

AWARD OF MEDALS

The Eighty-second Annual Award of Medals was held on Monday, June 8, 1992, at 10:30 a.m., in the presence of Their Majesties the Emperor and Empress.

The function was opened with an address by the President, in which he made a brief statement of each award. This year, the third presentation of the Duke of Edinburgh Prize for the Japan Academy also took place at the same time.

The Medals and Prizes were presented to the following recipients.

Imperial Prize and Academy Prize to Chushichi TSUZUKI
for "A Study of Socialist Thoughts and Movements in the Latter-half of the 19th Century in Britain"

Imperial Prize and Academy Prize to Tadimitsu KISHIMOTO
for "Studies on Interleukin 6"

Academy Prize to Koichi BAI
for "Studies on Medical Jurisprudence"

Academy Prize to Eizi HIROTA
for "Precise Molecular Structure and Dynamical Behaviors of Free Radical Molecules"

Academy Prize to Syozo OSAWA
for "Discovery of Atypical Genetic Coding Systems and Elucidation of Their Underlying Evolutionary Mechanisms"

Academy Prize to Hideji SUZUKI
for "Dislocation Theory of Plastic Deformation and Mechanical Properties of Solid Helium"

Academy Prize to Kenichi HONDA
for "Study on the Photoelectrode Reactions"

Academy Prize to Akinori SUZUKI and Hironori ISHIZAKI
for "Chemistry and Molecular Biology of Brain-neuropeptides in *Bombyx mori*"

Academy Prize to Akira KOBATA
for "Studies on the Structures and Functions of the Sugar Chains of Glycoproteins"

The Duke of Edinburgh Prize to Nobukiyo TAKAHASHI
for "Research and Activities Related to Natural Forest Management and Natural Environment Preservation"

After this, congratulatory addresses were given by the Prime Minister and the Minister of Education, Science and Culture.

The function was closed at noon.

THE OUTLINES OF THE RECIPIENS' WORKS

Chushichi TSUZUKI

A Study of Socialist Thoughts and Movements
in the Latter-half of the 19th Century in Britain

Professor Tsuzuki's researches extending over thirty years under this title have resulted in the following four volumes successively edited in English.

1. H.M. Hyndman and British Socialism, Oxford University Press, 1961.
2. The Life of Eleanor Marx, 1855–1898; A Socialist Tragedy, Clarendon Press, Oxford, 1967.
3. Edward Carpenter, 1844–1929; Prophet of Human Fellowship, Cambridge University Press, 1980.
4. Tom Mann, 1856–1941, The Challenges of Labour, Clarendon Press, Oxford, 1991.

The last quarter of the 19th century was a time in Britain which saw a historical turnabout in social and labour movements under the influence of "the Great Depression." Trade unions, which had hitherto been organized mainly by skilled workers and strongly characterized as craft unions, were replaced by "new unions," or industrial unions, which began to be organized containing unskilled and halfskilled workers and to carry large-scale labour disputes one after another. Socialist movements, though they had been less enthusiastic than those of Germany or France, became suddenly active, adopting Marxism, anarchism and land-socialism from the continental countries and the U.S. At the same time, socialism peculiar to Britain began to be formed, as was seen in the organization of the Fabian Society on the one hand, and various socialist parties, from the Social Democratic Federation (1884), the first possible Marxist party, to the Labour Representation Committee (1900), the direct ancestor of the present Labour Party, on the other.

Professor Tsuzuki's series of work intend, through the detailed biographies of four representative persons, each of whom lead an active and influential life under these circumstances, to analyze the situation of complex social movements and thoughts in Britain at that time, thus

throwing light upon this historical turnabout. There are many researches which have analyzed the general conditions of that time or the developments of the movements of various organizations, taken as a whole or through their individual activities. However, the studies which have traced the historical process through the personalities and activities of those who took the leadership there have not been able to be found many even in Britain. There lies the originality of his researches.

The features which enhance their academic value will therefore be summarized into the following two points:

1. Letters, diaries, memoranda and other materials which have been scarcely made use of are widely sought out, and by the aid of those, the thought, the character and the behaviour of each of the four are examined even into the inside, thus their whole figures standing out in bold relief.

2. Not confined to their simple biographies, his researches go so far as to explain the influences exercised by each of their thoughts, characters and behaviours towards organizations and movements with which they had relations, throwing light upon the history of British socialism and labour from the viewpoint entirely new.

