HUNGARIAN BIOPHYSICAL SOCIETY

BULLETIN — 1993.

BULLETIN

of the

HUNGARIAN

BIOPHYSICAL SOCIETY

1993.

PRESIDENT: L. KESZTHELYI
SECRETARY GENERAL: S. GYÖRGYI

TENTH ISSUE

On the title-page:

Two dimensional representation of small angle X-ray scattering on bacteriophage T7 solution (70 mg/ml) prepared and tested in Institute of Biophysics, SOTE. (The measurement was performed in European Synchrotron Radiation Facility, Grenoble).

Edited by: LÁSZLÓ KUTAS

Dept. of Biophysics, University Medical School Pécs
H–7601 PÉCS, P.O. Box 99. Hungary

1. INTRODUCTION

PREFACE

The Hungarian Biophysical Society was founded in 1961. Since that year the number of its members has continuously increased and presently reaches 400. The activity of the Society contains many areas. One of those is to edit an information bulletin in every third year. We decided that the bulletin due to 1993 should serve as an information material for the participants of the 11th Biophysics Congress of the International Union of Pure and Applied Biophysics. Please take it, read it in order to learn a little about the activity of our Society.

It is our great honour and also somewhat pride that after 32 years of existence of our Society and its participation in the congress organized by IUPAB we got the possibility to organize the 11th Congress and show the biophysicist community our strength and weekness.

In this booklet you will find information about the institutions where biophysics is a research and educational program, the description of the scientific results and how our Society is involved at large in the Hungarian scientific activity. In earlier times we were supported by the Hungarian Academy of Sciences, later by the Organization of Technical and Scientific Societies (OTSS) which was subsidized form the state budget. Presently, after the political changes in Hungary our Society is more or less independent (we function as a member of the OTSS but without receving any financial support). In spite of all difficulties (mainly financial) we are able to do all what our duty is in the Hungarian scientific community. We organize meetings, seminars, support our members to participate in meetings abroad. We have biannual competitions with modest prizes for young scientists and also a respected member is awarded the Jenő Ernst medal and prize. All these come from the Jenő Ernst Foundation. Jenő Ernst was the first president of the Hungarian Biophysical Society.

This bulletin, first in English, is the 10th in our series. We hope that many more fruitful years will follow and the Society will be a warm place form the Hungarian biophysicists and a firm partner in IUPAB.

With these thoughts I wish all readers a succesful Congress and pleasent time in Budapest.

LAJOS KESZTHELYI
President of the H. B. S.

XI INTERNATIONAL CONGRESS OF BIOPHYSICS

July 25-30, 1993, Budapest, Hungary

Hungarian Biophysical Society *Hungarian Academy of Sciences*
International Union of Pure and Applied Biophysics

THIRTY TWO YEARS OF THE ORGANIZED HUNGARIAN BIOPHYSICS

The physics oriented biology had rather strong roots in Hungary even between the two wars. The University Department of Biophysics in Pécs founded in 1947 was one of the first five university chairs of biophysics all over the world. The biochemistry school of A. Szent-Györgyi at Szeged had also a strong biophysical orientation. The main direction of biophysical research was the muscle biophysics led by Eugene Ernst.

The formal organization of the Hungarian Biophysical Society started in May, 1960 and was completed on March 3, 1961 with 111 founding members. Prof. E. Ernst was elected President and the author of this paper became Secretary. The foundation of the Society gave a remarkable impulse to the development of biophysical research and education in Hungary. In addition to the Biophysics Department of Pécs, Prof. I. Tarján founded the second biophysics chair in Hungary at the University Medical School of Budapest in 1968. Prof. L. Szalai established the third one at the József Attila University in Szeged in 1969, the fourth one was founded in Debrecen in 1970 by Prof. L. Tóth., meanwhile teaching of biophysics started also at the L. Eötvös University in 1965 and later the Biophysics Research Laboratory was formed at the Technical University of Budapest (P. Greguss). The largest biophysical research laboratory of the country was created in the frame of Biological Research Center of the Hungarian Academy of Sciences headed by A. Garay in 1971. The National Research Institute for Radiobiology and Radiohygiene was also a significant research unit with biophysical orientation.

The membership of the Hungarian Biophysical Society was steadily increasing. The number of members in the years 1980, 1985 and 1989 were 391, 512 and 768, respectively. In 1989 a revision of membership was initiated which resulted in the splitting of about 400 members of the Section of Basic Acupuncture, so the membership decreased to 400, or so.

Anyhow, we should state that the „density" of organized biophysicists in Hungary amounts to around 40 per million, which figure stands among the firsts of the world. (For comparison USA 22, Japan 30).

Concerning the quality of membership there were 13 members of the Academy, 28 D. Sc. and 83 Ph. D. in 1980. Numerous young scientists joined the Society during the past years. However we had 34 founding members (of 111) in our list in 1989.

The milestones of the scientific activity were the national meetings. 16 of them were organized during the 32 years. Moreover 9 different sections used to

Profs. E. Ernst (Founder of Hungarian Biophsical Society) and A. Solomon (the first Secretary General of IUPAB) in Pécs, 1964.

meet regularly to discuss special, narrow fields of biophysics. The number of meetings amounted to 8 to 12 a year during the last decade.

We may sum up that the Hungarian Biophysics had vivid and succesful 3 decades. The organization of the 11th International Biophysics Contress can be considered as a summit of the achievements of biophysicists in Hungary.

Fortunately, the details of the activity of the Hungarian Biophysical Society has been published in the triennial „Bulletin of the Hungarian Biophysical Society" in 9 Volumes 1963, 1966, 1969, 1972, 1975, 1978, 1981, 1985 and 1989. These volumes (over 1800 pages) offer a detailed review of the activity of biophysicists in Hungary between 1961–1993.

JÓZSEF TIGYI
Honorary President of the H. B. S.

THE HUNGARIAN BIOPHYSICAL SOCIETY

Founded in 1961 with the aim of providing manysided assistance to Hungarian biophysicists. The main points are:

- to promote and develop the biophysical research,
- to support biophysics teaching,
- aiding the application of biophysics,
- promoting the social and material appreciation of the biophysicists and their results.

The work of the Society is directed by the Presidium which consists of the Managing Presidium, elected members and the presidents and secretaries of the scientific sections.

The members of the present board are as follows:

Honorary presidents:	Prof. Imre Tarján, Member of the Academy
	Prof. József Tigyi, Member of the Academy
President:	Prof. Lajos Keszthelyi, Member of the Academy
Vice Presidents:	Prof. Sándor Damjanovich, Member of the Academy
	Prof. Györgyi Rontó, D. Sc.
Secretary General:	Dr. Sándor Györgyi, Ph. D.
Secratary:	Prof. Antal Niedetzky, Ph. D.
Treasurer:	Dr. Barnabás Sas, Ph. D.
Head of Control Commission:	Dr. Zoltán Szőkefalvi-Nagy, Ph. D.
Elected members:	Dr. Júlia Gidáli, D. Sc.
	Dr. László Kutas M. D.
	Dr. Tibor Lakatos, Ph. D.
	Dr. István Simon, D. Sc.
	Dr. László Szalay, D. Sc.
	Dr. Attila Török, Ph. D.
	Dr. Lajos Trón, D. Sc.
	Dr. Pál Vittay, Ph. D.

The leaders of the scientific sections are listed below.

Apart from the biannual national conferences the scientific activity of the members has been displaid in the work of the scientific sections of the Society. In the course of 32 years 7 sections (including some groups) were organized by those colleagues who wished to use the frame of an organization in the development of a special field of biophysics.

The sections and their leaders are as follows:

Radiation biology	President: Dr. György Köteles, D. Sc.
	Secretary: Dr. Lajos Gazsó, Ph. D.
Medical physics	President: Dr. Pál Zaránd, D. Sc.
	Secretary: Dr. Zoltán Dézsi Ph. D.

Ultrasound in medicine	President: Dr. Zoltán Tóth, Ph. D.
	Secretary: Dr. György Harmat, Ph. D.
Membrane-transport	President: Dr. László Horváth, D. Sc.
	Secretary: Dr. Tamara Kubasova, Ph. D.
Photobiology	President: Prof. György Rontó, D. Sc.
	Secretary: Dr. Béla Böddi, Ph. D.
Agro- and Food Physics	President: Prof. János Nagy, Ph. D.
	Vice presidents: Dr. József Kispéter, Ph. D.
	Prof: Árpád Nagy, Ph. D.
Radioecology	President: Dr. Béla Kanyár, Ph. D.
	Secretary: Dr. Pável Szerbin, Ph. D.
Groups:	
Biophysics of Acupuncture	President: Dr. Tibor Predmerszky, Ph. D.
	Secretary: Dr. Ajándok Eöry, Ph. D.
Bioelectrochemistry	President: Prof. Lajos Keszthelyi, Member of Acad.
	Secretary: Dr. Sándor Györgyi, Ph. D.

The programs and the scientific activities of the sections and groups are summarized separately, but one common feature has to be mentioned here: The great majority of the members of the sections belongs also to other national and international scientific communities being organized for a specific aim like radiation biology, ultrasound application, bioelectrochemistry, etc. The administrative and financial disadvantage of this situation is fully compensated by the possibilities of the manyside cooperation, the better opportunity of changing ideas with scientists working with the same methods but on other objects etc.

As to the international cooperation, it is also elaborated and organized by the sections and their members using, of course, the services and support of the Society.

As a consequence of their scientific activity many of our senior scientists were elected into the different boards of international scientific organizations, very often as the members of their managing presidiums.

Considering the position of biophysics among the adjacent sciences it is quite obvious that very close connections and fruitful cooperations have been formed with many Hungarian biochemists, physiologists, morphologists, biologists and other representatives of natural sciences, as well as with their scientific societies. Common scientific papers, books and also commonly organized local and national programs prove the success of this tendency.

The address of the Hungarian Biophysical Society:
H-1371 Budapest, Fő u. 68. P. O. Box 433. Phone/Fax: (1) 202-1216

SÁNDOR GYÖRGYI
Secretary General of the H. B. S.

NATIONAL MEETINGS OF THE H. B. S. (1961–1991)

1 st: Pécs, 23–26 August, 1961.
President: J. Ernst
Dept. of Biophysics, University Medical School

2nd: Debrecen, 21–25 August, 1962.
President: L. Tóth
Dept. of Medical Physics, University Medical School

3rd: Budapest, 26–28 August, 1964.
President: V. Várterész
National Research Institut for Radiobiology and Radiohygiene

4th: Budapest 23–24 May, 1966.
President: I. Tarján
Dept. of Medical Physics, University Medical School

5th: Szeged, 28–30 August, 1968.
President: L. Szalay
Dept. of Physics, József Attila University

6th: Pécs, 23–25 August, 1971.
President: J. Tigyi
Dept. of Biophysics, University Medical School

7th: Tihany, 31 May – 2 June, 1973.
President: J. Salánki
Biological Research Institut of the Hungarian Academy of Sciences

8th: Debrecen, 27–30 August, 1975.
President: S. Damjanovich
Dept. of Biophysics, University Medical School

9th: Pécs, 30 June – 2 July, 1977.
President: J. Tigyi
Dept. of Biophysics, University Medical School

10th: Tihany 20–22 September, 1979.
President: J. Salánki
Biological Research Institut of the Hungarian Academy of Sciences

11th: Szeged, 5–8 July, 1981.
President: L. Keszthelyi
Biological Research Center of the Hungarian Academy of Sciences

12th: Budapest, 24–26 August, 1983.
President: Gy. Rontó
Dept. of Biophysics, University Medical School

13th: Debrecen, 3–5 July, 1985.
President: D. Berényi
Nuclear Research Institut of the Hungarian Academy of Sciences

14th: Pécs, 2–4 July, 1987.
President: A. Niedetzky
Dept. of Biophysics, University Medical School

15th: Szeged, 3–5 July, 1989.
President: J. Kispéter, A. Török
University Medical School

16th: Budapest, 2–4 July, 1991.
President: L. B. Sztanyik
National Research Institut for Radiobiology and Radiohygiene

Abstracts of the 4th – 13th National Meetings have been published in English, too:

Acta Biochim. Biophys. Acad. Sci. Hung.

4th	1.	333-344 (1966)
5th	3.	449-469 (1968)
6th	6.	459-483 (1971)
7th	8.	183-214 (1973)
8th	11.	143-236 (1976)
10th	15.	111-159 (1980)
11th	16.	229-265 (1981)
12th	18.	1-124 (1983)
13th	20.	1-112 (1985)

Acta Physiol. Acad. Sci. Hung.

9th	52.	95-321 (1978)

LÁSZLÓ KUTAS
Editor

CELL BIOPHYSICAL RESEARCH IN DEBRECEN

The Department of the Medical Physics of the Medical Faculty of Debrecen University was established in 1921. The first director of the Department was Prof. József Wodetzky, who besides the educational and research activities in medical physics, also established an observatory. From 1934 to 1968 Professors János Bodnár, Zoltán Gyulai, Sándor Szalai and Lajos Tóth followed him on the Department. The Medical Physics Department was reorganized and became Department of Biophysics in 1969. Since that time the Department is headed by Prof. Sándor Damjanovich. The Department is well equipped, according to European standards. The available instruments are: fluorescence activated cell sorter, patch-clamps, tissue culture facilities, equipment to measure rotational anisotropy, lateral diffusion (FRAP), fluorimeters, photometers, microscopes etc.

The main research field of the Department of Biophysics was the experimental and theoretical investigation of relationship between enzyme structure and function. They characterized the internal dynamics of model peptides and enzymes and found close correlation between the internal mobility of enzymes and their catalytic activity. Lately, the interaction of cell surface ligand binding sites and the mechanism of information transfer through the cell membrane is studied among other cell biophysical problems.

The primary target of external stimuli is the plasma membrane for cells of living organisms. These specific signals are transmitted via second messengers. Beside the well known biochemical mechanisms of ligand-receptor interaction there are numerous physical events involved such as the alteration of the cell surface which takes place at the receptor level. Signal transduction processes across the cytoplasmic membrane and the membrane itself both play an important role in cell proliferation and differentiation. The interaction between a hormone and its receptor is followed by biochemical processes (cyclic nucleotide, phosphoinositol cascade, cytosolic and membrane bound kinases, Ca^{2+} signal), by changes in physical parameters of the cell membrane (ion permeability, membrane potential, membrane fluidity), and by dynamic rearrangement in twodimensional patterns of cell surface constituents. The signal transduction process is in turn influenced by the actual stage of the ensuing proliferation.

Specific problems under investigation in our institutes are the following:

Major histocompatibility complex (MHC) class I molecules are glycosylated integral membrane proteins. Their main function is presentation of antigens to T lymphocytes through specific interactions between multiprotein complexes of the antigenpresenting cell surface and the TcR/CD3 complex of the T lymphocytes. These specific molecular interactions between the T-cell receptor and the peptide-MHC complex result in T cell activation initiating the immune response. The structurally distinct, but genetically related class II MHC molecules play a similar role in presentation of peptides derived mostly from exogenous proteins. Earlier results from our laboratory (Szöllősi, J., et al., J. Immunol., 1989, 143:208), in accordance with other findings, revealed an intimate relationship (close proximity on the cell surface) between class I and class II MHC molecules. This kind of association between class I and class II molecules may have functional significance through regulating peptide-binding properties of class I and/or by assuring the conditions for their concerted action during the immune response.

The Centre for Theoretical Medicine, Debrecen

Integrins are members of a large family of α β heterodimer cell surface molecules appearing on a wide scale of cells. They play key role in adhesion of cells to other cells and to the extracellular matrix. A member of this family is LFA-1 antigen involved in adhesion of T lymphocytes to activated endothelium, when it binds to the appropriate ligand of the partner cell, to the ICAM-1 protein. ICAM-1 is a 80–115 kDa glycoprotein, member of immunoglobulin (Ig) superfamily. The LFA-1/ICAM-1 connection is a good example of interaction between Ig and integrin superfamilies. Producion of monoclonal antibodies initiated mapping of ICAM-1 positive cells. While LFA-1 is expressed mostly on leukocytes, the ICAM-1 is found on a variety of other cells. These observations raise the question: How is ICAM-1 organized on the cell surface and what may be the role of its hetero-associations with MHC molecules in its function?

We have discovered a novel immunomodulatory effect of the triphenylmethane polymer aurintricarboxilic acid (ATA). This effect is based on a conformational change elicited by the drug in certain receptors. This effect parallels and may explain its antithrombotic effect which is meditated via the von Willebrandt factor. We plan to extend the investigations to the platelet surface receptors and to the ICAMs. The methodological basis of this approach is a novel technique developed by us (Szabo Jr. et al., 1992, Biophys. J. 61:661), based on the pFRET principle. Platelet-derived Growth Factor (PDGF)-induced cell signals have been implicated in the pathogenesis of human brain tumors of mesenchymal origin. An analysis of this signaling system may help us to understand the pathophysiology of the tumor and may lead to its rational treatment. We found that PDGF-induced calcium signaling depends upon cell confluence in human brain tumor cell culture system. (Szöllősi, J., et al., Cytometry, 1991, 12:707; Szöllősi, J., et al., Cell Calcium, 1991, 12:447; Feuerstein, B. G., et al., Cancer Res., 1992, 52:6782). Thus, we must ask how cell confluence affects PDGF-induced cell signaling. This inquiry would help us to better define the PDGF-induced signaling system in brain tumors and to understand how the system functions in different environments. Our starting point is the question whether cell-to-cell communication is a parameter in the problem. It seems rational that alterations in direct cell contact should affect cell-to-cell communication. The parameters that we choose to examine here are gapjunctions, cell surface dynamics and ion channels. Since we have observed alterations in calcium signaling that depend upon cell confluence, now we are going to concentrate on the beginning and the end of the PDGF-signaling pathway, and on the calcium signal itself. At the beginning of the pathway, we ask whether confluence affects the PDGF receptor and its activation. At the end of the pathway, we examine how our model brain tumor cell line in various stages of confluence synthesizes DNA in response to PDGF. Regarding the calcium signal itself, we ask whether various parts of calcium signal are affected by changes in confluence.

