but which is by no means unusually complex by today's standards. A work day was the following: we went to work in the morning, we set the laser in roughly three to four hours and we could start working after lunch. (I counted once that the laser system had 46 mirrors out of which if only one was set a little bit incorrectly then the system did not work at all, or even worse, it did work, but imperfectly and this led to miscalculations.) To begin working meant that we got at the device in the first place with which the experiment itself was performed: the molecules were made to dance. For this I say, that by today's standards, this was a moderately complex experiment. I also add that the investment costs were around 4 million marks (in 1997–98) and the system was built for nearly two years. This is how a paprika centrifuge looks today.

Of course, temporal resolution continued to improve. In the early 2000s, a new technique appeared that further shortened the time scale. In 2001, the Hungarian *Ferenc Krausz* and his colleagues succeeded in producing attosecond impulses.[13] (The current world record is 80.) What is actually an attosecond? That is 10^{-18} second. In proportion: an attosecond is to 1 second what 1 second is to the age of the universe. If, at the end of the 1940s, Szent-Györgyi could have dreamed something to Szeged, then recounting his dream, he probably would have said the following: in my sleep I had seen an attosecond laser center in Szeged, which system can be used to observe those electrons which I think provide the basics for the vital signs of life. (Surely, Szent-Györgyi would not have used the term attosecond laser because at that time not even the word laser was known.)

In the last and short chapter let's look, through an example, at what atto-science really is. Based on the calculations by *Cederbaum* and his colleagues,[14] we know that following an ionization process, the gap, that is the result of the lack of an electron, moves along a long oligopeptide molecule (Gly-Gly-NH-NH_3) in 5–6

[12] Glaß, A., Rozgonyi, T., Feurer, T., R. Sauerbrey, R., Szabó, G. Appl. Phys. B 71, 267–276 (2000)

[13] Hentschel, M. et. al. Nature, 414, 509, (2001)

[14] Kuleff, A.I. Lünnemann, S. Cederbaum, L.S. Chem. Phys. 414, 100, (2013)

femtoseconds. Moreover, this movement is sensitive to which molecular structure modification we are dealing with. (Szent-Györgyi was talking about something like this when he was working on the basics of the vital signs of life.) At this moment, however, only theoretical calculations are available. A revolution in the development of calculating methods and computers, which revolution occurred in the preceding one and two decades, was required to perform the above-mentioned calculations, but for the experimental examination of the phenomenon further considerable progress in attosecond technology is necessary.

Finally let's ask a question worthy of Szent-Györgyi: why are protein molecules, such as the DNA itself, stable even when the sun shines on them? There are a lot of ultraviolet photons in the sunlight. If protein molecules had studied from the introductory quantum mechanics textbooks, they would know that as a result of ultraviolet light, it would be their duty to immediately fall apart because an ultraviolet photon loads so much energy into the molecule that the chemical bond inside them should break. As mentioned earlier, within some ten femtoseconds energy seeks out the weakest bond and breaks it. So that this wouldn't happen, and experience shows that this doesn't happen or happens far less than it is expected, something must occur in less than some ten femtoseconds. What could that be? Remember what Szent-Györgyi had said: "*something very important a whole dimension is missing from our line of thinking…*". There is an answer to the above-mentioned question which answer seems to have been discovered by evolution as well. The answer is conic section. This term is rather abstract. The word section indicates that in case of polyatomic molecules, it may happen that the surfaces of the excited and ground state potential energy intersect. In this intersection, the electron cannot decide where it belongs and this dilemma results in the fact that the electron instantaneously disposes of its excess of energy and falls into a ground state. This is a very important process which certainly plays a crucial role in the fact that molecules stay in one piece. Of course, it also applies to this case that the behaviour of conic intersections is clearly outlined by theoretical calculations, but direct experimental data are not yet available. So if you asked me what that task, worthy of the intellectual heritage of Szent-Györgyi, may be on which the Szeged laser centre should begin working? My answer is that the direct experimental study of the conic sections is surely such a task.

Acknowledgement

I would like to express my gratitude to Professor J. Ladik for sharing his personal correspondence with Albert Szent-Gyögyi.