Thus he opened up, after long years of effort, a new field in the history of social thoughts and movements through his original method of biographical approach. Moreover, he has got a high estimation both in Britain and in Western countries as having made, foreigner as he is, a great contribution to the field of modern British social history.

Tadamitsu KISHIMOTO
Studies on Interleukin 6

Since the discovery of T cell and B cell interaction in the antibody response, molecules which mediate the helper function of T cells have been one of the central issues in immunology. Dr. Kishimoto discovered the molecule which induces the final differentiation of B cells into antibody producing cells and he cloned the cDNA encoding this molecule which is now known as interleukin 6 (IL-6). His studies on IL-6 revealed the process of growth and differentiation of B cells into plasma cells by antigenic stimulation.

Studies with recombinant IL-6 and anti-IL-6 antibody demonstrate that the function of IL-6 is not restricted to the B-lineage cells, but it shows a wide variety of biological functions on various tissues and cells, including immune, hematopoietic and neural systems. Particularly, IL-6 was shown to induce the production of various acute phase proteins in liver cells as hepatocyte stimulating factor. It was also shown to act on megakaryocytes and to induce an increase in platelets.

Abnormal constitutive production of IL-6 was found to be involved in various diseases, such as multiple myeloma, rheumatoid arthritis, Castleman's disease, cardiac myxoma, mesangium proliferative glomerulonephritis and AIDS-related Kaposi's sarcoma. In transgenic mice bearing the human IL-6 gene, generation of monoclonal plasmacytomas was demonstrated, confirming the involvement of IL-6 in myelomas and plasmacytomas.

In order to understand the functional pleiotropy and redundancy of cytokines including IL-6, Dr. Kishimoto cloned the cDNA of IL-6 receptor and revealed the unique organization of the IL-6 receptor system. It consists of two polypeptide chains, a ligand binding receptor molecule (IL-6R) and a signal transducer (gp130). The binding of IL-6 with IL-6R triggers the association of a signal transducer, gp130 and the signal is transduced through gp130. This unique receptor system, which was originally discovered in the IL-6 receptor system, has later been shown to apply to other cytokine receptor systems, such as GM-CSF (colony stimulating factor) and NGF (nerve growth factor). The discovery that the same signal transducer can be utilized by several different cytokine receptors could explain the functional redundancy of cytokines.

Dr. Kishimoto identified a nuclear factor responsible for the regulation of the IL-6 gene expression and cloned its cDNA (NF-IL6). He found that NF-IL6 was involved not only in the IL-6 expression but also in the regulation of the IL-6 inducible genes such as acute phase proteins in liver cells. The discovery of IL-6 and NF-IL6 revealed the molecular mechanisms of the acute phase reaction in inflammation.

In summary, Dr. Kishimoto characterized molecularly IL-6, IL-6R, the signal transducer gp130 and NF-IL6 and on the basis of these informations, he revealed the mechanisms of antibody production, acute phase reaction and the functional redundancy and pleiotropy of cytokines. Moreover, his studies provide the clues to the pathogenesis of several diseases, such as multiple myeloma and autoimmune diseases.

Koichi BAI

Studies on Medical Jurisprudence

Professor Koichi Bai has explored a new field of jurisprudence by analyzing various legal aspects of medicine in the following four books: Book ① "Medical Law" [Iwanami Shoten, 1970], Book ② "Legal and Policy Aspects of Organ Transplants and Brain Death—25 Years' Experience in Great Britain" [Iwanami Shoten, 1988], Book ③ "Studying Brain Death" [Nihon Hyoronsha, 1989], and Book ④ "Law and Ethics of Foregoing Life-Sustaining Treatment" [Yuhikaku, 1990].

I. Book ① systematizes the study of medico-legal problems from three different points of views, philosophical, litigious and institutional.

The First Chapter introduces the concept of “informed consent” to Japan for the first time, based on German judicial precedents and theories. In the 1960’s the concept attracted increasing attention in the United States, Germany and elsewhere. It means that the patient’s consent is a necessary condition for the legality of any medical act and that such consent is effective only when the patient is adequately informed by the physician as to the nature, effectiveness, and possible side effects of, and alternatives to such an act. This concept establishes the sovereignty of patients in their relations with physicians, and challenges the traditional paternalism of physicians in the medical community. Moreover, the author attempts to introduce to Japan a new idea of human rights—the right of self-determination of patients based on their physical integrity.