Sodium channels are extremely important in excitable cells, however much less is known about their involvement in cell activation processes.

It has been shown that an almost ubiquitous Na^+ influx was triggered by a particular ligand, bretylium tosylate (BT) activating the Na^+ -K^+ -ATPase and repolarizing the plasma membrane. Recently, the repolarizing action of BT has been verified by patch-clamp. The well known anti-arrhythmic effects of BT could be attributed to repolarization, too. It has been postulated on the basis of experimental observations, that the above effect of BT may influence the alternative cell activation processes in lymphocytes, the one involving the phosphatidyl-inositol-diphosphate cascade and activating the protein kinase C, and the other working via IL-2 signaling. It has been suggested, that those signal transducing processes, which are more exposed to membrane potential changes of the plasma membrane are more sensitive to BT. The detailed mechanism of the differential action of BT on the two separate signal transducing pathways is still to be clarified by patch-clamp experiments on lymphocytes (Gáspár et al.BBA 1137:143–147 1992).

The involvement of classic voltage-dependent Ca^{2+} channels has been assumed in cell activation processes, because the T-cell receptor/CD_3 ligands or mitogenic lectins induce an increase in intracellular Ca^{2+}. It has been suggested that the step that requires Ca^{2+} in mitogenesis is the production of IL-2, therefore – although Ca^{2+} channels/transporters appear to play an important role in mitogene induced IL-2 proliferation, – Ca^{2+} -independent modes of signal transduction are also present in the T-cell.

For further information please contact: Zoltán Krasznai Ph.D. assistant professor (DOTE Debrecen 4012 P. O. Box 3. Hungary Telephon and fax: (52)-312 623)

ZOLTÁN KRASZNAI
Assistant Professor

DEPARTMENT OF BIOPHYSICS, UNIVERSITY MEDICAL SCHOOL OF PÉCS

The legal predecessor of the Department was the Chair of Physics of The Hungarian Royal „Erzsébet" University that had been moved from Pozsony (now Bratislava) to Pécs after the Great War in 1921. Professor of physics László Rhorer was the director of the Department over the period of 1923 to 1936. He was interested in the fields of physics related to biomedical problems. He made an outstanding research investigating the kidney function, medical radiology and the medical application of X-rays. His death interrupted the promising development. His successor (Elemér Császár 1937–1944) focused his attention to the physics of X-ray and its medical application.

The Chair of Medical Physics began to develop and became a true centre of biophysical research during the decades after the Second Word War. Eugene Ernst (1895–1981) was appointed to the director of the Department in 1945 and he directed it for 27 years. (1945–1972). He played a definitive role not only in the development of the Department but in creating real biophysics at national and international level and he achieved a general appreciation of this new branch of biosciences.

He proposed to declare officially that the chair was a „Department of Biophysics", the first one that became the birthplace of the biophysical research and education in Hungary. The first national „isotope laboratory" of biological profile was established in the Department in 1954. Eugene Ernst's initiation was to form the „Research Group at the Department of Biophysics of the Hungarian Academy of Sciences" that became the basis of the development of the Hungarian biophysics. This Researh Group works within the Department since it has been founded. Eugene Ernst organized the Hungarian Biophysical Society in 1961. He was its first President and then its honorary life President (1969–1981). He had a significant part in organizing the International Union for Pure and Applied Biophysics (IUPAB) in 1961, he was a member of the IUPAB Council over two periods. He proposed to publish the journal „Acta Biochimica et Biophysica" of the Hungarian Academy of Sciences (1966), he was its first Editor in Chief. This Journal gave the Hungarian biophysicists a possibility of publication over two decades. Professor Joseph Tigyi was the following director of the Department (1971–1991). He carried on to develop the activity of the Department on the basis of its traditions.

Under his directorship the Department moved from its former, very modest conditions to a detached building in the new University Campus as a result of his organizing activity. He established international co-operation with quite a few well-known research laboratories abroad, e.g. the Biophysical Department of the Humboldt University of Berlin (Prof. R. Glaser), the Department for X-ray investigations of solids (Academy of Sciences of Austria, Graz, Prof. Laggner), the Biophysical Institute of Pushchino (Prof. G. Frank), Department of Psychobiology at the University of California, Irvine (Prof. M. Miledi). He was engaged in organizing scientific life as the President

of the Biological Section of the Academy, President of the Hungarian Biophysical Society, Vice President of the Academy, Editor in Chief of the Acta Biochimica et Biophysica and at last but not least as the Secretary General of the IUPAB. All of these activities made a significant contribution to the development of the national and international biophysics. The present director of the department is Prof. Béla Somogyi from 1992. He is interested in the investigation of problems of the molecular biology by luminescence spectroscopy. He established a new laboratory in the department equipped to do experiments in fluorescence spectroscopy.

The fields of research done in the Department were determined partly by national traditions partly by the ambition to cover a possibly wide spectrum of the research in Hungary. That was an important point and a significant drive because the Department was the only laboratory that investigated biophysical problems in Hungary for a long while.

The traditional subjects of the department can be classified, as follows:

1.) Structure and function of muscle
2.) Problems of excitatory processes in muscle and nerve
3.) Biological effects of ionizing radiations
4.) Transport of liquids and the state of water in biological systems.

The investigation of the structure and function of the cross striated muscle was the most important research in the Department for a long while. The significant new results of this research were the followings:

– Detection of structural changes and rearrangement of substances during muscle activity (electron microscopy and micro-autoradiography)
– Analysis of the time dependence of shortening of muscle
– Efficiency of muscle work
– Volume decrease.

Eugene Ernst's comprehensive monograph (German version 1958, English version, updated 1963) analyses the results of these investigations. This book considers some significant results of other fields of investigation, too:

– An alteration of the potassium-sodium exchange occurs under the effect of direct stimulation by electric current and under the effect of stimulation through nerve (physiological, indirect stimulation)
– Trace elements have a significant effect on the electrical properties of excitable tissues.

The investigation of the interaction of local anaesthetics with nerve membranes (in progress now) is an important contribution to the interpretation of the basic excitatory phenomena.

– Small doses of ionizing radiations may result in excitation of muscle tissues, contrary to the former opinion that these radiations have no effect on muscle.
– Visible light and UV radiation have excitatory effect on sensitized nerves and muscles.
– Temperature gradient produces a thermo-electromotive force in muscles and nerves.
– Trace elements of extreme low concentrations have a crucial influence on the response of biological tissues to radiations in analogy with impurities in semiconductors.
– Biological significance and role of thermodiffusion and thermo-osmosis were investigated in connection with the research about mobilization of water in biological tissues.

The Department had an initiative role in developing the teaching of biophysics as witnessed by Eugene Ernst's textbooks „Introduction to Biophysics (1947; revised and updated edition 1966) and the „Biophysics" written by many contributors, editor: Eugene Ernst (1974, 1977).

More information: Dr. Béla Somogyi (Department of Biophysics University Medical School of Pécs P. O. Box 99. 7643 Pécs, Hungary)

BÉLA SOMOGYI
Director

INSTITUTE OF BIOPHYSICS, SEMMELWEIS UNIVERSITY OF MEDICINE AND RESEARCH LABORATORY FOR BIOPHYSICS, HUNGARIAN ACADEMY OF SCIENCES, BUDAPEST

The two institutions exist together in the same place, the Research Laboratory is a transferred unit of the Academy into the University Institute. The University Institute was established in 1949 while the Laboratory in 1980. The great majority of the staff (18) belongs to the University (while two others to the Academy) performing the teaching duties on three faculties of the University (Faculty of General Medicine, Pharmacy and Dentistry). There are lectures and practicals from biophysics (partly in German and English for the roughly 300 foreign students) every year in both semesters for altogether 900 students. Besides the weekly lectures and practicals exams (semifinals nad finals), entrance examinations, non obligatory courses, optional parallel lectures etc. mean the teaching activity of the staff.

At the same time research work is done by the members of the Institute (Laboratory) which is supported partly by the Academy of Sciences, but mostly by different grants and international R&D programs.

Main fields of interest: Structural studies on biological macromolecular systems (virus nucleoproteins, proteins, membranes); investigation of the molecular mechanism of structural and functional changes exerted in biopolymers by different physical and chemical agents.

Macromolecular systems studied:

Nucleoproteins: bacteriophages (chromosome models) T7, MS2; of high purity and concentration (100 mg/ml), their isolated DNA/RNA components.

Proteins: monomeric hemoproteins as myoglobin, hemoglobins, cytochromes, peroxidases.

Membranes: biological (red blood cell membrane), artificial (bimolecular lipid membrane-peptide complex).

Techniques: UV-visible absorption, fluorescence and phosphorescence spectroscopy, luminescence lifetime measurements, polarized emission studies, laser excited fluorescence spectroscopy at cryogenic temperatures: fluorescence line narrowing, dynamic light scattering; microcalorimetry, automatic apparatus for measuring the parameters of phage-bacterium interaction, halfautomatic apparatus for measuring the parameter of bacterial growth; measurements of biological solar dosimetry (direct and global exposure), underwater biological dosimetry radioisotope labelling (used as daily routine in kinetic studies).

Current topics of interest and ongoing projects

1. Investigation of the structure of macromolecular systems.

Nucleoproteins: Kinetics and structural changes in T7-phages induced by different solvents, quantitative characterization of dark genotoxicity and photoreactivity of coumarin derivatives where the structural and functional changes are studied on nucleoprotein complexes.

Proteins: Optical monitoring of the structure of proteins, e.g. monitoring the protein structure through the phosphorescence of tryptophan, luminescent labelling of liposome-protein systems in order to study the drug-binding effects, molecular basis of PUVA therapy: binding of porphyrins to proteins.

Membranes: Experimental and theoretical investigation of the structure of simple membranes, as well as the phase transition temperature and enthalpy as indicator of functional changes under the effect of channel forming peptides and tenzides.

2. Environmental biophysics

Investigation of the action mechanisms of ultraviolet radiation, as well as some chemicals and drugs as factors influencing the state of biosphere, the estimation of their biological dose and prediction of their health hazards.

Bacteriophage T7 (in solution) and uracil crystalline thin layer biological sensors with portable measuring instruments have been developed and used. These sensors are uniquely suitable for evaluation and prediction of health risk of UV-B radiation.

Two different prototypes of microbiological automatic measuring apparatus were developed which permit (a) exact and short term determination of the genotoxic and cellular toxic effects of a wide variety of substances, and (b) very sensitive determination of the concentration of antibiotics used in animal foods and food premixes.

GYÖRGYI RONTÓ
Director

The opening ceremony of the 12th National Meeting, Budapest, 1983.
(From right: Prof. I. Tarján, the previous director and Prof. Györgyi Rontó the present director of the Institute.)

DEPARTMENT OF BIOPHYSICS, JÓZSEF ATTILA UNIVERSITY SZEGED

Biophysics teaching in Szeged started in 1966. The Institute began its activity in 1969 originally in symbiosis with the Institute of Experimental Physics and in 1976 it became an independent unit of the Faculty of Sciences located at its present place. The founder and head of the Institute until 1991 was dr. L. Szalay. The late sixties were favorable for biophysics in Szeged, the Biological Research Center of the Hungarian Academy of Sciences was established, teaching and research in modern biology started to emerge.

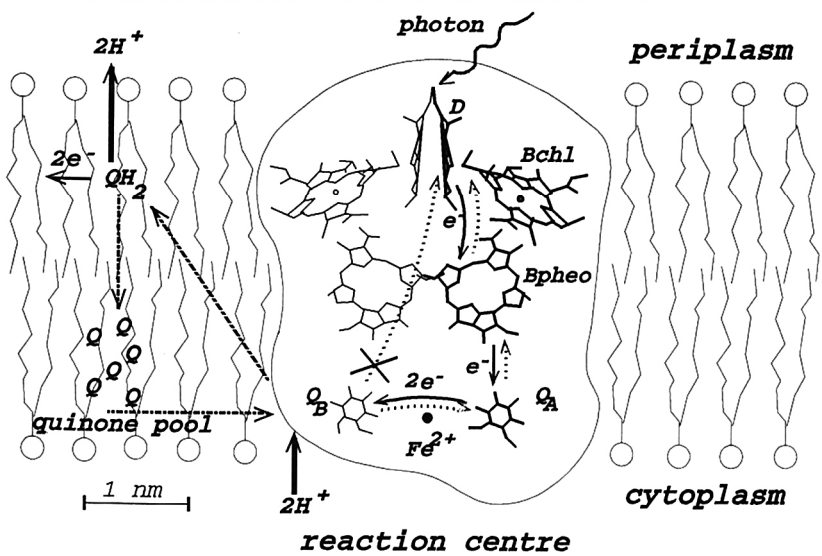
The Department of Biophysics grew out of the Department of Experimental Physics and this determined our early research program based upon the experience and facilities available: from the luminescence properties of organic dyes to the optical spectroscopy of proteins, photosynthetic pigments and micellar systems. Cooperations on national and international level turned our interest from these model studies to physiological investigations on green plants and algae. All the experiences on applications of luminescence in biology and medicine were collected in a handbook, as a joint work with the Biophysics Institute of the Kossuth Lajos University, Debrecen in 1983.

Since 1966 our main task has been teaching students of biology, of teachers in biology and also medical students of Szent-Györgyi Albert Medical University, Szeged. The main activities of our educational duties are: lecturing, laboratory practices, introducing students into research work. Our experiences in this field was collected in a textbook, titled Biophysics (published by the Ministry of Public Education in 1985 and 1986), and more recently in a manuscript of a scheduled textbook, titled Introduction to Biophysics. Since 1985 we have been participating in the program of teaching foreign students of medicine in English.

From 1972 a smaller group sponsored by the Hungarian Academy of Sciences had worked in the Institute and became independent in 1990. The main interest of this group was herbicide resistance of plants.

The Institute had and still has wide international relations. Our coworkers spent long periods in many laboratories and contributed to their work in Urbana, Baltimore, Bethesda, Rochester, Gif-Sur-Yvette, Göttingen, Tübingen, Manchester, London. These cooperations enriched our research program. In 1991 dr. Péter Maróti became the head of the Institute (further information: Egyetem u. 2. Szeged, Hungary, H-6722).

Nowadays the major interest is the study of primary photophysical and photochemical events of photosynthesis in bacteria and single-cell algae. Light induced electron transfer generates a transmembrane proton gradient and, ultimately, ATP. This complex system is studied by biophysical and biochemical techniques and the photochemical processes are followed by optical kinetic methods. We are seeking a description of the structural relationship between the reaction centers, proteins, quinones, and the functional interaction between the electron transfer and proton turnover (binding, unbinding). In


photon
periplasm
2H+
2e-
QH2
D
Bchl
e-
Bpheo
e-
2e-
QB
QA
Fe2+
quinone pool
1 nm
2H+
cytoplasm
reaction centre

other aspect we are investigating the role of the membrane to determine the electron and proton transfer reactions. The close similarity between the reaction center of bacteria and PS2 of higher plants enables us to propose mechanism for the action of commercially important herbicides. Kinetic spectroscopies have shown that the reaction center (see Fig.) exists in more conformational substates which are in equilibrium. The observed kinetics and stoichiometry of flash-induced proton binding to the reaction center depend on the conformational changes of the protein by controlling the protonatable amino acid groups.

Within the frame of international cooperations some colleagues of ours became interested in problems falling out of our research field being just methodically near to it. One of them dealt with the study of the photosynthesis of cyanobacteria in the Imperial College of Sciences, Technology and Medicine (London). This problem was studied mainly in the direction of photoinhibition by equilibrium and kinetic measurements of fluorescence and oxygen evolution. Another coworker studied the dynamical properties of lymphocyte membranes in the USUHS Pathological Institute (Bethesda, MI) by means of flow cytometry and laser microscopy. A common work was done in the Biochemical and Molecular Biology Institute of the MAYO Foundation (Rochester, MN) related to the study of the directional changes of myosin molecules in muscles. Measurements of fluorescence polarization spectra of labelled molecules were carried out to clear up the movement of cross bridges as a function of physiological states.

The members of the Institute are as follows:

Head of the Institute: Prof. P. Maróti
Scientific adviser: Prof. L. Szalay

Teaching and research staff:

E. Bálint
L. Kálmán
G. Laczkó
L. Nagy
A. Ringler
J. Tandori
Cs. Tápai
K. Turzó
Z. Várkonyi

Technical staff:

Mrs. M. Bánáthy
K. Csontos
Mrs. I. Dunai
Mrs. A. Eperjesi
A. Jedlicska
Mrs. M. Kothencz
Mrs. J. Laskay

ZOLTÁN VÁRKONYI and LÁSZLÓ SZALAY

INSTITUTE OF BIOPHYSICS, BIOLOGICAL RESEARCH CENTRE OF THE HUNGARIAN ACADEMY OF SCIENCES

According to the interdisciplinary character of biophysics, the research work of the Institute is related to a large scale of physical aspects of biological phenomena. The laboratories are well-equipped, and most of the major items of biophysical equipment are available. They include electron microscopes, ESP instruments, spectrophotometers for UV to IR absorption measurements, fluorimeters, laser-Raman and CD spectrometers, atomic absorption spectrometer and various chromatographic facilities. The home-made, fast kinetic setups are important representatives of our equipment: laser flash -induced absorption kinetic changes can be measured with 10 ns time resolution.