Conclusion

This *first* volume of the Compendium of Knowledge by the University of Szeged is based on the open university lectures held to celebrate and commemorate in 2012 the year of the 75th anniversary of Albert Szent-Györgyi's Nobel Prize award.

In 2012, the University of Szeged commemorated a *double anniversary*. On the one hand, the various events referred to the fact that *the birthplace of vitamin C is a laboratory in Szeged*. It was 80 years ago, 18 March 1932, when Szent-Györgyi announced that hexuronic acid and vitamin C are the same material and in the autumn of 1932, he demonstrated that the Szeged sweet pepper has high vitamin C content. Finally, it was here in Szeged where Szent-Györgyi produced large amounts of the valuable material. On the other hand, in 2012, the University by the banks of the river *Tisza* celebrated that the University of Szeged is a *Nobel Prize awarded* university. It was indeed 75 years ago when, mostly for his local achievements, Albert Szent-Györgyi was awarded the most important award in the scientific world and brought back to Szeged the Nobel Prize that he received on 10 December 1937 in Stockholm for "the biological combustion processes and in particular for the discoveries in the field of the role of vitamin C and the catalysis of fumaric acid.

The diverse genres and forms of the academic celebration during the double anniversary were inspired by Szent-Györgyi's versatile personality. Most of the programmes were coordinated by the Directory of International and Public Relations at the University of Szeged.

Albert Szent-Györgyi was a quick and efficient *science organizer.*

Between 22 to 25 March 2012, nine Nobel Prize-winning scientists visited the town of vitamin C to honour the *Szent-Györgyi International Conference* at the University of Szeged. This event of historic significance was greeted by the institutional paper, reborn as University of Szeged magazine, with a special Szent-Györgyi issue that is partly in English.

In the headquarters of the Szeged Academic Committee of the HAS, the University of Szeged organized a *memorial exhibition* to honour Albert Szent-Györgyi. In the anniversary year, the traditional medical and health sciences Szent-Györgyi Days were also held. As part of the autumn programme of the Hungarian Science Festival, the life and work of Szent-Györgyi was discussed in a *university and science history symposium*.

The University day celebration that began with a festive meeting of the Senate of the University of Szeged was crowned by a *memorial concert* in 2012. The performance repeated the concert that was given 75 years earlier in the Szeged National Theatre building to honour Szent-Györgyi.

As *an arts and sports enthusiast*, the research-teacher professor at the University of Szeged had lived a colourful life. In 2012, it was the first time that the Sports Center at the University of Szeged organized an Albert Szent-Györgyi *tennis tournament* and a Szent-Györgyi *volleyball tournament*.

The Department of Culture at the University of Szeged announced a photo project titled: "Everything that is vitamin C". The *photos* that were taken were presented at the Autumn Cultural Festival exhibition at the University of Szeged. The "My Szent-Györgyi' *essay contest* also motivated the students.

One of Szent-Györgyi' s *writings*: The crazy ape (*Az őrült majom)* was presented by the actors of the Szeged National Theatre. The Szeged University Theatre, paying tribute to the predecessors, presented the so-called student Hamlet and thus recalled the spirit of the era. At the end of the Autumn Cultural Festival, films were shown on the Nobel Prize winner scientist. These films included: *Századfordító magyarok: Szent-Györgyi Albert*, *Psalmus Humanus* and *Egy világfi Szegeden*.

After the student awards ceremony, there was a premiere at the University of Szeged Choir concert to honour the festive occasion. A work titled the *anthem of Szent-Györgyi*, composed by *István Benedekfi*, was performed.

Albert Szent-Györgyi *has become a familiar face in Szeged* and become an honorary citizen.

Under the title: "In Szent-Györgyi's steps" the organizers invited the public repeatedly to take part in a *town and cultural history walk*. For the contemporary admirers of the Nobel Prize-winning scientist, this included a visit to the memorial room establishes in the Dean's Office at the Medical Department of the University of Szeged .

Representatives of both the University of Szeged and the local town council have made their *pilgrimage* to the downtown cemetery to pay their tribute to the Szeged grave of the Nobel laureate's mother Szent-Györgyi Miklósné Lenhossék Jozefin.