The Second Chapter addresses legal control over medicine. It analyzes judicial precedents on medical malpractice in light of the physician’s “duty of care.” It refers to the deterrent impact of law, in the form of negligence lawsuits (especially blood transfusion cases), on future medical practice.

The Third Chapter discusses the Japanese system of medical service. It points out legal problems concerning persons engaged in medical service and medical institutions. It explains details of the Emergency Service (managed by fire departments), and calls attention to contradictions and defects caused by the duality of the medical system and transportation system.

II. Book ②, Book ③, and Book ④ discuss legal issues involved in the last stage of human life, which have been brought on by two advanced technologies: life support apparatus and organ transplants.

There are two approaches to the issues: namely, whether or not to change the concept of death (A approach); and whether to allow terminally ill patients to refuse life-sustaining treatment (B approach). These two approaches are correlated but should be kept separate and distinct as legal issues. Book ③ discusses Approach A and Book ④ discusses Approach B, based on a number of judicial precedents, legislation and reports of various committees in the United States.

Book ③ focusses on the relation between the biological=medical concept of death and social=legal concept of death. It discusses two obstacles to accepting brain death as death of an individual: technical reliability and social acceptability. It presents theories which are useful to resolve whether brain death should be accepted in this country.

Book ④ examines the interrelation of three factors which must be considered in deciding whether or not to forego life-sustaining treatment: the patient’s right to refuse medical treatment, the physician’s duty to extend a patient’s life as long as possible, and the generally accepted idea of respect for life.

Book ② describes the legal developments in Great Britain in organ transplants during the 25 year period of 1961 to 1985, specifically exploring the relation between the dysfunction of an organ and the death of an individual. The approach of British society with its emphasis on regulation by professional code rather than by statute, is quite unique and interesting.

III. In all the above publications the author pays considerable attention to the correlation between the patient's right of self-determination and the physician's autonomous norm of conduct. The author states that the intensity and methods of legal control over medical practice should be varied according to the type of treatment in question. He attempts to define the significance and limits of legal control over medical care without underestimating or overestimating its role, thereby laying the foundation for a systematic integration of medical law.

The author's study is quite original and unique in Japan. No one else has attempted such a study or conducted such a thorough examination of Japanese and foreign legislative history, judicial precedents, academic studies, government documents, and public opinion surveys. The author is highly regarded not only in the field of legal studies but also in other fields of learning, such as medicine and life-ethics, for his role as a pioneer in the development of medical law.

Eizi HIROTA

Precise Molecular Structure and Dynamical Behaviors
of Free Radical Molecules

Free radicals are characterized by involving unpaired electron(s) which lend these molecular species high chemical activities and shorten their lifetimes. They play important roles as intermediates in many chemical reactions. Thus it was a long standing problem to determine the structure of free radicals precisely. Its solution has long been waited in order to analyze the mechanisms of chemical reactions in detail as well as to develop new areas in the theory of molecular structure and valence bond. Various difficulties prevented spectroscopic methods employed for determining the precise structure of chemically stable molecules such as microwave and infrared spectroscopy from being readily applied to the study of free radicals of short lifetimes.

Eizi Hirota is a pioneer in microwave spectroscopic study of free radicals; in 1967 he succeeded in detecting microwave spectra of SO and subsequently of ClO, NS, BrO, NCO, SF, and others, by which he determined their molecular structures precisely and unveiled characteristic behaviors of these species mainly caused by unpaired electrons. His success was based upon the followings: (1) efficient production of free radicals was realized by selection of proper precursors and by electrical discharge in

them, (2) the sensitivity of microwave spectroscopy was very much improved by extending the working frequency region to shorter wave and by developing a suitable modulation method using a computer, and (3) an analytical method was developed to analyze the spectra of free radicals.

Hirota paid attention also to infrared spectroscopy which has been known to be complementary to microwave spectroscopy; he developed a new spectroscopic method using infrared diode lasers as light sources and made it as powerful as microwave spectroscopy for free radical studies. Furthermore, by introducing the time axis in these high-resolution spectroscopic methods, he made it possible to carry out dynamical observations maintaining the frequency or wavenumber resolution high. He has investigated more than 100 free radicals using these methods, important free radicals such as methyl CH_3 , vinyl CH_2CH , vinoxy CH_2CHO , ketylenyl HCCO , and silyl SiH_3 being included. Particularly significant is that the structures of these species have been precisely determined and their properties such as the unique potential surfaces in the ground electronic state have been unveiled. Hirota made an outstanding contribution to elucidating the mechanisms of reactions in which these species participate, by monitoring them in real time through their high-resolution spectra. For example, he investigated chemical reactions of fundamental importance such as the oxidation reaction of ethylene and the photodissociation reaction of methyl iodide by measuring and analyzing the quantum-state distributions of resulted free radicals and showed the hitherto accepted views to be completely in error.