The four independent research groups are organized according to the level of complexity of the biological material investigated.

1. Laboratory for membrane bioenergetics (Lajos Keszthelyi)

The central interest of the research group is connected to the elucidation of the molecular mechanism of energy transducing proteins.

Molecular motions and charge translocations coupled to the protein function are investigated with specroscopic methods of high time resolution. A novel method has been developed in our laboratory for the quantitative characterization of fast, intramolecular charge displacements. Application of this powerful method yielded important new results in the interpretation of the bacteriorhodopsin proton pump, and it was successfully used in the investigation of other proteins, e.g. the visual pigment of algea, or the Na^+K^+–ATPase, as well.

2. Laboratory of molecular dynamics in membranes (László Horváth)

The aim of this research unit is to study the molecular dynamics of lipids at the interface of membrane proteins, and to characterize membrane-bound enzymes.

Spin label electron spin resonance (ESR) spectroscopy has an optimal sensitivity for distinguishing bulk fluid lipids and motionally restricted solvation lipids because of its optimal time scale. Microscopic and macroscopic lateral diffusion are followed by molecular collision and imaging experiments, respectively.

In addition to the lipid research, membrane-bound proteins and membrane-coupled processes are also investigated:

– redox systems in the plasma membrane of mammalian, bacterial and yeast cells;

– photosynthetic systems, protein-pigment complexes by spectroscopic methods;

– membrane-bound hydrogenase enzymes with special emphasis on solar energy bioconversion.

3. Laboratory of stress physiology and transport in plants (László Erdei)

The laboratory investigates mechanisms of stress tolerance and adaptation in plants. The work is based on wide experiendce obtained in studying the regulation of transport processes and the principles of optimalized nutrition in plants. The recent work is focused on the following main topics:

– the mechanisms of salt and drought tolerance at different levels of organization;

– pollution stress tolerance and stress-induced substances;

– calcium-calmodulin related mechanisms.

The role of growth regulators and calcium in stress responses and adaptation are also investigated.

4. Laboratory of molecular neurobiology (Ferenc Joó)

Interactive mechanisms providing the molecular basis of plastic neuronal reactions in the peripheral and central nervous systems have been studied in this laboratory using an interdisciplinary approach in several model systems of different complexity.

By using rapid freezing and freeze-fraction techniques, we were able to follow the morphological changes in nerve terminals with high time resolution.

Other studies were designed in order to elucidate the significance of certain particular morphological units in the formation and maintenance of the regular structural and functional integrity of the main olfactory bulb.

Biological Research Centre of the Hungarian Academy of Sciences, Szeged

Special emphasis is given to search for the recognition of new principles which could promote regenerative efforts of the central nervous system after different injuries, such as brain ischemia and edema.

LAJOS KESZTHELYI and PÁL ORMOS
Director Deputy Director

THE „FREDERIC JOLIOT-CURIE" NATIONAL RESEARCH INSTITUTE FOR RADIOBIOLOGY AND RADIOHYGIENE (OSSKI)

The establishment of an institute for radiobiology research was decided by the government in 1954, immediately after the Bikini-test, the radioactive debris of which resulted in a global contamination and worldwide concern. The actual foundation, however, took place on 1 January 1957. The task of the institute was expanded in the subsequent years to radiation hygiene, development of radiopharmaceuticals and other products labelled with radionuclides, and control of equipments emitting non-ionizing radiations.

At present, the institute is made up of three departments. These are radiobiology research, radiation hygiene, and radiation and radioisotope applications. There is also a division of non-ionizing radiations which is not attached to any of these departments: plus units covering central services, and economy and finance. The governing of the institute is assisted by a directorial council and an advisory board of external scientists. The institute is part of the National Public Health Centre, directed by the Chief Medical Officer and subordinated to the Minister of Health an Social Welfare.

Intensive research is performed in the Institute to study the mechanism of action of ionizing radiations in biological systems, with special emphasis to te following.

A model was developed in the Division of Tumour Biology to study the effects of neutrons on the health of offsprings of irradiated animals. In these experiments, pregnant mice were exposed to fission neutrons of a research reactor. The experiments demonstrated cellular death in the developing mouse foetus within 6 hrs, and 30–40% loss in the brain weights of newborn mice at about 3 weeks following irradiation with a dose of only 0.5 Gy. The results support the assumption that neuroblast proliferation is a highly radiosensitive process and its disturbance can explain the occurrence of severe mental retardation among the A-bomb survivors irradiated in utero during the 8th to 15th weeks of gestation. It was also observed that there was a higher than 60% incidence of neoplasms in 2 yrs old mice exposed to fission neutrons in the late gestation period compared with the normal incidence of about 20% in the unirradiated, control animals.

New complexing agents have been developed by the Division of Radiotoxicology to increase the elimination of radioactive strontium and cerium from

the body, when these isotopes are already absorbed from the gastrointestinaltract or the respiratory system. These compounds are water soluble and of very low toxicity. A single injection of the new decorporating agents is capable to reduce the radioactivity content to 5–15% of the initial body burden. Based on these encouraging results, the drugs seem to be promising for the removal of internal radiostrontium contamination from humans.

Upon the initiative of the OSSKI there have been several remarkable achievements in the practical application of radiobiological effects and radioactive isotopes.

Among these, it should be mentioned that the introduction of radiation sterilization of disposable medical equipment and supplies in the country has been facilitated by the elaboration of the technology, by the establishment of a reliable sterilizing dose, and by the development of sterility control in the Division of Radiation Microbiology. The unit is an IAEA recognized training centre in radiomicrobiology for young scientists from the developing countries.

Radiation can also be used for detoxification of bacterial endotoxins, the most powerful immunomodulators. However, parenteral administration of native endotoxin is associated with severe, and mostly intolerable toxic effects. Irradiation of endotoxin with high doses (of the order of 150 kGy) decreases its toxicity without significant alteration of its immunogenic properties. Current clinical trials suggest that radio-detoxified endotoxin (TOLERIN^{R}) might be a useful tool in human medicine to enhance nonspecific resistance and to regenerate the immune system.

National Research Institute for Radiobiology and Radiohygiene, Budapest

Research, development and production of radioactive diagnostic agents for medical use have been performed in the OSSKI since the mid 60s. Until now about 10 different radiopharmaceuticals have been developed by the Division of Isotope Application for early detection of cardiac diseases, lung embolism, brain defects and lymph node involvements in cancer. In addition, various radioimmunoassay (RIA) kits have also been produced for detection of miniscule concentrations of biologically important substances, such as hormones, proteins, and drugs. Besides their use within this country, the products are exported to 18 countries in Europe, South-America and the Far East.

Besides the chromosome aberration analysis, the lymphocyte micronucleus test has been introduced for dose assessment in the case of radiation accidents. This method has proved to be a reliable and easily performable technique for screening of persons exposed to radiation in excess of about 0.2 Gy.

The Department of Radiation Hygiene consists of five divisions: operational and environmental radiation hygiene, personnel and environmental dosimetry, and a division of internal dosimetry and computer assisted radioactivity measurements.

The major task of the Division of Operational Radiation Hygiene is to provide expert advices and technical assistance for the National Public Health Authority in respect of complience of medical, industrial, agricultural, research and training places of work when using radiation sources with the applicable rules and regulations of radiation protection.

The Division of Personnel Dosimetry is responsible for the implementation of a centralized and nationwide dosimetry control of all individuals who are regularly exposed to ionizing radiation in their occupations. Radiation doses received from external sources by more than 15 thousand workers are monitored, evaluated and registered bimonthly by the Division using film-badge dosimeters.

The Division of Environmental Radiation Hygiene carries out radioactivity measurements in samples collected from various media of the environment including the atmosphere, surface and ground waters, soil, plant and animal organisms. A retrospective study on the radiostrontium contamination of the Hungarian population has also been performed by this unit through determination of ^{90}Sr content in more than 12 thousand teeth estracted on the bases of medical indications by the district dentistries of Budapest in the years of 1978–1992. In addition, the Division is the central organ of the nationwide Radiological Measurement and Data Acquisition Network of the Public Health Authority.

Site-specific levels of environmental radiation outdoors and indoors have been measured by the Division of Environmental Dosimetry since the early 1980s. Alterations in the dose-rates have been detected as a result of the actual meteorological conditions or as a consequence of the environmental contamination with radioactive substances after the accident at the Chernobyl nuclear power plant.

Individual monitoring of workers for internal exposure to incorporated radionuclides is not included in the program of the personnel dosimetry service. Thyroid activities of workers involved in the preparation of iodinated radiopharmaceuticals are, however, routinely checked by the Division of internal dosimetry and computer assisted radioactivity measurements, using a Canberra Body Burden Analysis System. The same system was extensively used after the Chernobyl accident for the measurements of gammaemitting radionuclides in the bodies of several hundreds of individuals, both Hungarian citizens and visitors of the country. Alpha-, beta- and gamma-spectrum analyses are also made by the Division in various environmental, food, water and other samples. In addition, data submitted by the operating organization as well as by the competent national authorities as the results of their environmental surveillance around the Paks Nuclear Power Plant are collected, evaluated and interpreted by the computer assisted Data Evaluation Centre operated by the Division.

LÁSZLÓ B. SZTANYIK
Director

BIOPHYSICS IN THE KFKI RESEARCH INSTITUTE FOR PARTICLE AND NUCLEAR PHYSICS OF THE HUNGARIAN ACADEMY OF SCIENCES

Research in relation to biological topics can be dated back to the early 1970s when Prof. Lajos Keszthelyi and his team of experimental nuclear physicists studied the origin of the optical purity of living matter by measuring time spectra of positron annihilation in several L- and D-amino acid samples. After these pilot studies the group officially became the Biophysics Group with the well-defined aim of applying atomic and nuclear techniques in solving certain biological/biophysical problems. Trace analysis of biological and biochemical samples utilizing ion beams of a few MeV energy offered the most natural way of making use of the scientific expertise and experimental instruments accumulated earlier. As the basic analytical tool the particle induced X-ray emission (PIXE) spectrometry, which is a rapid, sensitive, multielemental technique for elements heavier than Mg, was chosen, whereas special isotope sensitive nuclear reactions (NRA method) are used to detect lighter elements. Our new approach of using PIXE and suitable nuclear reactions simultaneously (PIXE-RP technique) has offered a unique tool to perform such kind of trace element analyses. The determination of trace element composition of various types of synaptic vesicles or the simultaneous measurement of the protein and metal ion content of a SOD enzyme are illustrative examples. Even more specific results can be obtained when the ion beam analysis is combined with biochemical separation processes. Developing a unique technique for direct in situ ion beam analysis of protein bands of thin layer electrophoretograms (PAGE, CAE) important new results in enzymology were obtained. It was found, among others, that the active center of the bacterial hydrogenase enzyme from Thiocapsa roseopersicina could contain both Fe and Ni ions and the Fe/Ni ratio was also determined. In contrast to former expectations it was also found that the Fe ions were bound to the larger subunit, whereas the smaller subunit carried the Ni ions following the drastic decomposing SDS-PAGE treatment.

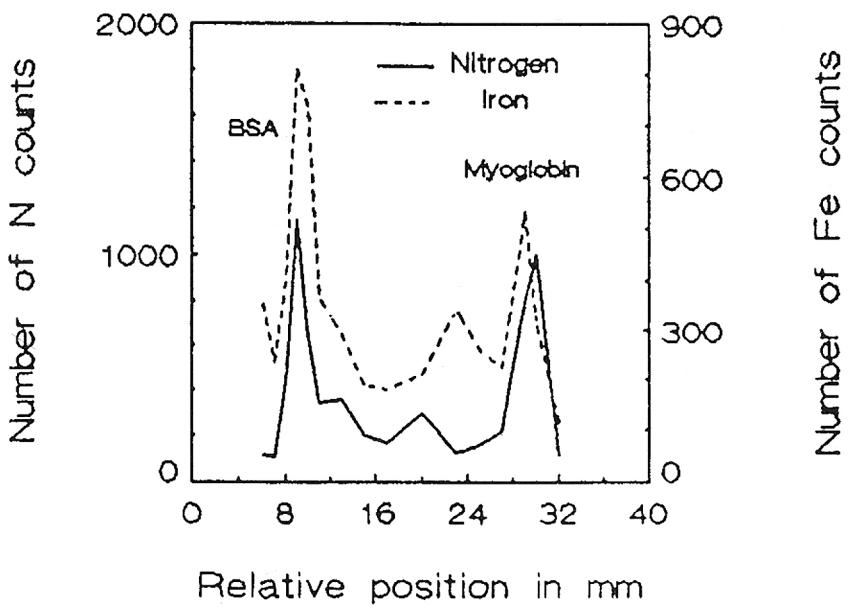
Besides these analytical studies a second, more biological, biophysical oriented activity has gradually evolved. Valuable results were obtained from studying the biophysics of neuromembranes. The photocycle and the accompanying electric signals from bacteriorhodopsin (bR) were studied in different conditions by flashes from a nitrogen laser driven dye laser. The kinetics of spectral changes associated to solubilization and dark adaptation in native and solubilized Bacteriorhodopsin (bR) has been studied. For the experimental study of the activity pattern of neural cell cultures a multi microelectrode culture chamber system was constructed for monitoring simultaneously the morphological and electrophysiological development of neural cells in vitro.

The Biophysics Group commenced research into neuroscience as early as 1983. That time our research philosophy was motivated by the question, how can our knowledge on brain structure and function be utilized to design the near generation of computing devices? Later specific self-organizing algo-

rithms were developed for understanding of certain fundamental neural phenomena, such as ontogenetic neural development, plastic behaviour and learning, periodic and aperiodic neural dynamics associated with neurological disorders, sensory motor coordination, different levels of vision, olfaction, dynamic memory organization etc.

Recently our research on theoretical and computational neuroscience mainly concentrated on making realistic neural models in terms of dynamic system theory. The mechanism of information processing in the olfactory bulb is studied by mathematical models. This neural structure, as well and its model, shows a set of dynamic phenomena, as oscillation, chaos, learning-induced bifurcation, coexistence of limit cycle and strange attractor, associative memory based on spatiotemporal patterns. An algorithm was established within the framework of Ventriglia's kinetic model to describe the activity circulation in the cortex – hippocampus – cortex loop. Some mathematical conditions of processing time-dependent inputs in neurodynamic systems were investigated. The conceptual power and the mathematical machinery of the notion of „computation with attractors" can be preserved for rather narrow class of the input functions only.

Just recently our theoretical activity was widened by bio-optical investigations. A general geometric optical method was presented to calculate the shape of the aspherical interface that eliminates spherical aberration of the doublet corneal lenses of some extinct trilobites. The aerial visual field of aquatic and amphibious animals distorted by refraction at the air-water interface was geometric optically investigated.



Fe and N distributions along a stained CA electrophoretogram containing myoglobin and BSA band measured simultaneously by PIXE and (p, p' γ) nuclear reaction.

The address of the Institute:

KFKI Research Institute for Particle and Nuclear Physics of the Hungarian Academy of Sciences
H-1121 Budapest, Konkoly Thege u. 29–33. Tel: (1) 155-1682 Fax: (1) 169-6567

ZOLTÁN SZŐKEFALVI-NAGY
Head of the Biophysics Group

BIOPHYSICS IN THE DEPARTMENT OF ATOMIC PHYSICS, EÖTVÖS UNIVERSITY, BUDAPEST

Members of the Department are interested in a wide range of science from the quarks to the galaxies, including various biological fields. There is a theoretical, a nuclear, a resonance, and a biophysical group in the Department.

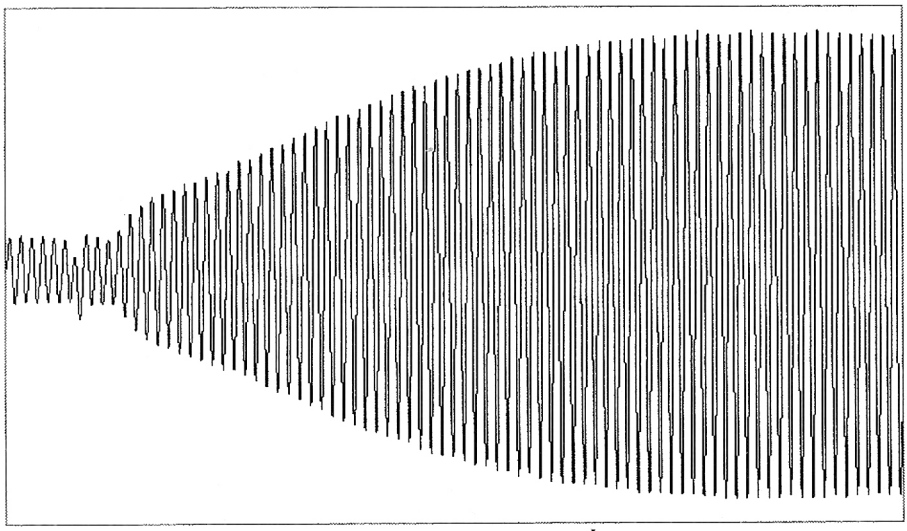
The Biophysics Group was founded in 1976. It is led by Elemér Papp, it's members are András Balázs, György Fricsovszky, Géza Meszéna and, temporarily, Ha Viet Hien from Vietnam.