With the support of the University of Szeged, in the "birthplace" of vitamin C, the former academic institution and Szent-Györgyi's apartment: the *Déri Miksa* vocational school celebrations were held and the *Szent-Györgyi memorial room at the site was inaugurated*.

In Szeged, the professor has become a popular university teacher and leader.

Today's youth has also remembered the history of the University of the Szeged Youth Movement that was the *first united student body* and formed on encouragement by Albert Szent-Györgyi. On the one hand, with a press history exhibition titled: "Selection from the papers of the University of Szeged" which exhibition was an assignment by the Department of Media Center and compiled by the Klebelsberg University Library. On the other hand, with a tableaux exhibition under the title: "The University of Szeged Youth Movement – mosaics, pictures and articles on the youth organization founded in December 1940". At the joint opening of the two exhibitions a book was presented: University youth associations in Szeged 1919-1944.

The idea came from the richness and exemplary status of Szent-Györgyi's research, teaching department head and rector activities to announce, for the first time in 2012, the *Szent-Györgyi Study Competition*, which attracted high school students from across the country's borders.

Albert Szent-Györgyi was also *professional in scientific information dissemination*. He wrote articles, gave interviews and held lectures at the Open University; contributed to the recognition of scientists and the popularization of science.

Following the Kolozsvár tradition, the professors organized *Open University lectures* in Szeged as well.

Albert Szent-Györgyi also talked about his research. For example, in 1933, on the open university lecture of Szent-Györgyi, under the title: "Life through the eyes of a chemist", a contemporary correspondent of the *Délmagyarország* wrote the following: "*In a throughout fascinating and witty presentation, Professor Szent-Györgyi has demonstrated the fight which science does to find out the most hidden secrets of life*".

This gave rise to the idea that in the commemorative year, between September 12 and December 5, 2012, coordinated by the Department of Marketing and Communication. Department, the popular, 12 part lectures series: Open University – Szeged should recall the person of Szent-Györgyi via the professional means of the researchers, teachers and leaders of the University of Szeged. The 10th semester of the Open University i.e. lectures on Szent-Györgyi are available: http://www.u-szeged.hu/szabadegyetem-szeged/korabbi-szemeszterek/szemeszter

Detailed information and photographs on the programmes of the *commemorative year* are available on a website, designed for this occasion within the website of the University of Szeged, which has been updated since 2012: http://www.u-szeged.hu/szentgyorgyi

The first volume of the Compendium of Knowledge by the University of Szeged, which illustrates the intellectual heritage of Szent-Györgyi, revives the traditions of science popularization.

Contemporary newspaper articles could be matched with each topic in the Open University – Szeged series. Moreover, two lectures out of the 12 are titled: "The basics of biochemistry" and "Life through the eyes of a chemist" which are the same as the topics chosen by Szent-Györgyi in 1931 and 1933. These writings that summarize the presentations of Szent-Györgyi or report on his activities confirm the key role of the press in popularizing science. It is clear from the studies that the articles provide inspiration or backdrop for today's scientists to elaborate on what they want to say.

Out of the 12 edited sections from the autumn 2012 Open University programmes, 10 was shaped into an article and put into this volume. Under the title: The interrogation of nature from Szent-Györgyi to today, Professor Emeritus *Kálmán Szendrei* (Faculty of Pharmacy) held a lecture.

Although Professor Szendrei replaced Professor Emeritus Gábor Miklós, Faculty of Pharmacy) who fall ill in autumn 2012, but Professor Szendrei did not want to put into writing what has been presented.

However Professor Gábor has handed over for publishing the basics of that part of his Open University lecture that was not presented. Archivist *Róbert Károly Kiss* (University Archives, University of Szeged), who processes the international relations and cultural diplomacy activities of Szent-Györgyi, stayed away from turning his lecture into an article.