Hirota's contribution concerns the fundamentals of molecular science, and thus gives impact directly or indirectly to many areas related to molecular science. For example, recent remarkable progress in detecting interstellar molecules at Nobeyama Radio Observatory owes at least partly to Hirota's laboratory studies of free radicals. Also in manufacturing high performance Si films in semiconductor industry, reference has often been made to Hirota's finding that SiH_3 is a far more important intermediate than SiH_2 .

To summarize, Eizi Hirota has succeeded in establishing high-resolution microwave and infrared spectroscopic methods to study short-lived free radicals, by which he achieved the precise structures of these species, hitherto most difficult to obtain, and clarified their behaviors in detail. In this way he has developed a new area between two main branches of chemistry, structural chemistry and chemical reaction, and has given strong impact to many related fields; his achievements have been highly appreciated not only in our country but also internationally.

Syozo OSAWA

Discovery of Atypical Genetic Coding Systems
and Elucidation of Their Underlying Evolutionary Mechanisms

The decipherment of the genetic code is one of the most important contributions that molecular genetics has made to modern biology. This was accomplished around 1966. Since then scientists regarded this coding system as common over all organisms on the earth (Therefore termed "universal genetic code"). In 1979, a few exceptional coding systems were found in the mitochondrion. However, such deviations were considered unimportant, because only small number of proteins are encoded in mitochondria, and evolutionary changes in this organelle could be tolerated without much difficulty.

In 1985, Osawa and his associates found that in the bacterium, *Mycoplasma capricolum*, the codon UGA, a "stop codon" in the universal coding system, codes for the amino-acid, tryptophan. This discovery attracted much attention worldwide in the field of molecular evolution, since this is the first time that a non-universal code was discovered in the genome controlling the entire bacterial cell. Furthermore, they carried out detailed investigation on the molecular structure of the genes of the transfer RNA (t-RNA) involved. This research revealed that the code change occurred under AT-biased mutation pressure (A=adenine, T=thymine), accompanied by duplication of the gene involved. The underlying evolutionary process can most readily be explained by the neutral theory of molecular evolution.

In contrast to *Mycoplasma*, which is extremely low in G+C content (G=guanine, C=cytosine), the bacterium *Micrococcus luteus* is very high in G+C content. Osawa and his associates found that in *M. luteus*, the codon GUG is frequently used as the initiation codon instead of AUG, which is the initiation codon in the universal coding system. Another important finding is the existence of unassigned codons, such as CGG in *Mycoplasma*, AGA and AUA in *Micrococcus*, suggesting intermediate stages of neutral evolutionary change of the genetic code under biased mutation pressure. Osawa and his group further studied the nonuniversal codes in eukaryotes and found that in planarian mitochondria, UAA, the universal stop codon, codes for tyrosine, and that a specific tRNA species plays a role in the change of assignment of codon CUG from leucine to serine in one of the *Candida* yeast lines. In collaboration with his associates, Osawa conducted important research on the phylogeny of organisms based on the 5S ribosomal RNA sequences. They have constructed a phylogenetic tree covering whole organismic kingdoms by using 5S ribosomal RNA sequences from more than 350 organisms. Of particular importance is the finding that "Archaeobacteria," previously accepted as the most ancient group of organisms, are not

that old but more recent, namely, they appeared much later than eubacteria, and are evolutionarily much closer to eukaryotes than eubacteria. Osawa also did pioneering work on molecular biology of ribosomes. He is a biologist in the field of experimental molecular evolution of whom Japanese biologists can proud.

Hideji SUZUKI

Dislocation Theory of Plastic Deformation
and Mechanical Properties of Solid Helium

Helium(He) solidifies at very low temperatures above the pressures of 25 atm, and the crystal structures of solid He are, like usual metals, face-centered cubic(fcc), body-centered cubic(bcc) and hexagonal close-packed(hcp) crystals depending on temperatures and pressures. Professor H. Suzuki was the first who systematically established the crystal defect mechanism, especially, the crystal dislocation mechanism of the plastic deformation and, thus, of the mechanical properties of solid He through his extensive and intensive research works.