A biophysics university course was launched in 1976. It was a subcourse of Physics from the 5th semester, and included biochemistry, genetics and physiology. In the last few years a reorganization was implemented in the physics course by introducing specialization from the 7 th semester. The biophysics course was reshaped to fit into this structure and a new type of biophysics lectures was started.

The central research topics of the Biophysics Group is bioenergetics: bacteriorhodopsin and photosynthesis. These works are carried out in close cooperation with the Biological Research Center in Szeged. In the early years orientation studies were our topics. Later the group shifted to electrical measurements.

E. Papp, Gy. Fricsovszky and Ha Viet Hien are involved in purple membrane research. Orientation of purple membranes in AC electric fields and the kinetics of the M state of the bacteriorhodopsin were investigated. In a new project transient conductivity change of the purple membrane suspension due to proton release and uptake is under investigation. (See the graph.) Three exponential components of the conductivity change were discovered.

Géza Meszéna in interested in photosynthesis research. In his first study, magnetic orientation of chloroplasts was investigated. Later wavelength-dependence of photovoltage of chloroplast suspension was discovered. Polarity of the photovoltage signal is opposite to expected in the long wavelength-side of the chlorophyll absorption bands. This phenomenon is explained in the term of the interference pattern of light distribution in the thylakoid membrane. He is also active in theoretical investigation of bioenergetic processes and the biological evolution.



András Balázs is interested in quantum biophysics of proteins. Together with other quantum chemists of our University, they calculated the force field and vibrational spectra of formamide, acetamide, etc. and, as a larger step, also the dipeptide N-acetil-N'-metilalaninamide, all in an ab initio formalism, using a middle-size basis set (4–21). They are working on the excited and ionized forms (model compound N-metilacetamid) from both geometric and vibrational point of view, utilizing large basis sets.

In the theoretical part of the Department a small group led by Tamás Geszti (members are F. Pázmándi, I. Csabai and F. Czakó) are interested in neural network modelling. This research has two main goals: to get a better understanding of brain functions and to develop artificial networks, which can help to solve problems, hard for the traditional algorithms. They investigated the famous Hoppfield model and gave a new explanation for dream sleep. The Kohonen model of neural self-organization was also studied. They made some applications of these networks in data-processing, e.g. signal-peptid recognition in protein-, and quark-gluon separation in particle physics data.

Noémi Rozlosnik (leader of the Resonance Group of the Department) is using spectroscopic methods in biophysics, biochemistry and medical application. She investigates the biological membrane structure and free radicals in different biological systems by EPR and measuring EPR parameters of some iron and vanadium complexes. Computersimulation programs were developed for evaluation of complicated EPR spectra. She also measures heavy metals in air and biological samples by plasma-emission spectroscopy.

GÉZA MESZÉNA

BALATON LIMNOLOGICAL RESEARCH INSTITUTE OF THE HUNGARIAN ACADEMY OF SCIENCES, TIHANY

Sixty six years ago on the 5th of September, 1927 the opening of the first Biological Research Institute was celebrated in Tihany, Hungary. Accordingly, an old dream of many natural scientists has been realized: the natural biological research received an independent home with well-equipped laboratories of the time, with calm but stimulating atmosphere indispensable in scientific research.

From the point of view of the research work the Institute was given a double program: to study Lake Balaton on the one hand, and to study general biological and physiological problems on the other.

During the first two decades the Institute not only became famous among scientists in Hungary and abroad but provided research possibilities for several Hungarian and foreign scientists, too. There was almost nobody among the Hungarian biologists who, at that time, did not work once or several times in our laboratories.

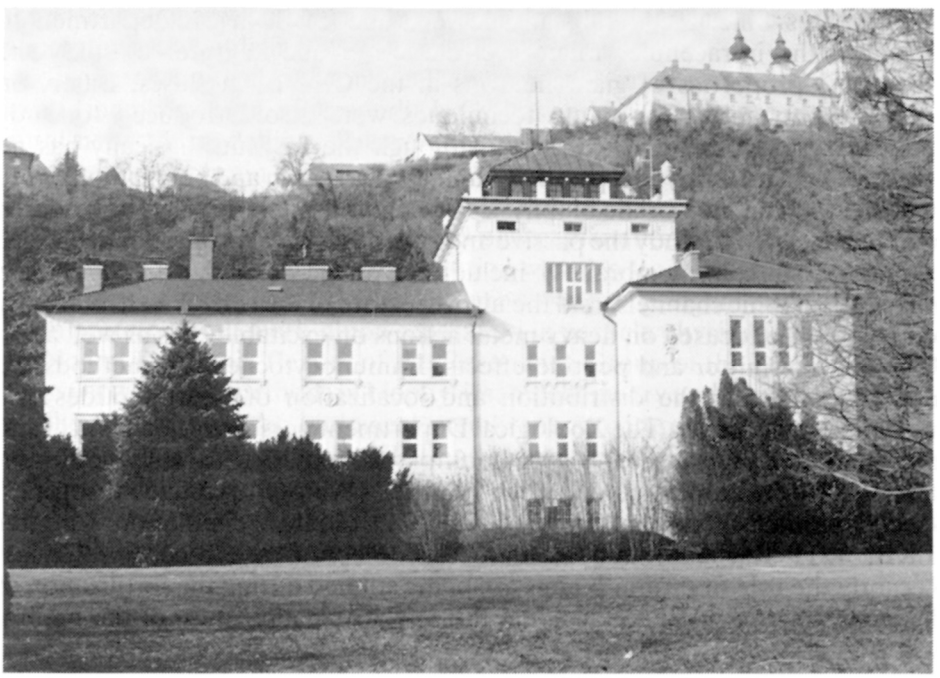
Adhering to the principles of its foundation, scientific activities have been persued in different fields. Since 1962 a reorganization of the Institute took place. Two departments were organized: the Hydrobiological Department dealing with the problems of the Lake, and Zoologicaal (Neurobiological) Department focusing its attention on the nerve and muscle physiology of invertebrates. Since 1964 a substantial efforts were made in this Department to introduce the intracellular microelectrode technique in order to study the membrane properties of giant neurons in the CNS of molluscs. Later, on voltage-clamp and patch-clamp techniques were also introduced to study elementary processes of excitation. Although the Institute basically has no projects explicit biophysical profile a number of research and publications were from the topic of membrane biophysics of excitable membranes. The research was concentrated to study the passive and active electrical properties of cardiac and neuronal cell membranes, including voltage-dependent and voltage independent ionic channels, and the ultrastructure of the cells as well. Recently our studies are focused on heavy metal actions on excitable cells as well as on different transmitter and peptide effects. Immunocytochemical methods are used to determine the distribution and localization of neuropeptides and transmitter substances. The Zoological Department possesses biochemical and morphological laboratories giving multiple possibilities to study different themes. The Institute is equipped with HPLC (Waters), Atomic Absorption Spectrofotometer (Perkin Elmer 5100 PC), Liquid Scintillation Counter (LKB, 1211 Racheba) and scanning and electron microscopes. (Tesla). Recently the role of proton pumps are being studied during the fertilization of the roe of fish in order to elucidate the effect of acidification of the natural waters.

Thus, at both Departments there are excellent possibilities to perform experiments using different biophysical methods. The Institute owns a Guest House with 17 comfortable quest-rooms for visiting scientists.

The address of the Institute is:

H–8237, Tihany, P.O.B. 35. Hungary.
Tel: (86) 348-244 Fax: (86) 348-006

TIBOR KISS
senior research ass.



Balaton Limnological Research Institute of the Hungarian Academy of Sciences, Tihany

ISOTOPE DIAGNOSTICS AND RADIATION BIOLOGY IN BIOMEDICAL CYCLOTRON LABORATORY, DEBRECEN

The Biomedical Cyclotron Laboratory (BCL) was founded in 1987 with the aim to apply cyclotron facilities of the Nuclear Research Institute (NRI) of the Hungarian Academy of Arts and Sciences in medical care and biomedical research. The laboratory is headed by Professor Lajos Trón.

The staff of BCL consists of 8 teachers-researchers (5 physicists, 2 chemists, 1 medical doctor) and 3 technicians. They have the following positions: full professor (1), associate professor (1), principal investigator (1), senior investigator (1), junior investigator (3), resident (1). Two of them possess scientific degrees (1 person is doctor of biological science, 1 person is candidate of biological science), five have university doctor degree, one person is medical doctor. All staff members speak foreign languages.

In order to start neutron radiation therapy of patients within a reasonably short time a neutron source with Be as target material (using the external proton beam of the cyclotron) has been installed. The construction of the neutron producing target chamber was the result of a cooperation between coworkers of BCL and NRI. We characterized the radiation field of the Be + proton (18 MeV) neutron source by physical-dosimetric measurements; the energy spectrum of fast neutrons and the dose intensity distribution curves have been determined. Neutron irradiation experiments have been routinely carried out on cellular systems according to our own research projects and on various cellular and small laboratory animal systems in collaboration with members of other departments (University Medical School, Department of Radiology and Department of Microbiology; National Research Institute of Radiobiology and Radiation Hygiene; Kossuth Lajos University of Debrecen, Department of Ecology).

For neutron therapy of tumors of relatively deeper localization higher energy neutrons are required. For this purpose we developed and installed (partially as our research and development) a gas target chamber having deuterium as target material. Neutron and gamma dose intensity distributions were measured in the radiation field of this neutron source without collimation and also using a home made experimental collimator. The energy distribution of the fast neutrons produced was as well determined. Using results of water phantom measurements for deep dose distributions, dose intensity profiles and isodose curves have been constructed.

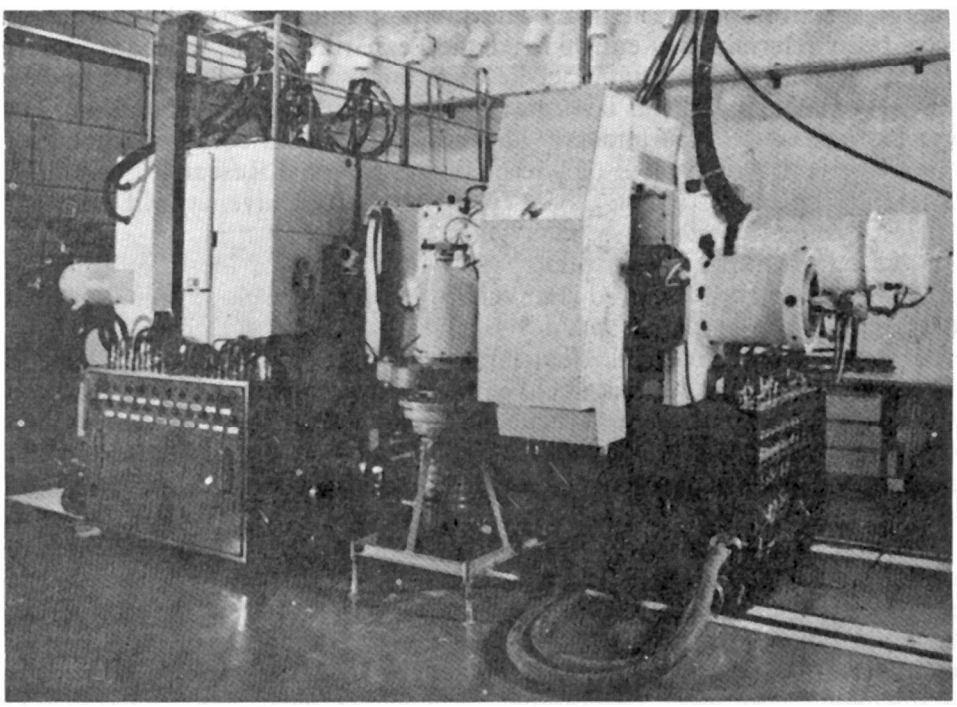
The cyclotron of NRI systematically produces short living radioactive isotopes used in nuclear diagnostic laboratories of the country. For labeling purposes ^{123}I and ^{67}Ga have been constantly produced since 1989 and the beginning of 1991, respectively. Nowadays sterile gallium (^{67}Ga) citrate is also manufactured as radiopharmacon. Our department being not involved directly in the manufacturing of these products is in charge of carrying out the related and necessary quality control investigations. These measurements include the control of nuclidic, chemical and radiochemical purity as well as sterility of the

products. In the case of products (e.g. sterile gallium citrate injection) we also contributed to the development of protocols for quality control measurements and took part in the development and construction work allowing the preparation of sterile products.

To the efficient production of high chemical purity $^{111}In\ Cl_3$ aspiring to a large scale national consumption we developed and modified the protocol of the radiochemical separation. As a result we succeeded in producing $^{111}InCl_3$ of very good chemical purity with high radiochemical yield. Both parameters compare advantageously to the international standards. The product $^{111}InCl_3$ can be used as an intermediate to label antibodies and blood cells. The developed extraction apparatus serves as a good starting system for the future construction of an automatic version.

We are routinely carrying out diagnostic investigations with our planar scintillation camera. The number of investigations (scans) per year is around one thousand.

The planar scintillation gamma camera was obtained from Gamma Ltd, Budapest in 1987. At that time the first generation of data acquiring unit and the appropriate data processing software was not in the production line any more, while the second generation of these options was still in development. The lengthy development and the very high cost of these facilities made us



The MGC type Cyclotron of the Nuclear Research Institute of the Hungarian Academy of Sciences, Debrecen

initiate a research and development program in cooperation with experts from other institutions. This program resulted in the installation of a system which is at least comparable to the second generation of the system by Gamma Ltd and it is currently used at many isotope diagnostic laboratories of the country.

In 1993 a Positron Emission Tomograph Center is being installed in Debrecen. The Biomedical Cyclotron Laboratory is in charge to operate the system and run and organize the research activity of the center. The installation was preceeded by an intensive radiochemical development program.

For ^{18}F production purposes we developed target chambers of different constructions. The optimized version requires a very small amount of ^{18}O enriched water as target material, – a critical point because of the high cost of the „heavy oxygenwater". The final version can be loaded with high ion currents required to match activity demands of PET investigations. We solved the synthesis of the inactive precursor of FDG (2-^{18}F-2-dezoxy-D-glucose) and the coupling of ^{18}F to the precursor. Based on NMR and HPLC quality control measurements the product is homogeneous, its radiochemical purity fulfills the requirements necessary for human in vivo diagnostic use. Procedure to register the product has recently been initiated.

Parallel to the development of the FDG synthesis a HEADS (high efficiency annihilation detecting system) program was developed aiming the coincidence detection of PET isotopes. The equipment, although not providing image formation, allows linear scans of the investigated systems. A stereometric mechanism has been constructed to the HEADS device and the panels for the required electronics have been worked out as well.

Before the installation of the PET camera transmembrane signalling was the main research field of the laboratory. Special attention was paid to the study of the spacial relationship of the membrane proteins. The laboratory contributed basically to the development of the flow cytometric energy transfer measuring technique. As a result of this the sensitivity of the method was increased and the investigation of systems with a lower level of antigen expression became possible. Expression of membrane antigens as well as the existence of macromolecular complexes on the cytoplasmic membrane was studied in cells of different phases of the cell cycle.

The regulation of intracellular ion concentrations in another field of interest. Special flow cytometric assays have been developed to measure intracellular concentration of monovalent cations. Alterations in these cellular parameters are studied during tumor progression.

Aiming a better understanding of cell demage by ionising radiation, cell parameters mentioned above (intracellular ion concentrations, supramolecular structure of membrane antigens, etc) are studied using samples exposed to radiation of different kind and different dose.

For further information please contact:
Biomedical Cyclotron Laboratory University Medical School of Debrecen
P.O.Box. 3. H–4012 Debrecen, Hungary. Telephon and fax: (52) 312–623

LAJOS TRÓN
Director

SECTION OF RADIATION BIOLOGY

The Section of Radiation Biology was established in the early 70's. The purpose was to ensure a forum for the growing number of scientists who were interested in this complex branch of science. At its meetings reports and lectures both on basic phenomena of experimental radiation biology and the application of them for medical and industrial fields were given. At present the Section has close to 100 members including representatives from universities, research institutes, and government agencies. At present the main objective of this Section is to assist the specialists in various fields to keep abreast with new theories, experimental results, techniques which have relevance e.g. to oncoradiology, radiation technolgy, safety standards for radiation protection. Many of the members are also members of the European Society for Radiation Biology (ESRB). For years the Hungarian section has been and still is represented in the Council of the ESRB. From time to time members are invited by the International Atomic Energy Agency, too, to assist in various projects as experts. Over the years the interest has greatly broadened to the increasing use of ionizing radiation in medicine and industry including the nuclear power plant program of Hungary. The Hungarian radiobiologists usually give informative pictures on their scientific achievements at the biannual meetings of the Hungarian Biophysical Society. During the last couple of years the Section has focused its interest with collaboration of the Eötvös Loránd Physical Society Health Physics Section on the new recommendations of the International Commission on Radiological Protection (ICRP) as the new issues include fairly detailed biological information as well as sophisticated knowledge on health physics. For a better mutual understanding the joint meetings proved to be helpful. The following topics have been discussed in details: deterministic and stochastic effects of ionizing radiation, interaction of radiation with matter. DNA damage and repair, estimates of the probability of carcinogenic effects, hereditary and teratogenic effects.

Several members of our Section are members also of the Health Physics Section and through this also of the International Radiation Protection Association (IRPA).