Compared to the web-based presentations, this volume gives more. Out of the 12 lecturers, 10 university lecturers have taken on to put their pulpit lectures into writing: Professor *László Dux*, (Faculty of Medicine, University of Szeged), Professor *István Hannus* (Faculty of Science and Informatics, University of Szeged), Professor *Mária Homoki-Nagy* (Faculty of Law and Political Sciences, University of Szeged), Assistant Professor *Csaba Jancsák* (Juhász Gyula Teacher Training Faculty, University of Szeged), Professor *József Pál* (Faculty of Arts, University of Szeged), Professor *Pukánszky Béla* (Juhász Gyula Teacher Training Faculty, University of Szeged), academic *Gábor Szabó* (Faculty of Science and Informatics, University of Szeged), Professor *Gábor Tóth*, (Faculty of Medicine), historian *Tamás Vajda* (University of Szeged, University Archives), Professor *János Wölfling* (Faculty of Science and Informatics, University of Szeged).

The trainees at the Department of Media Center contributed in shaping the lectures into written texts. Highlighting this feature indicates a close relationship between scientists and students which characterizes the University

of Szeged. The photographs and important documents that are favored by the authors of the studies illustrate the atmosphere of the age of Szent-Györgyi and linked to the fact known by the authors. It happens sometimes that a contemporary photo or fact emerges repeatedly in this volume. The editor did not consider it to be his task to filter out these duplicates or half-information bits because it was considered that these fit the atmosphere of the given presentation and study.

The dissemination of knowledge and looking after Szent-Györgyi's heritage is not limited to anniversaries; these did not end in 2012. These aspirations of the University of Szeged are shown in the fact that, among other things, in 2013, the University took part in the events of the 84th Book Festival Week. The Publishing Department at the University of Szeged presented workshops operating within the walls of the University. By opening for visitors the front door of the study room of Albert Szent-Györgyi on his Dóm square work place, a university sanctuary of the book, literary historian *József Pál* lectured on the poems of the Nobel Prize winner scientist. The modern reader may keep the imprint of this in his hands. The library here is the guardian and mediator of university values and by the editors of the Compendium of Knowledge by the University of Szeged, the library is respected in its undying merits via the fact that in the first volume of the series a study is published on Szent-Györgyi that had been written by a librarian: *Tasiné Ildikó Csúcs* (Klebelsberg Library, University of Szeged).

In the process of explaining and popularizing research work, the University of Szeged took another step in 2014. During the 85th Book Festival Week, among many other programmes, with the assistance of the professors who got involved in the editorial work of the Compendium of Knowledge by the University of Szeged, the University "*took science to the streets*".

In Albert Szent-Györgyi's work it is continuously present that at an early stage he already had the feeling that the only way to find answers to the scientific questions of the age was to step out of the disciplinary framework. By recognizing this, the University of Szeged aims, in several ways, to preserve, keep constantly on the surface and follow Szent-Györgyi's spirit and keep the memory of the Nobel Prize winning scientist.

November 2014

Ilona Újszászi


SZÉCHENYI 2020
MAGYARORSZÁG KORMÁNYA
Európai Unió
Európai Regionális Fejlesztési Alap
BEFEKTETÉS A JÖVŐBE

“To see what everybody sees and think what nobody has thought of yet” claimed Albert Szent-Györgyi on the essence of discovery. He was also a professor for the popularization of science. This volume of the Compendium of Knowledge by the University of Szeged exposes the little-known or the unknown dimensions of Szent-Györgyi’s activities, which are far beyond his narrow area of expertise: medical science and chemistry. This volume is based on those free university lectures that were organized to celebrate the year of the 75th anniversary of the Nobel Prize awarded to Szent-Györgyi. The contemporary professors and teachers at the University of Szeged illustrate the versatility of Szent-Györgyi, focus on the beauty of research as a profession and put into the spotlight the exciting world of science. Before us stands a biophysicist, a humanist, a sportsman, a teacher, a diplomat, a science coordinator, a philosopher-poet and a scientist with influence on the economy and someone who also asks questions to which the researchers may find answers in the future and with the help of such equipment as the ELI-ALPS Laser Research Centre at Szeged. The books in the Compendium of Knowledge by the University of Szeged also answer the following question that may be raised by the reader: why is a University by the river Tisza the only research centre in Hungary where a Nobel Prize worthy performance was accomplished and hope to be accomplished in the future.

9 789633 063477