First of all, the typical plastic deformation behavior, namely the stress strain relationships of solid He must be mentioned. This kind of measurements of solid He above 25 atm at very low temperatures can not be made using conventional experimental apparatus. Therefore, Professor Suzuki constructed a specially designed apparatus, by means of which he could obtain variety of stress strain curves with various different parameters such as temperatures, shear strain rates, initial dislocation densities and so on. He obtained always sharp and large yield drops which were analyzed quantitatively together with the above mentioned parameters following the well established Gilman-Johnston theory. From the analyses of the results he could definitely conclude that the plastic deformation proceeds and mechanical properties are explained by the dislocation mechanism in solid He.

Professor Suzuki made many additional experiments such as the sound velocity measurements, the ultrasonic attenuation in solid He, and the temperature dependence of pressures in solid He of constant volumes. The results of these experiments confirmed the dislocation mechanism strongly, and sometimes including the mechanism due to point lattice defects such as vacancies in solid He.

Professor Suzuki discovered the following two quantum mechanical effects in solid He. One is the difference of zero point vibrational amplitudes of different isotopes of He, as a result of which He-3 atoms interact with dislocations in solid hcp He-4 as if He-3 atoms were larger in size. The other is the quantum mechanical tunneling of a screw dislocation through a Peierls

potential barrier of a bcc He-3 crystal. This reduces the stress required to move the screw dislocation by a factor of 6, which is surprisingly large.

Now additional few words must be mentioned as to Professor Suzuki's works concerned with dislocations in metals. He published many research works in the field of lattice defects in metals. Here, one series of researches will be mentioned. This is closely related with the quantum mechanical tunneling of screw dislocations in the bcc He crystal mentioned above. He proposed a model of screw dislocation core in bcc metals, in which one can make computations of atomic configurations around the screw dislocation and the dynamic behaviors of the screw dislocation. Many researchers in the world followed him or improved his model creating an active field of researches of model computations of screw dislocations.

In conclusion Professor Hideji Suzuki made a distinguished contribution in the field of dislocation theory of solid He, which in turn contributes to the whole field of crystal lattice defects of all the crystalline materials. This is important also in the materials industries, because nowadays the dislocation or lattice defect viewpoint is one of the indispensable requisites for the development of new crystalline materials.

Kenichi HONDA

Study on the Photoelectrode Reactions

Conventional electrochemistry has thus far dealt mainly with systems in the ground state and little attention has been paid to systems in the excited state. An electrode reaction is concerned with the electron transfer across the interface (solid electrode—electrolyte solution) where both solid and liquid phases can take the electronically excited state upon irradiation. It is expected that the electrode reaction in the excited state will show an entirely different behavior from that in the ground state.

Based upon the above concept, Dr. Kenichi Honda started during the 1960's the pioneering research work on electrode reactions where the excited state took part. The most important achievement of this work was his discovery of electrochemical photolysis of water into hydrogen and oxygen by irradiating a semiconductor electrode with light in the visible wavelength region. This work opened the way for converting light energy into chemical energy. It provided a profound impact to the field of chemistry and gave rise to the world-wide trend toward the interdisciplinary areas of the photoelectrochemistry and the photocatalysis. His works are briefly described in the following:

I. Photoelectrochemical reactions with semiconductor electrodes

In 1968, it was discovered that oxygen evolved on a n-TiO₂ electrode surface by the oxidation of water by irradiating the surface with blue light

and not through the application of an external potential. By constituting an electrochemical cell with combining a Pt electrode, the electrochemical decomposition of water with oxygen on the irradiated TiO_2 and hydrogen on Pt respectively was achieved without any electric energy. The mechanism of this process is explained as follows. With semiconductor electrodes in the ground state, only the majority carriers take part in the electrode reactions. However in the excited state, the carriers generated by light absorption are involved in the reactions. The potential energy difference of these two kinds of carriers corresponds to the band gap energy of the semiconductor. Consequently the photoelectrode reaction proceeds as if the electric potential is applied to the electrode. The thermodynamic decomposition potential of water is 1.23 eV and the band gap of n- TiO_2 is 3.0 eV. Hence, the photohole generated in the valence band has enough energy to attract an electron from OH^- or water molecule to form oxygen. This work attracted much attention as a new process of water decomposition and very intensive research works on the light energy conversion based on the principle of the present work have been undertaken in the world. Besides TiO_2 , Dr. Honda studied also a variety of semiconductors such as ZnO, CdS, GaAs, MoS_2 , and SrTiO_3 to improve the conversion efficiency and stability of the electrode.