Recently, among the contemporary topics of radiation biology the followings are in the interest of members and are or are to be discussed at Section meetings:

– low dose effects, the hormesis and adaptive response of cells,

– combined effects of ionizing radiation and chemicals, drugs, antiblastic compounds, environmental pollutants,
– new approaches in radiation cytogenetics,
– role of cytokines in development and therapy of radiation sickness,
– biological effects of non-ionizing radiations,
– biological indicators of radiation injuries,
– the predective assays in the individualization of radiation treatment of tumor-bearing patients. Concerning the latter a lecture was already given by Dr. J. Mircheva (IAEA) entitled "Modification of Radiation Response in Cancer Treatment" with special emphasis on new experimental and clinical approaches in 1993.

This is an example that beside the members and invited lecturers, foreign visitors are also invited to deliver lectures and to give seminars.

Former officers of the Section were Dr. T. Predmerszky as president and Dr. J. Gidáli as secretary. In 1992 the Section elected Professor G. J. Köteles (Deputy Director General of the „Frederic Joliot-Curie" National Research Institute for Radiobiology and Radiohygiene, Budapest) as president and Dr. L. G. Gazsó (Head of Department of Radiation Biology of the same Institute) as secretary. ESRB Council members: earlier Professor E. J. Hidvégi and at present Dr. L. G. Gazsó.

The Section is open for specialists from various fields either to become members or to participate at its meetings and in scientific work. For further information, please, contact Dr. L. G. Gazsó, in the „Frederic Joliot-Curie" National Research Institute for Radiobiology and Radiohygiene, 1221 Budapest, Anna u. 5. Hungary, Phone/Fax: (1) 226-5750.

LAJOS GAZSÓ – GYÖRGY KÖTELES
Secretary and President of the Section

SECTION OF MEDICAL PHYSICS

The first Hungarian cobalt teletherapy unit had been planned by Prof. Bozóky and it was installed in 1957 in the National Institute for Oncology. The great majority of the radiotherapy centres (using megavoltage therapy units) were built until 1974. Since that time, like in other countries, the cooperation of physicists and physicians in the radiation therapy was absolutely necessary.

The physicists working in the field of radiation therapy have established the Medical Physics Section of Hungarian Association for Biophysics in 1974 and elected Prof. Bozóky as their president. The Medical Physics Section is a member of the IOMP since 1975. The activity of the Section is limited mostly to radiation therapy, and engineers and a few physicists working in the field of diagnostic radiology and/or nuclear medicine are usually involved in the routine work with and in the maintenance of major items of equipments (e.g. CT, MR). They are members of other societies. In our country there is no university where medical physicists are educated. This may be understandable if the size of the country is considered, at least the postgraduate education should, however, be solved since without that the medical physics will never be recognized as an independent discipline as it is recognized in the countries of the Common Market. The so far neglected regular education is the most important step on this way. For this aim the first very important steps made in 1992 were the foundation of Hungarian IOMP Library in Budapest and the regular workshop organized with the assistance of the Clinical Science Foundation (London).

Up to now the Section has not organize an independent congress, its members used, however, to take part at the meetings organized by the Societies of Hungarian Oncologists or Radiologists. The scientific activity of the members of our Section in connected predominantly with brachytherapy, teletherapy, TL dosimetry, Q. A. of radiation therapy and radiation protection.

A very important result and success in medical physics was the introduction of computer aided treatment planning (1978). The implementation of this project was supported by the I. A. E. A. The dose distributions were calculated in the whole country by using the EXTDOS program (written by van de Geijn) on a central computer. The early (1970) version was updated in 1982 (version 1980).

The next step was the introduction of a PC based version of the above program. The original program was adapted for PC and the interactive graphical I/O routines were written by members of the Medical Physics Section. In this work medical phyicists of various centres were involved.

The Section is open for experts from other fields to become members and to cooperate in the scientific work. For detailed information do not hesitate to contact Dr. P. Zaránd (Uzsoki Hospital, Radiation Physics Dept. H-1145. Budapest, Uzsoki u. B29. Phone: (1) 251-2168.

PÁL ZARÁND
President of the Section

ULTRASOUND SECTION OF THE HUNGARIAN BIOPHYSICAL SOCIETY

In the framework of the Ultrasound Section of Medical Biology, the Hungarian Society of Biophysics was the first in Hungary to provide a forum twenty years ago for specialists interested in the use of ultrasound in the field of medicine and biology to exchange experiences and propagate the cause of ultrasound diagnosis in the country. Scientific meetings on the latest results and development in diagnostic ultrasound are held 2 or 3 times a year. The Ultrasound Section is a founding member of both the European Federation of Societies for Ultrasound in Medicine and Biology and the World Federation for Ultrasound in Medicine and Biology, thus it can facilitate international relationships and contacts for Hungarian specialists in sonography.

At the historical 7th World Congress in Washington, 1988, organized by the World Union and the American Institute of Ultrasound in Medicine, four members of the Hungarian Section were honoured with a Pioneer Award. The Hungarian Section organized the 1st Hungarian Symposium on Ultrasound in Medicine in 1985, attended by sonographers from all fields of diagnostic ultrasonography. Owing to the specialization in ultrasonography, the 2nd Hungarian Congress on Ultrasound in Medicine was organized in 1989 with the participation of the Hungarian Societies of Radiologists, Gastroenterologists and Cardiologists.

At the steering board of the European Federation of Societies for Ultrasound in Medicine and Biology, Hungary is represented by the secretary of the Hungarian Section and Hungary is to organize the European Congress to be held in 1996.

The tasks of the Section include organizing and supporting lectures and postgraduate training courses for groups and individuals, working out principles and directives in diagnostic ultrasonography and promoting the participation of Hungarian specialists at international congresses. More than 15 members of the Society from the different sections received a scientific degree. 7 books and 4 textbooks have been published by the members so far.

The members of the Committee of the Hungarian Ultrasound Section play an active role in the different medical societies and in the elaboration of a unified system of directives and principles in ultrasonography in the different fields of medicine.

Address:
Department of Obstetrics and Gynecology, Univ. Medical School, Debrecen.
H–4012 P.O.Box 37.

ZOLTÁN TÓTH
President of the Section

THE ACTIVITY OF MEMBRANE SECTION

There was a Biennial Meeting in 1983 when the members of the Society came to a decision to establish a Membrane Section the necessity of which was already obvious: more and more "membrane" lectures were taking place within the Society's programs. On the 12th Biennial Meeting, for instance, the lectures were delivered about the newest results of membrane-dynamic studies (L. Trón, J. Szöllősi, S. Damjanovich – Institute of Biophysics of the University of Medicine, Debrecen), plasma membrane as a radiosensitive target (G. J. Köteles – "Frédéric Joliot-Curie" National Research Institute for Radiobiology and Radiohygiene, Budapest); besides, many posters dealt with the aspects of structural and functional changes of membranes. The book "Membranes and membrane-related diseases" of co-authors G. Gárdos, I. Szász, B. Sarkadi was also published in 1983 by "Medicina" Publishers.

In the meantime, the measurements have shown that 73 members of the Society expressed their desire to join the Section. The establishing meeting was hold on 20th February 1984 in Budapest. For a president post, L. Keszthelyi was elected, S. Györgyi became a secretary; the following board members were elected: Á. Enyedi, L. Horváth, L. Kovács, G. J. Köteles, T. Lakatos, Z. Szőkefalvi Nagy. The new scientific forum began to work with enthusiasm. All structural changes of arteficial membranes as well as structural-functional alterations of biomembranes were explained according to the Singer-Nicolson's "fluid mosaic model" the influence of which was still new at that time.

On the establishing session already, two lectures followed by interesting discussion were delivered (L. Horváth – Institute of Biophysics of the Biological Research Center Szeged: „Significance of fluidity modulation on the temperature adaptation of plants"; G. J. Köteles et al. – "Frédéric Joliot-Curie" National Research Institute for Radiobiology and Radiohygiene: „Derangement of plasma membrane upon ionizing radiation"). At the same year the members of the Section participated in the 14th Membrane-Transport Conference (Sümeg) as well as in the scientific session organized together with the Membrane Group of the Hungarian Biochemical Society, and related to the induced membrane phenomena (L. Keszthelyi et al. – Institute of Biophysics of the Biological Research Center, Szeged: "Light-induced phenomena in bacterial purple membrane"; L. Trón – Institute of Biophysics of the University of Medicine, Debrecen: „Ligand-induced changes of cytoplasma membrane followed by fluorescent method"). Some members of the Section participated in the international „membrane school" (23.09.–02.10.1984, Varna).

The activity of Section shown at the year of its establishment was continued in the following period as well. The Section Board was regularly organizing scientific sessions and stimulating the members to participate in the similar programs of other societies. Thus, the members of the Section essentially contributed to every-year conferences on membrane transport (Sümeg) with their lectures, posters and by taking part in organization-realiza-

tion of these forums as well. Similar activity could be found during biennial meetings of the Hungarian Biophysical Society (13th Biennial Meeting: 3–5 July 1985, Debrecen; 14th Biennial Meeting: 2–4 July, 1987, Pécs). In the course of these meetings, such membrane topics were discussed as the mechanism of drug – red blood cell membrane interaction, membrane permeability, studies of charge transport of Na–K ATP-ase in model membrane, phase-transition, membrane movements during a photocycle, distribution of negative charges on the surfaces of various cell types, relationship between structure and function: changes of functional condition of lymphocyte membrane leading to alterations of surface topology; ionizing radiation induced regional changes of a plasma membrane. The membranologists of the Institute of Biophysics of the Semmelweis University of Medicine and of the Institute of Biophysics of the Biological Research Center participated with their lectures in every second-year seminars organized by the Group on Organic Condense Systems, Macromolecules of Eötvös Loránd Physical Society.

Although the biophysical topics dominated at the first years of the Society's activity, at the nineties the interest of researchers turned to other directions, too: regulation of Ca-pump, relationship between cell membranes and lymphokines, receptor and effects, neurochemical – and bile investigations, lipid peroxydation. The international experience and results accumulated in immunology – especially in the field of cytokines – also stimulated research activity concerning membranes. This trend – together with other topics – was reflected in lectures and posters presented at the 15th (3–5 July, 1989, Szeged) and the 16th (2–5 July, 1991, Budapest) Biennial Meetings.

After 5 years of the Seciton's existence, there was a session followed by the election of new board (11. 12. 1989, Budapest). The topic of scientific part of the agenda was rather striking: „From a conformon till a toy catapult" and covered the new achievements on the membrane energy transfer mechanisms (S. György – Institute of Biophysics of the Semmelweis University of Medicine: „Some sentences for the protection of title – and topic choice"; B. Sarkadi-National Institute of Haematology, Blood Tranfusion and Immunology: „The energetic relations of cell membrane ion-pump"; L. Keszthelyi – Institute of Biophysics of the Biological Research Center: „The bacterial rhodopsin as a model for biological pumps"). The new board was elected: the president – L. Horváth (Institute of Biophysics of the Biological Research Center), the secretary – T. Kubasova („Frédéric Joliot-Curie" National Research Institute for Radiobiology and Radiohygiene), members – Á. Enyedi (National Institute of Heamatology, Blood Transfusion and Immunology), L. Kovács (Institute of Physiology of the University of Medicine, Debrecen) Z. Szőkefalvi Nagy (Central Research Institute of Physics), F. Tölgyesi (Institute of Biophysics of the Semmelweis University of Medicine).

During the las 3 years, the Section organized 2 scientific sessions with 35–40 participants each. The active discussions after lectures showed that the topics were interesting and actual for several „neighbouring" disciplines. The other explanation for the success of programs was the personality of the invited lecturers. The first meeting was held on 04. 12. 1991 in Budapest (O. Csuka –

National Institute of Oncology: „The role of membrane receptors in the transmission of mitotic signal"; J. Timár – Ist Institute of Pathophysiology of the Semmelweis University of Medicine: „Peroxydative membrane injury in synapsis"; K. Blaskó – Institute of Biophysics of the Semmelweis University of Medicine: „Peptid-like substances as a model for membrane channels; G. Berencsi – National Institute of Hygiene: „Relationship between virus infection and cell membrane").

TAMARA KUBASOVA
Secretary of the Section

SECTION FOR PHOTOBIOLOGY

About 6 years ago a group of scientists and clinicians with interest in photobiology, photochemistry, photomedicine and spectroscopy decided to form the Hungarian Section of European Society for Photobiology. Hungarian Society for Photobiology (HSP) was created as a Section of the Hungarian Society for Biopysics and established in 1987 under the guidance of Prof. Györgyi Rontó, who is the officer in the Executive Committee of ESP. Her scientific activity and the results of Hungarian photobiology were recognized, when Prof. Rontó was elected to the Vice-President of Association International de Photobiologia (AIP) in the period 1988–1992. Since its inception HSP has received encouragement from the European scientific community. In 1989, the group had the opportunity to organize the third ESP meeting in Budapest. Our first National Representative was Dr. Tatjana Szitó. This position is tilled by Dr. Béla Böddi from 1991.

The Hungarian Society for Photobiology has about 30 members. Our members in the European Society for Photobiology have either associate status – paying fee in local currency to the National Representative – or full one – paying reduced fee in western currency to the Treasurer of ESP. – At the expense of fees paid to the National Representative, the HSP has possibility to support the participation of the members at international meetings.

In Hungary various research groups are involved in several subspecialties of photobiology. This review will give a short summary of their activities (with a few exception).

The *Department of Plant Physiology* of the *Eötvös Loránd University* (Budapest) is working on three main fields of plant photobiology. Protochlorophyllidechlorophyllide photoreduction in the process of chlorophyll biosynthesis in higher plants is studied in the laboratory of Dr. F. Láng and Dr. B. Böddi. Low temperature fluorescence emission spectra of dark-grown and illuminated plants are analyzed by computer aided methods. The effect of light flashes of different intensities are used to get a characterization of the photoenzyme protochlorophyllide- NADPH-oxidoreductase and the kinetics

of its activity. A model has been created combining the biophysical, biochemical and cellular aspects of this subject. Dr. É. Sárvári and Dr. P. Nyitrai are specifically interested in the structure and biogenesis of chlorophyll containing thylakoid membrane particles. The effect of different external (light) and internal (plant hormones and protein biosynthesis) factors are examined by this group. Research program on herbicide- and stress-effects on the photosynthetic apparatus is carried out by Dr. Z. Szigeti. Chlorophyll-a fluorescence induction is studied to determine the mode of action of stressors and photosynthetic herbicides. The pigment photodestruction and the inhibition of the photosynthetic electron transport cain are examined.

The *Institute of Biophysics of Semmelweis Medical University* (Budapest) directed by Prof. Gy. Rontó. She is working with her research group since the sixties in the field of UV radiation damages of chromosomal models: bacteriophages. The recently found ozone depletion and in consequence of this the increased UVB radiation in the biosphere underline the importance of their results. Based on these they (S. Gáspár, A. Bérces, P. Gróf, Z. Gugolya) worked out valuable methods for measuring the biologically effective doses. Bacteriophage T7 (in solution) and uracil crystalline thin layer biological sensors have been developed and used in outdoor measurements as well. These sensors are uniquely suitable for evaluation/prediction of health risk of UV-B radiation. Research program on the quantitative characterization of dark genotoxicity and photoreactivity of psoralen derivatives is another branch of the studies of UV damages in chromosome models. This activity is carried out by K. Tóth and G. Csik. The structural and functional changes and their connections have been studied on phage nucleoprotein complexes. The group of Dr. J. Fidy (A. Kaposi and L. Herényi) is interested in the structural studies on proteins based on the laser excited low temperature optical spectra of functional chromophores embedded in the protein matrix. This method is especially applicable for the study of hemo-proteins.

The Department of Oxidation Processes of the *Central Research Institute for Chemistry* of the Hungarian Academy of Sciences (Budapest) is involved photobiology-oriented program. Part of the research efforts of the department led by prof. D. Gál deals with photodynamic therapy. Work is directed towards the better understanding of the photochemistry of the process, especially the primary photochemical steps involving the excited photosensitizers and the active species formed during these interaction. The photochemical properties or protonated hematoporphyrin are investigated by Dr. G. Móger. ESR spectroscopy of animal tissue samples from PDT treated mice is carried out by Dr. T Shulyakovskaya and Dr. L. Sümegi. The study of formation and decay of singlet oxygen in PDT related system (S. El-Zemzam and Dr. T. Vidóczy) and the investigation of interaction of free radicals with excited sensitizers (Dr. A. Gedra, Dr. Zs. Kuti) are important contributions of this research field. This group has various techniques such as ESR spectrometry and high sensitivity fast photodiode detector for the direct measurement of the emission of singlet oxygen.

The major interest in the *Institute of Biophysics of József Attila University* (Szeged) is the study of primary photophysical and photochemical events of photosynthesis in single celled algae and bacteria. Light induces electron and proton transfer, which generates a transmembrane proton gradient and, ultimately, ATP. This complex system is studied by rapid kinetic optical, biophysical and biochemical techniques. Prof. L. Szalay, Dr. P. Maróti and G. Laczkó are seek a description of the interaciton between the reaction center proteins and quinines and the role of the membrane in the electron and proton transfer reactions. A mechanism has been proposed for the coupling of electron and proton transfer and for the action of commercially important herbicides. The observed kinetics and stoichiometry of flashinduced proton binding depend on the conformational changes of the protein by controlling the degree of exposure of protonable amino acid side groups to the water phase.

An important department is headed by Professor S. Damjanovich at the *University Medical School of Debrecen.* They use fluorescence resonance energy transfer measurement as an excellent tool for determining distance relationships, protein interactions and supramolecular structure on cell surfaces.

GYÖRGYI RONTÓ
President of the Section

THE INTRODUCTION OF AGRO- AND FOOD-PHYSICAL SECTION

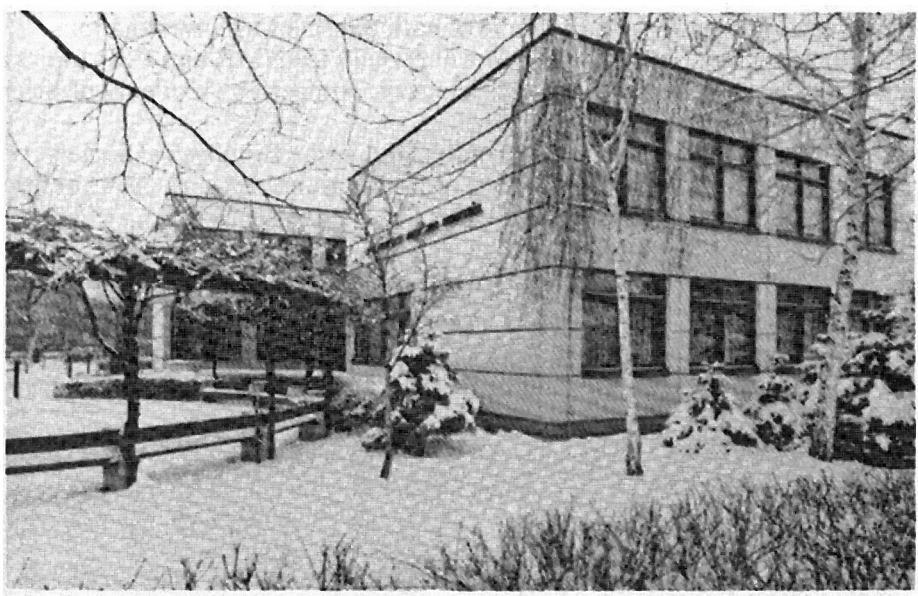
Between July 3–5, 1985, at the XIIIth Itinerary Meeting of the Hungarian Biophysical Society, national research workers presented 25 posters in section. The possibilities for the application of biophysical methods in agriculture. The idea was brought up during this Meeting that, in the frame of the Society, a Section dealing with agro- and food physics should work in the future. At the meeting of April 21, 1987, the Presidium of the Society decided in favour of the formation of this section, in order to take the responsibility in the field of research, for the studies of agricultural, food-industrial and biophysical topics and, in the field of edication, for the support of biophysics teaching in agricultural and food-physical university edication.

According to these aims, the Section was formed with about 40 members in September 25, 1987. It should be mentioned that the Section made its working plans in close co-operation with the Agrophysical Working Committee of the Academy Committee in Debrecen, which was formed in 1981, and was undertaking the co-ordination mission of national agrophysical investigations.

The main intentions of our Section are as follows:

– it is desirable to know other's works, and we organize two meetings every year (with lectures and round-table discussions);

– it is also important to follow the working plans of other Sections and to take part in their programs concerning our Section.



College of the University of Horticulture and Food Industry, Szeged

We usually have one-day meetings at different institutions such as:

- about the work of Agricultural Research Centre in Karcag;
- the position of food-physical research, the application of different physical methods (PIXE, ESR, TL, photoacustics and NIR technique);
- the position of national environment protection and environment analytical problems, at the Food-Industrial Forum in Budapest;
- about the work of Agricultural Technical Institute in Gödöllő.

We have also taken part in organizing meetings on special topics:

- Radiation technology in food economy (1987);
- Radiation technology in food economy and agriculture (1991)

The symposium materials have been presented in extra issues of J. Food Physics, published at the University of Horticulture and Food Industry since 1988. These publications are usually edited by the members of the particular Section, under the auspices of the Hungarian Biophysical Society. The Journal comes out twice a year in Hungarian with English abstracts, and from the two parts one English issue is also punlished every year.

Realizing the role of biophysics in agriculture and food industry, on the basis of national summing-up, the Food-Industrial Forum has been organized, which gives oppurtunity to experts in different fields of food science and food industry to get information on the position of national food physics. The Forum enables us to know research/developing activities, intentions and problems, furthermore to form new co-operation connections.

We have surveyed the set of instruments in food science and food industry. It was decided at the statutory meeting in October 1991 that according to the special research fields, thematic meetings would be organized every year. The following meeting was at the Development and Quality Testing Institute of Refrigeration Industry, with the topic of national rheology investigations.

The next Forum Meeting (1993) will be held for NMR and ESR topics at the Central Research Institute for Chemistry, Hungarian Academy of Sciences.

Our Section, under the auspices of the Hungarian Biophysical Society, will organize the first national conference of international level in 1994, entitled International Conference in Food Physics.

JÓZSEF KISPÉTER
Vice-President of the Section

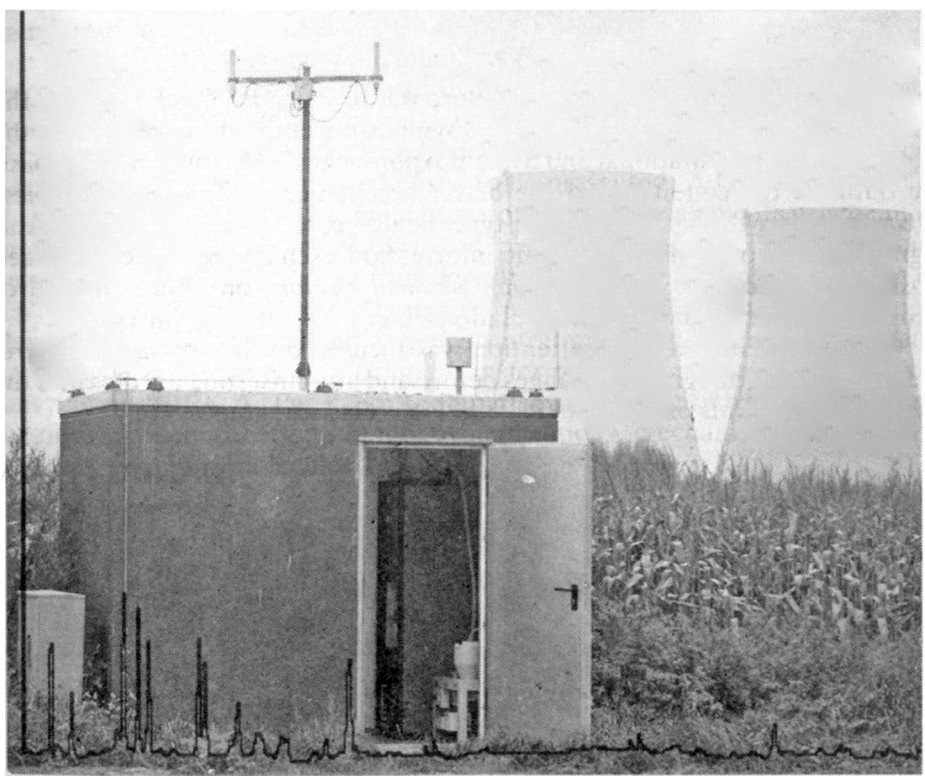
RADIOECOLOGICAL SECTION

The Radioecological Section was founded in October 1992 by nearly 30 members. Thus, the Section is the newest one established within the Hungarian Society of Biophysics. The main objective of the Section is to promote information exchange among the specialist dealing with the use of radionuclides and their effects on the environment. The members of the Section as well as the elected presidium are interested in the fields of ecology, geography, agriculture, radiation protection, radiochemistry, radiobiology and they are involved mainly in interdisciplinary research, applications and teaching.

One of the main aims of the Section is to decrease the gap between the experts of the „greens" and of the „atomic-lobby". The members wish to organize informal meetings on the topics of various energy-sources, effects of radiation etc. in cooperation with other societies.

The first year program is focused mainly on organizing meetings in the main institutes involved in radioecology. The first meeting was held in the Academic Research Institute for Soil Science and Agricultural Chemistry, Budapest.

The Section has a close connection to the International Union of



Radioecologists (IUR), this way it is to take part as cooperation partner to the National Research Institute for Radiobiology and Radiohygiene in organizing an IUR Summer School on „Radioecolgy and Environmental Monitoring in Normal and Accidental Situations". The Summer School is to be arranged from 26. July to 7. August, 1993, with altogether 25 participants, mainly from Europe.

The head of the Section is B. Kanyár, the secretary is P. Szerbin – both from the Natl. Res. Inst. Radiobiol. Radiohyg., Budapest – and the other members of the presidium are: É. Beleznay (Res. Inst. of Atomic Energy, Budapest), Cs. Béres (Kossuth L. Univ. Science, Debrecen), J. Dombóvári (Res. Inst. of Irrigation, Szentes), T. Németh (Res. Inst. Soil Sci. and Agricult. Chem., Budapest), F. Schweitzer (Res. Inst. of Geography, Budapest), S. A. Szabó (Univ. of Horticult. and Food Industry, Budapest) and S. Tarján (Natl. Inst. of Food Control, Budapest).

PÁVEL SZERBIN
Secretary of the Section

WORKING GROUP ON ACUPUNCTURE

The Working Group on Acupuncture was founded in March, 1984. In the next year we organized an international symposium entitled „Workshop on the Biophysical, Computational and System Approaches". On this academic basis we outlined the conditions of the better acceptance of *Traditional Chinese Medicine* (TCM) in our Western-type health care. Our contribution was significant not only in the scientific information exchange, but we organized *postgraduate courses for Hungarian medical doctors* on clinical topics of acupuncture such as needle manipulations, etc.

In the recent years our attention was focused on the *plantacupuncture,* studying the thermographic changes before and after inserting needles into the hyporesistive points of some plants, e.g. Ficus elastica, grapes, etc.

AJÁNDOK EŐRY
Secretary of the Group

BIOELECTROCHEMICAL GROUP

The formation of one of the youngest groups of our Society in 1985 was motivated mostly by the rapid development of the bioelectrochemical research in Hungary and the expansion of our international connections in that field, but the visit of the president of the International Bioelectrochemical Society (BFS) of that time, prof. G. Milazzo also supported the organization. (Tn 1988 Prof. Milazzo was elected the honorary member of the Hungarian Biophysical Society.)

The first great trial of the new group was, in 1987, the organization of the 9th International Symposium of Bioelectrochemistry and Bioenergetics in Szeged, Hungary. The main topics of the conference were: electrochemistry of biologically important molecules, structure and function of membrane systems, bioelectrochemistry of the nervous system, applied bioelectrochemistry and the connection between membrano bioelectrochemistry and the long-range effect of electromagnetic fields, while the last day was devoted to the session of the Bioelectromagnetic Society where the problems of the effect of magnetic field on the biological systems was discussed.

As an appreciation of the organization of a succesful conference and of his results in the bioelectrochemical research Prof. Lajos Keszthelyi, the president of the Bioelekctrochemical Section and of the Symposium was elected as the member of the BES Council in 1988.

A regular local forum of the members of the Bioelectrochemical Group is the annual meeting on „Membrane Structure and Function" (Sümeg, Hungary), organized by the membrane sections of the Hungarian Biochemical, Biological, Physiological and Biophysical Societies, including our group too, where the new results of the field used to be presented. A typical program of such a meeting represents the maln topics of the Hungarian bioelectrochemical research: ion transport mechanisms in plants, transport ATPases in plant membranes, carrier mediated transport of divalent metal ions, regulation of Ca^{++} -pump in plasma membrane, redox activity of plasma membranes, changes in the intracellular ion concentration during neurotransmission processes, the mechanism of charge transfer processes of biologically important proteins (BRs, ATPases, etc.) comparison of the transport behaviours and the physico-chemical effects of monovalent cations, mechanisms of the action of channel forming molecules, etc.

SÁNDOR GYÖRGYI
Secretary of the Group

RELATION OF HUNGARIAN BIOPHYSICISTS TO IUPAB AND UNESCO

1. IUPAB

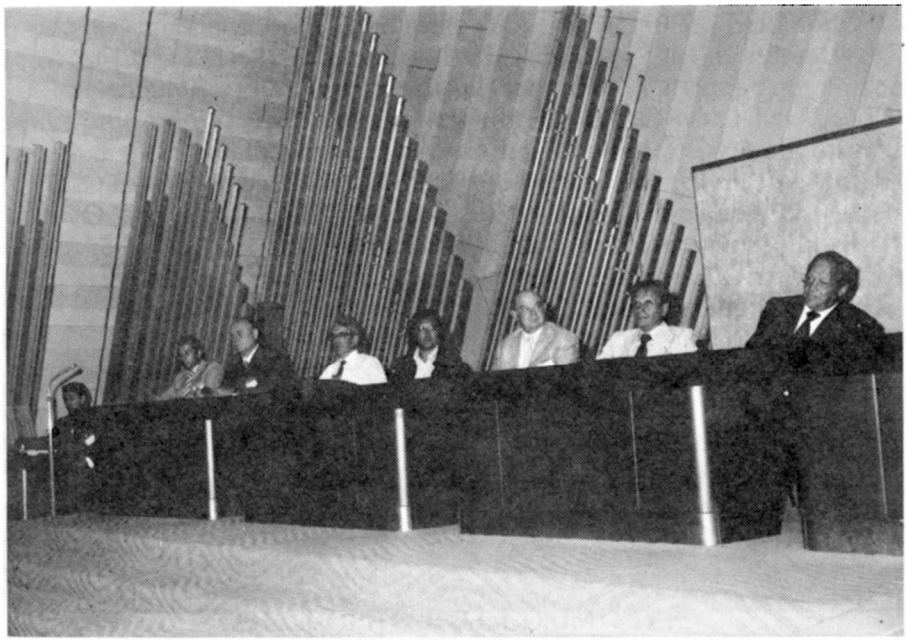
The Hungarian Biophysics was organized in 1960, one year before foundation of IUPAB[1], therefore many Hungarian biophysicists attended the first International Biophysics Congress at Stockholm 1961, where the predecessor organization of IUPAB, the International Organization for Pure and Applied Biophysics was founded. The good reputation of the Hungarian biophysics was demonstrated by the fact, that prof. Ernst was elected a member of the Council and he served two terms in it. Following the foundation, Hungarian biophysicists always had some kind of leading position in various bodies of UIPAB. We had membership, e. g., in the Radiation Biophysics Commission (Tigyi 1966–72 and 1987–93, Rontó 1984–87, Sztanyik 1987–93), in the Commission of Education and Development of Biophysics (Ernst 1969–72, Tigyi 1978–84 chairman, Biró 1990–93) in the Commission of Molecular Biology (Szentágothai 1969–72) in the Commission of Cell and Membrane Biophysics (Keszthelyi 1990–93), in the Council of IUPAB (Tigyi 1972–78).

The author of this paper was elected Secretary General in 1984 (Bristol) and served 9 years on this post.

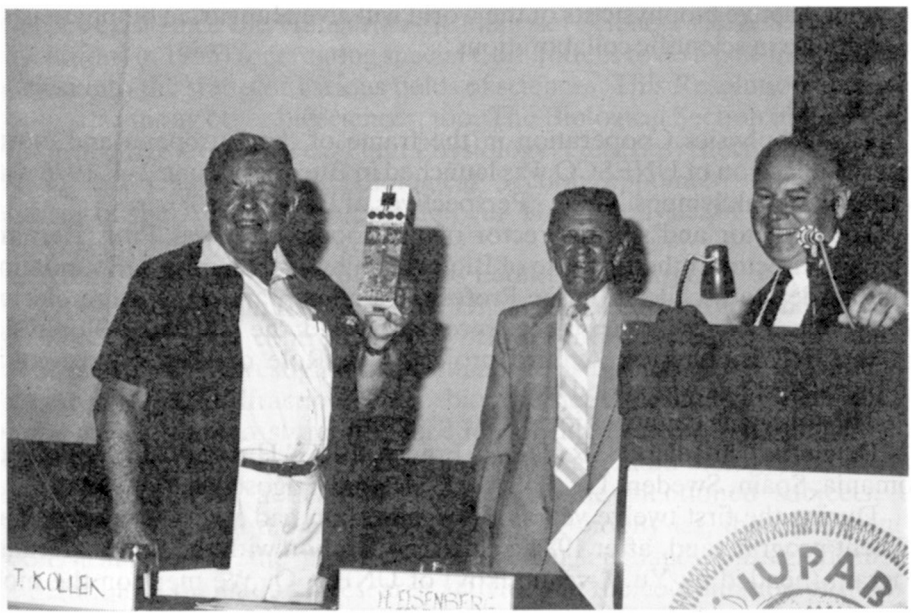
During the past decades 3 IUPAB sponsored scientific meetings were organized in Hungary, and the Hungarian biophysicists had a relatively large delegation at the 10th International Biophysics Congress (1 plenary lecturer and 4 symposium speakers).

One of the most important result of the close cooperation between Hungarian biophysicists and IUPAB was the possibility to organize the 11th

[1] See: J. Tigyi "Thirty two years of the Organized Hungarian Biophysics" in this issue.



The opening ceremony of the 5th International Biophysics Congress, Copenhagen, 1975. (From left: F. Oosawa, K. Wüthrich, J. Tigyi, D. Phillips, M. Montal, V. Gurfinkel, G. R. Kosztyuk, F. Lynen.)



The opening ceremony of the 9th International Biophysics Congress in Jerusalem, 1987. (T. Kollek, Mayor of Jerusalem, Profs. H. Eisenberg and J. Tigyi)

The Foundation of UNESCO Collaboration in Budapest, 1976. (Tigyi, A. Pullman, J. Jaz)

International Biophysics Congress, July 25–30, 1993. We hope, that the meeting of active biophysicists of the world will give Hungarian biophysicists a new impulse in scientific collaborations.

2. UNESCO.

The Biophysics Cooperation in the frame of the European and North American Region of UNESCO was launched in Budapest, June 2–4, 1976 with an International Symposium on „Perspectives of Biophysics"[(2)].

The initiator and spiritus rector of the cooperation was Prof. Bernard Pullman, director of the Institute of Biological Physico-chemistry, Foundation Edmund de Rothschild in Paris. Professors Pullman and Tigyi were elected cochairmen. Two research projects were established: the Molecular Biophysics and the Cell Biophysics. A third project: The Role of Water and Ions in Biological Systems was added later.

The following countries joined the program:

Belgium, Canada, CSSR, DDR, France, FRG, Hungary, Italy, Poland, Romania, Spain, Sweden, UK, USA, USSR, and Yugoslavia.

During the first twelve years this organization had a very up to date and efficient program and, after 1984 a close cooperation with the „Biomaterials" program (headed by Yu. Ovchinnikov) of UNESCO. We mention the most

[(2)] Acta Biochim. Biophys. Acad. Sci. Hung. *12.* (2) 1977.

remarkable meetings only: Budapest 1978, Paris 1980, Baltimore 1982, Bucharest 1982, 1984, 1987, Houston 1983, Alma Ata 1984, London 1988.

Unfortunately, this very successful cooperation did not get financial support any more, because of the crisis of UNESCO when USA and UK suspended their membership. However the Biophysics Cooperation of the UNESCO European and North American Region was a very useful venture of UNESCO and helped the development of world biophysics remarkably. During the last 4 years of cooperation it was an important point to involve the biophysicists of the developing countries in the program. After a few years gap the UNESCO formed a world-wide program: Molecular Biology Network headed by Prof. A. Azzi. We hope that we can continue our collaboration also in this new project.

JÓZSEF TIGYI
Secretary General of the IUPAB

THE BIOPHYSICAL COMMITTEE OF THE HUNGARIAN ACADEMY OF SCIENCES

Scientific committees of the Sections of the Hungarian Academy of Sciences exist since the Hungarian Academy of Sciences (H.A.S.) adopted a Resolution (in 1965) for creating special Committees to do a fact-finding-investigation into the status of various fields of sciences. This Resolution applied to biophysics among other biosciences, too. The Biological Section of the H.A.S. established five Committees: Plant Physiology, Genetics, Biochemistry, Biophysics, and Cytology. The Biological Section appointed Eugene Ernst, member of the Academy, to preside over The Biophysical Committee. The members on the Committee were:

József Tigyi, László Bozóky, János Ladik, Imre Tarján,
Ottó Fehér, István Ketskeméthy, Olga Geszti, Erika Ágoston.

This Committee controlled the work of nine sub-committees doing the actual fact-finding-investigations into nine fields of biophysics: submolecular structures (X-ray diffraction, etc.), biocybernetics, excitatory phenomena, micro- and sub-micro sturcture, function of muscle, transport phenomena, radiation physics: dosimetry, radiation biophysics (radio biology), bioenergetics. In addition to a detailed report over the mentioned subjects, the Committee discussed the problems of teaching biophysics, the equipment of biophysical research, the importance of learning languages, the significance of cooperation in the national research activity and the coordination of fields of research.

After the Committee had finished its fact-finding-investigation it became one of the nine standing Espers' Committees of the H.A.S. The Biophysical

Committee had thirteen members, Eugene Ernst was its president and Joseph Tigyi its secretary.

The function of the Board was controlled by the Biological Section of the H.A.S. and it reported its activity to the Biological Section yearly. Its task was to survey the research, education, publication, and educational lecturing for the general public in the fields of biophysics. At the same time it served as an advisory board of the Biological Section of the H.A.S. and in this capacity it gave expert opinion on the projects of the biophysical research groups in Hungary, surveyed their reports, and prepared proposals about developing the biophysical research at national level.

Minor changes in the composition of the committee occurred together with the periodical re-elections of the officials of the Academy. Eugene Ernst carried on presiding at the Committee after the 1976 elections, Dr. A. Niedetzky became the secretary of the Committee that had eleven more members. The second Hungarian textbook of biophysics entitled „Bevezetés a Biofizikába" (Introduction to Biophysics) written by Eugene Ernst was published in this period (the first one published in 1947 of the same title was much shorter and it was practically the written form of Eugene Ernst's lectures on selected sections of biophysics). After Eugene Ernst's death (27. 02. 1981.) Joseph Tigyi took over the leadership of the Committee that had 15 members as a total at that time. Eight expert teams (transport phenomena, muscle function, excitation, radio biophysics, photo biology, quantum biology, biocybernetics, and theoretical biophysics) helped the work of the Committee. In this year the Committee decided to hold a part of its sessions at various research departments of biophysics to make a closer contact with the scientists and to become familiar with the actual problems of scientific work.

The secretary of the Committee has been Tibor Lakatos since 1985. Sándor Damjanovich followed Joseph Tigyi as president in 1988, and Lajos Trón took over this post in 1991.

An important task of the committee has been, since 1985 to, review the applications for OTKA grants (OTKA is the Hungarian acronym for National Foundation of Scientific Research). Two referees read and report each application, the Committee discusses the reports and proposes a sequence of acceptance to the OTKA authorities, as a result of a secret ballot. It gives an estimate, too, if the financial demand of the applicants matches the goal of the submitted project.

Recently, the Committee had to survey again the work done at various research centres of biophysics to help the Academy in reorganizing of the research activities in Hungary.

At present, sixteen committees are affiliated of the Biological Section of the Academy, one of them is the Biophysical Committee and it keeps trying to contribute to the production and reproduction of the contitions of successful research in biophysics.

TIBOR LAKATOS
Secretary of the Commitee

Building of the Local Committee of the Hungarian Academy os Sciences, Pécs. (Photo: István Vadász Jr.)

MEMBRANE TRANSPORT CONFERENCES IN SÜMEG

Sümeg, a nice, small town in the western part of Hungary, not too far from Lake Balaton, has been for 17 years the spot of the annual conferences of the Hungarian scientists dealing with the investigation of the structure and function of biological and model membranes, the molecular mechanism of transport processes, including also immunobiological and other clinical aspects of the membrane structure and function. (Earlier, between 1972–1976, the first conferences were located in Tihany, at the Lake Balaton.)

The organization of these conferences is rather special: it is propared and settled by individuals, the members of the membrane sections of the Hungarian Biochemical, Physiological, Biological, Haematological, Neurochemical, Clinical, Immunological and Biophysical Societies. Naturally all themes which are interesting for and investigated by the members of these sections are discussed in a 3 to 4 years cycle. The forthcomming program used to be decided at the end of the preceding conference by the participants, whose number is around 100–120.

As to the structure of the conferences the participants discuss two or three themes in reviews and shorter oral contributions while the posters represent all fields of the membrane research in Hungary. The posters are arranged in the hotel where almost everybody is accomodated permitting unlimited discussions during the whole day.

Comparing the programs of the 23 conferences one can follow the development of the membrane-transport research. At the beginning of the seventies the physiology and biochemistry of different transport processes were in the limelight and membrane biophysicists worked also on different transport models or on the description of transport processes by using non equilibrium thermodynamics. These were the years of the appearance of different lipid model membranes (BLM, liposome) in Hungary. Than, parallel with the development of microscopic and submicroscopic physical methods the study of the membrane structure, its alterations and their role in the regulation of transport processes came to the front. The beginning of the eighties were the years of the investigation of the structure and phase transitions of lipid membranes, the construction of different models in order to describe and explain these structural alterations. Nowadays, having new methods of high resolution and sensitivity the knowledge of the structure and function of membrane proteins on molecular level is the main aim.

Some titles from the program of the XXIII. Sümeg Conference (1993) prove this opinion:

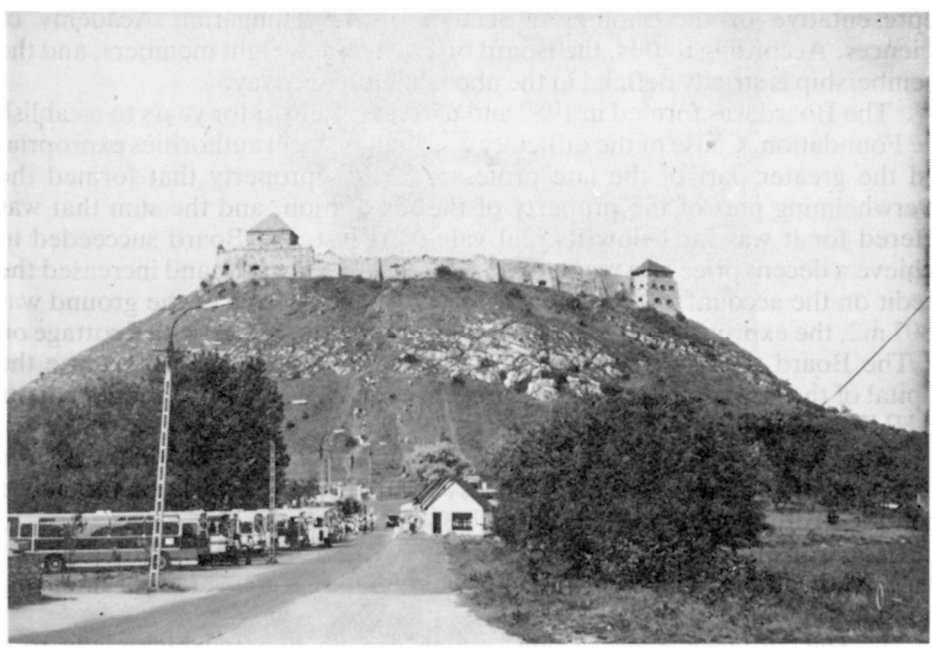
– Mapping of the cell surface protein patterns by using combined luminescent anisotrophy and energy transfer measurements.

– – Expression of Na^+- K^+- ATPase isoforms along the nephron.

– The study of the structure and function of a Ca^{++} – ATPase with perturbation methods.

– Investiqation of Ca-transporting ATPase in different blood cells.
– The perturbation of the function of Na^+/K^+ pump in diabetes mellitus.
– Tannins and phenols as the inhibitors of the plasmamembran ATPase in plants.

SÁNDOR GYÖRGYI



The site of the Membrane Transport Conferences is Sümeg situated north of the lake Balaton.

FOUNDATION „EUGENE ERNST"

The late Eugene Ernst, former director of the Department of Biophysics of the University Medical School of Pécs (1945 to 1972) was a member of the Hungarian Academy of Sciences. He was awarded by „Kossuth Price" twice, founded the Hungarian Biophysical Society (1961) and presided it from 1961 to 1969 and he was its Honorary President till his decease. He died in 1981. His last will and testament appointed the Hungarian Academy of Sciences as his heir under the contition that his legacy would be the monetary basis of a foundation to support biophysics in Hungary.

The initial property of the Foundation consists of HUF 280 000 cash, a piece of ground and a building within the area of the city, Pécs. The Academy nominated a board of trustees to establish the foundation and to administer its function. The President of the Board is the biophysicist of the highest scientific degree from among the followers of the founder, its secretary is a person selected by the president from among the scientists of the Department of Biophysics of the University Medical School of Pécs (The Department of Biophysics includes a local Research Group of the Hungarian Academy of Sciences.) The Trustees are: the President of the Committee of Biophysics of the Hungarian Academy of Sciences, the President and the Secretary General of the Hungarian Biophysical Society, the director of the Department of Biophysics of the Biological Research Center of Szeged, the representative of the Legal Department of the Hungarian Academy of Sciences and the representative of the Biological Section of the Hungarian Academy of Sciences. According to this, the Board of Trustees has eight members, and the membership is strictly defined in the above mentioned way.

The Board was formed in 1982 and used every effort for years to establish the Foundation. Cause of the difficulty was that the local authorities expropriated the greater part of the late professor Ernst's property that formed the overwhelming part of the property of the foundation, and the sum that was offered for it was far below its real value. At last, the Board succeeded to achieve a decent price as a result of a few years long lawsuit, and increased the credit on the account of the Foundation. The original area of the ground was 8807 m2, the expropriation of 5126 m^2 decreased it to 3681 m^2 with a cottage on it. The Board tries to convert this property into money and to increase the capital of the Foundation by it. The present capital of the Foundation amounts to HUF 2 792 000 (31. December, 1992.)

The Constitution of the Foundation was accepted in 1987 and the President of the Academy of Sciences confirmed it. Because of the above mentioned difficulties the Foundation began to function in 1989.

The Constitution of the Foundation – as written up by the Board–determines, that the interest of the capital of the Foundation can be used for financing the following items:

1. *The „Eugene Ernst Medal"* which can be donated biannually to a Hungarian biophysicist who did an outstanding work in the field of biophysical

research, in the education, or as an organiser. The money that is given with the Medal amounts to the 80 per cent of the prevailing Award of the Academy of Sciences.

Till now, two Hungarian biophysicists received the „Eugene Ernst Medal":

József Tigyi, Member of the Hungarian Academy of Sciences (1989)
Györgyi Rontó, Professor of Biophysics (1991)

2. *„Eugene Ernst Prize"* aims to reward young biophysicist below 35 who won an essay competition as invited by the Hungarian Biophysical Society. This Prize is given at the biannual National Society Meetings of the Hungarian biophysicists. The Board of Trustees decides about the award taking into consideration opinion of the Presidium of the Hungarian Biophysical Society based on the reports of experts. The Foundation has been awarding this Prize since 1985. Four young biophysicists got this Prize in 1991, the total of it amounted to HUF 75 000.

Eugene Ernst (1895–1981)

3. *„Eugene Ernst Award"* is given for a significant scientific activity. The Board of Trustees takes the decision after having been considered the proposal of the Presidium of the Hungarian Biophysical Society. This Award is given occasionally.

The Foundation supports young Hungarian biophysicists' participation at international scientific conferences. We have distributed the following amounts till now:

1985	HUF	20000.–
1986		15000.–
1990		345000.–
1991		24000.–
1993		500000.–
Total		904000.–

(In the years 1990 and 1993, the Board supported the participation at the International Biophysics Congresses in Vancouver and in Budapest, respectively.)

The Medal, the Prize and the Award can be given only to Hungarian citizens for activities done in Hungary.

We believe, that the Foundation supports the development in the field of biophysics with good results when it appreciates scientific achievements of the biophysicists both morally on financially.

Further information Dept. Biophys. Univ. Med. School of Pécs
H-7643 Pécs, Szigeti út 12. Phone/Fax: (72) 314-017

ANTAL NIEDETZKY
Secretary of the Board of Trustees

TEACHING AND EDUCATION IN BIOPHYSICS

In the training of physicians biophysics is one of the fundamental sciences. It has a multifarious function. One of them is to provide basic knowledge, and to prepare for their application in practice. It has an important role in the formation of the scientific world concept of students. To provide – in cooperation with other fundamental disciplines – up-to-date theoretical and practical basis for the subsequent studies seems to be the most important function of this field of science.

Education in biophysics is taking place in Hungary at several universities. According to the number of students involved, we have to mention first the four university medical schools (in Budapest, at Debrecen, at Pécs and at Szeged). The bioengineers of the Technical University of Budapest and the biophysicists and biologists at different univesities of sciences are much fewer in number than the students of medical universities. The largest-scale training is at the Semmelweis University of Medicine (SOTE), located in the capital, Budapest. Therefore, somewhat arbitrarily, in the following paragraphs we would like to give a survey of the ongoing education at the Institute of Biophysics of SOTE, about the development, circumstances and problems of our educational schedule on biophysics.

1. Short history

The University of Nagyszombat (now Trnava in Slovakia), the predecessor of the Lorand Eötvös University of Sciences (ELTE), founded in 1635, became a complete – four faculty – university by establishing the Faculty of Medicine in 1769. From then on, for nearly a century, physics was learned by the students only in a two year preliminary philosophical course which was an obligatory requirement of becoming a medical student. According to the new code of examinations in 1875, however, physics was established as a pre-final examination for all future doctors. (The medical students visited the lectures together with the students of the faculty of philosophy.)

Despite the fact that the Faculty of Medicine had requested the establishment of a separate department of medical physics as soon as 1870, the situation remained unchanged, physics was taught by a department which was not part of the medical faculty, so the preferences of medical education were not accepted for a lenghty period of time.

The government decided in 1947 to set up the Institute of Medical Physics as a department of the Faculty of Medicine which has been functioning only

from 1949, from 1967 as Institute of Biophysics. In 1951 the Faculty of Medicine became an independent (self governing) university with three faculties, this is now the Semmelweis University of Medicine. Among the medical universities in the country, Debrecen and Pécs have their own Institute of Biophysics. (The latter was the first medical university in Hungary having the department of biophysics.) In Szeged, biophysics is taught by the Department of Biophysics of the University of Sciences. There is one condition which all four departments teaching biophysics for medical students must satisfy, namely that the program of the biophysics curriculum has to be constantly modernized. This is necessary due not only to the appearance of new trends, the widening of the scope of knowledge but to the change in the pre-university qualification of the students and to the coordination with the other sciences as well. Thus, our teaching program should be regarded as an intermediary station of a continuous progress. Today's students will become physicians, pharmacists and dentists of the upcoming decades.

2. Education in the near past and present

The Institute of Biophysics teaches on all three faculties of SOTE (Medicine, Dentistry and Pharmacy), thus oversees the biophysical (or pharmacophysical) education or all students in the first year. The number of students admitted to the faculties has varied throughout the years. There were years when this number exceeded 800 students.

At present, classes are the smallest ever (see Table 1). Their level of knowledge in physics can be regarded satisfactory, since they had to pass entrance examinations in physics (and in biology). Thus, we don't have to teach or to repeat the curriculum of secondary school physics. The previous statement does not apply to our foreign language students: teaching has been taking place in German since 1983 and in English since 1989. Our educational engagements in the academic year of 1992–93 are shown in Table 1. Besides the basic curriculum we give a tow hours seminar for our foreign language students weekly, in order to assure their satisfactory level of biophysical knowledge.

3. The scenes of education

Biophysics has a course of two semesters for all the faculties in the first year of the six year medical curriculum, and is finished by a final exam at the end of the second semester. Lectures and laboratory practices are held. The laboratory practices (and seminars) are held for separate groups of students of each faculty. The number of students in these groups vary from 10–24. Each member of the group has the opportunity to perform the same experiment simultaneously and individually, or maximum in groups of 2–3 students. In this aspect the Institute of Biophysics at SOTE provides a unique possibility in respect of practical work.

Table 1. *Timetable of the Institute of Biophysics at SOTE*[1]

	number of groups	number of students	number of teaching hours				
			lecture			lab. practice	
			I–II. semester h/week		h/year	h/week	h/year
Med.[2]	24	265	2.5 2.5	2 2	67.5 67.5	60	1800
Dent.	6	66	2.5	2	67.5	15	450
Pharm.	6	124	2	2	60	18	540
German (Med.)	6	110	2.5	2	67.5	lab.: 5 sem.: 12	810
Med.+ Dent. English Pharm.	9	157	2.5 2	2 2	67.5 60	lab.: 23 sem.: 18	1230
Total	*51*	*722*	*16.5*	*14*	*457.5*	*161*	*4830*

4. The educational program

4.1. Course of lectures

The subject of the lectures – based on the knowledge of physics and mathematics acquired in secondary school – contains selected chapters. In selection the aspects of medical (dentist and pharmaceutical) education were emphasized. So the basic elements of the lectures at the different faculties generally coincide, but specific topics are also considered. Below we give a survey on the program of lectures of medical students and a summary of the laboratory practices.

4. 1. 1. Medical dataprocessing, computers (biomathematics, biometry)

The most frequently used functions for the mathematical description of the processes in nature and the of different physical laws describing the phenomena are duscussed with the help of simple differential equations. The specific relationship between the mathematical formalisms and their physical/ biophysical meaning is emphasized in order to reduce the aversion associated with the mathematics nowadays indispensable in medicine.

The majority of the basic concepts and methods of biometrics are discussed also in laboratories by solving problems with the aid of computers.

[1] Education is taking place in Debrecen, Pécs and Szeged at Faculties of Medicine and Dentistry, in Szeged at the Faculty of Pharmacy, too. The number of Hungarian students in these universities is about 1/3 each of that in Budapest. In all three of these universities there is English language education, too.

[2] The students of the Faculty of Medicine are divided into two parts, reading biophysics lectures separately.

4. 1. 2. The molecular structure of the living system

This chapter provides up-to-date structural and conceptional bases of the matter with special emphasis on the biological – partly ordered – systems.

4. 1. 3. Optical and ionizing radiations; biological effects and applications

This chapter deals with the physical basis of the interaction between radiation and the living matter with special emphasis on molecular interpretation. The bases of numerous modern measuring-technical, diagnostic and therapeutical methods are discussed. This knowledge serves as physical basis of presently used and future techniques in large diagnostic and therapeutic centers.

4. 1. 4. Methods of biological structure analysis

The principles of the most important methods and the information obtained by them is dealt with. This is a continuously developing chapter since almost all physical methods – even the newer ones, rapidly increasing in number – have a possible medical application.

4. 1. 5. Thermodynamic basis of life-processes; transport processes

Starting from general laws this chapter aims to give foundations for the study of macroscopic and microscopic transport phenomena playing an important role in physiologic and pathologic processes.

4. 1. 6. Medical signal processing, bioelectronics

Due to the development of microelectronics, an ever increasing number of electronic devices is used in medical practice for diagnostic and therapeutic purposes. The basis concepts of the medical techniques are presented.

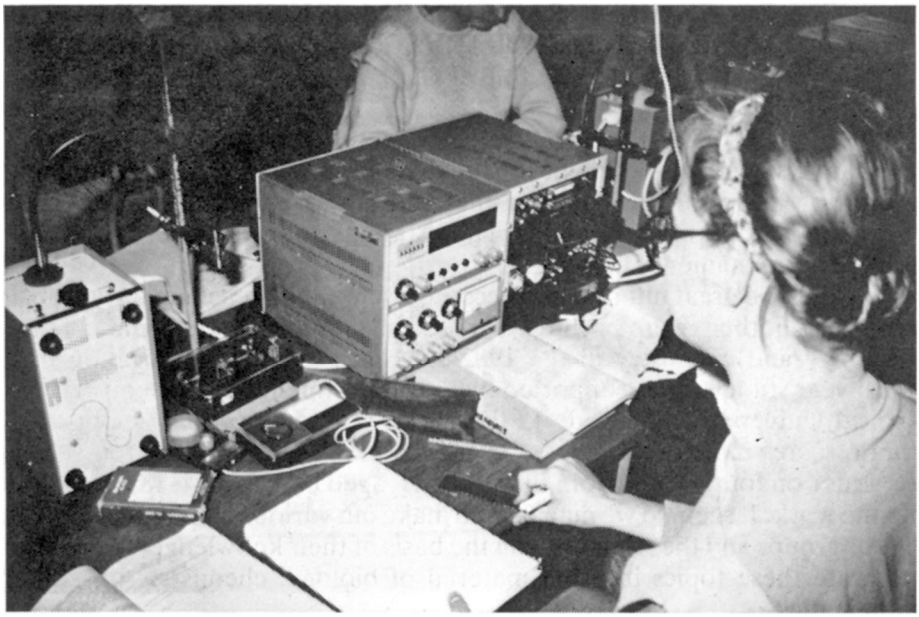
4. 1. 7. The biophysical basis of excitation processes

A few simple bioelectric phenomena are discussed based on non-equilibrium thermodynamics and bioelectronics, in accordance with the special characteristics of the partially organized systems; at the same time this gives a good example for the exact discussion of biological phenomena.

This knowledge helps to understand physiologic and pathophysiologic excitatory processes, as weel as their relationships with informatics.

4. 2. Laboratory practices

In the majority of the practices the students carry out the experiments and the evaluation of the measured data in protocols individually. There are a few measurements where, – having only one special device (e.g. X-ray apparatus, EKG, dosimeters, . . .) –, the whole group works together led by the tutor. Some medically interesting, unique student experiments were developed by the staff on the Institute of Biophysics, e.g. the model of CT scan or the electric model of the vascular system. Only thematic groups of the practical experiments are listed below:



Medical students experimenting on the model of sensory function in the Institute of Biophysics (SOTE), Budapest

- Medical dataprocessing
- Optical methods of structure analysis
- Ionizing radiation, dosimetry
- Physical basis of the biological effect of the electric current; medical signal processing
- Biological processes, sensations

We have a textbook and a laboratory manual in three languages to give help to the students in their studies. Textbook: „An Introduction to Biophysics", edited by G. Rontó and I. Tarján (7th revised and enlarged edition, 1991) „Laboratory Manual of Biophysics" compiled by the staff of the Institute of Biophysics (director: prof. G. Rontó).

GYÖRGYI RONTÓ
Professor

TEACHING BIOPHYSICS IN RADNÓTI MIKLÓS KÍSÉRLETI GIMNÁZIUM (THE EXPERIMENTAL SECONDARY SCHOOL „RADNÓTI MIKLÓS") IN SZEGED

Biophysics was first taught in study circles in our grammar school in the autumn of 1981. In the first year the course was launched for third grade students. The topics were stimulus manifestations, the biophysics of perception and the biomechanics of muscles.

Taking the great interest into account, we went on teaching the group and organized another group of third year students, taught by Béla Gál, a teacher of biology and chemistry in the 1982/83 school-year. The education of the fourth year students was supported by the Department of Biochemistry of the Medical University of Szeged. At that time this group was also supported by other research institutions of the Academy and other universities too.

Later on four groups from the students, aged between 14–18, were drawn into the work. It seemed we managed to make out various biophysical topics for all four groups and the students – on the basis of their knowledge – were also to intergrate these topics into the material of biology, chemistry, physics and mathematics.

In the 1985/86 school-year an experimental special biophysics class was launched for 18 students. Teaching of this subject has been going on ever since. After taking a successful entrance exam, 10–16 students can get into this section from all over the country every year. The textbook for students was written by Béla Gál and Dr. Gábor Németh. Expert opinions on the book were given by Dr. József Tigyi, Dr. Lajos Keszthelyi, members of the Hungarian Academy of Sciences and by Dr. Attila Török assistant professor. Biofizika (Biophysics) by Szalai-Ringler is also used as supplementary material.

Béla Gál, the teacher of Radnóti Miklós Kísérleti Gimnázium, has taught biophysics since the very beginning. He did research in the subject in question with an academic scholarship. Dr. Gábor Németh, who took up the work later, had done research for about two decades in the Medical Biology Institute of the Medical University of Szeged.

In the first year mainly methodology is taught as weel as how to use biophysical equipment, such as microscopes and electronmicroscopes. Students learn about the light- and electronmicroscopic structures of the cell, isolation of the ingredients of the cell, centrifugation, gel filtration with special regard to macro-molecules.

The material in the second year contains the mechanism of respiration, the biophysical problems of heart and circulation and the biophysical interpretation of muscular functions. Students also get acquainted with the terminology of biometrics this year.

The material of the third year deals with the biophysics of senses. Starting out from the phenomena of membrane stimulus, the students learn about the biophysical aspects of eyesight, hearing, skin and chemical perception. The subject matter is brought to completion by a lot of practice. The material in the

fourth form is about the problems of energy conversion of living beings. It also deals with ATP production in general connection with the effectivness of the thermodynamic laws in living organs. The material also in volves ATP production of Halobacterium, the photosysthetic pigments and the mitocondria according to the Mitschell chemiozmic conception.

For two years the first and second year materials have been taught together in the second form. Our results have proved that on the basis of the country-wide selection and entrance exams, the most talented and diligent students could get into the special biophysics class. Three classes have taken school-leaving exams since biophysics was introduced and there were only three students who couldn't get into the university right after finishing their secondary education. But they all continued their studies at the university a year leter.

It is also worth mentioning that there are 2–3 third or fourth graders – specialized in biophysics – among the first ten of the National Biology Competition for Secondary School Students.

When introducing biophysics, our aim was to give modern, dynamic, scientific knowledge and conception to our students. It's getting more and more important to prepare our students suitable for higher education. Although it is possible to get into universities from any other secondary school, the way we prepare our students is not indifferent.

With bulding biophysics into the curriculum, we would like to give our students basic biophysical knowledge already in secondary education, so that we could make it easier for them to continue their studies in higher education. We also do our best to poularize teaching biophysics in Hungary on the basis of experiences abroad.

GÁBOR NÉMETH

TEXTBOOKS BY HUNGARIAN BIOPHYSICISTS FOR UNDERGRADUATED COURSES

The books listed below cover a wide range of topics of interest to students and research workers in biological and medical sciences studying biophysics. They provide basic concepts of mathematics and physics, current techniques and applications.

Ernst, E.:	Biophysics of the Striated Muscle Akadémiai Kiadó Budapest, 1963 (first impression in German: 1958)
Ernst, E.:	Inroduction to Biophysics Akadémiai Kiadó Budapest, 1968 (in Hungarian)
Ernst, E.:	Biophysics (second, extended edition) Akadémiai Kiadó Budapest, 1977 (in Hungarian) (first impression: 1974)
Tarján, I.:	Physics for physicians and biologists Medicina Kiadó Budapest, 1964 (in Hungarian)
Tarján, I. (editor):	Introduction to Biophysics Medicina Kiadó Budapest, 1977 (in Hungarian)

Szalay, L., Damjanovich, S. (editors): Luminescence in Biology and Medicine
Akadémiai Kiadó
Budapest, 1983
(in Hungarian)

Szalay, L., Ringler, A.: Biophysics
Tankönyvkiadó
Budapest, 1985
(in Hungarian)

Tarján, I., Rontó, G. (editors): An Introduction to Biophysics
Medicina Kiadó
Budapest, 1987
(in Hungarian)

Rontó, G., Tarján, I.: An Introduction to Biophysics with Medical Orientation
(second, revised and enlarged edition)
Akadémiai Kiadó
Budapest, 1991
(firs impression: 1987)

JÓZSEF BELÁGYI
Professor

The address of the Society:

HUNGARIAN
BIOPHYSICAL SOCIETY
(MAGYAR BIOFIZIKAI TÁRSASÁG)

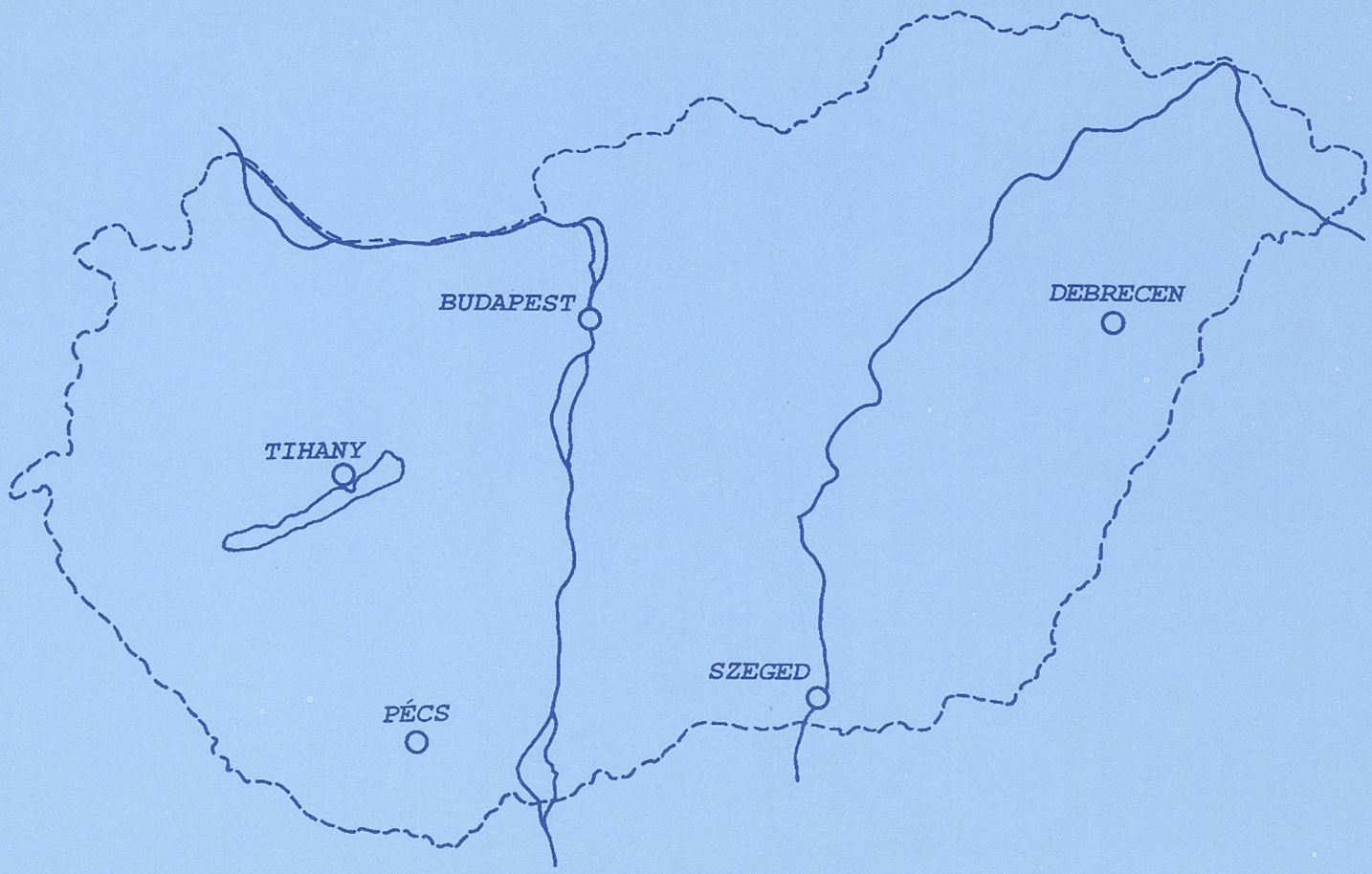
P.O. BOX. 433.
H—1371 Budapest
HUNGARY

Executive Secretary: Mrs. Magdolna Pusztai
Budapest II., Fő u. 68. II/212.

Phone/Fax: (36)-(1)-202-1216

CONTENTS

Felelős kiadó: dr. Keszthelyi Lajos, a MBFT elnöke
Printed in Hungary
by Pécsi Nyomda Rt. (93-809), PÉCS – 1993.
Felelős vezető: dr. Farkas Gábor vezérigazgató


BUDAPEST
DEBRECEN
TIHANY
SZEGED
PÉCS