II. Photocatalytic reactions based on the photoelectrochemical process

One of the interesting applications of the photoelectrochemistry is photocatalytic process using dispersed semiconductor particles. Dr. Honda explored the photocatalytic reduction of CO_2 to form organic fuels such as methanol using TiO_2 and CdS particles. This work is expected to be applied to the future artificial carbon cycle.

III. Photoelectrochemical simulation of the primary stage of photosynthesis.

The photoelectrochemical decomposition of water can be considered to correspond to the artificial model of the primary stage of the photosynthesis. Dr. Honda prepared a Chl-sensitized photoelectrode by coating the semiconductor with Chl-containing LB films. This photoelectrode gave a very high quantum yield of conversion and served to elucidate the primary stage of photosynthesis.

In conclusion, Dr. Honda established the new interdisciplinary field of the photoelectrochemistry through which the important application of the light energy conversion is developing.

Akinori SUZUKI and Hironori ISHIZAKI
Chemistry and Molecular Biology of Brain-neuropeptides
in *Bombyx mori*

The life cycle of an insect is characterized by molting and metamorphosis during growth and development. In 1922, Kopeć suggested that the insect brain secretes a substance (or substances) responsible for initiating these processes. Later, the presence of a causative agent of peptidyl nature was confirmed. The agent, which was named prothoracicotropic hormone, induces the release of the molting hormone (ecdysone) from the prothoracic glands. Until recently, however, the agent had not been chemically identified due to its existence in extremely small quantities in insects and the resulting difficulty of its isolation.

In 1970, Suzuki and Ishizaki started their joint research with an aim at isolating the prothoracicotropic hormone using *Bombyx* moth heads and succeeded in establishing an isolation procedure in 1987 after repeated trials. The procedure consists of sixteen steps of purification to yield several micrograms of the peptidyl object from 500,000 moth heads. However, when injected into a brainless *Bombyx* pupa, the hormone thus obtained elicits adult development even at a dose of 0.1–0.2 ng/pupa. Remarkably, it was inactive in other kinds of insects tested, suggesting the possibility of species specificity in the action of prothoracicotropic hormone.

Through amino acid sequencing and cDNA analysis, the primary structure of *Bombyx* prothoracicotropic hormone was ultimately established. The compound was found to have a homodimeric structure, each subunit being composed of 109 amino acid residues. The mode of disulfide bonding in the molecule was also elucidated. Thus, about 70 years after Kopeć's pioneering suggestion, the entire picture of one of the insect prothoracicotropic hormones has been given.

During the course of this study, Suzuki and Ishizaki also isolated a bioactive peptide from *Bombyx* moth heads and termed it bombyxin. This compound showed prothoracicotropic hormone activity on *Samia cynthia ricini* but not on *Bombyx*. Surprisingly, the primary structure of bombyxin was found to be quite similar to those of insulins in vertebrates. This work is the first example of isolation from an invertebrate of a peptide belonging to the insulin superfamily, and is noteworthy from the viewpoint of molecular evolution.

In addition, the following three neuropeptides were isolated and structurally determined: an eclosion hormone which elicits the adult emergence from *Bombyx* pupa in cocoons; a pheromone biosynthesis activating peptide that stimulates the production of the sex pheromone (bombykol) in *Bombyx* male moths; and an adipokinetic hormone which

promotes the transfer of lipids from the fat bodies into body fluid in *Bombyx* moths.

Thus, the joint work by Suzuki and Ishizaki has opened a new area of research in entomology and contributed to the reconstruction of insect physiology on the molecular level.

Akira KOBATA

Studies on the Structures and Functions of the Sugar Chains
of Glycoproteins

Dr. Kobata has developed a series of sensitive methods and established the way to investigate the structures of *N*-linked sugar chains. By using the methods, he elucidated the structures of the *N*-linked sugar chains of more than a hundred glycoproteins. Findings of new "hybrid type" subgroup, pentaantennary complex type sugar chains, and a common heptasaccharide core in high mannose type sugar chains are some of the important results obtained by these studies.

Comparative studies of the sugar chains of γ -glutamyltranspeptidases purified from various organs of several mammals led him to propose for the first time the occurrence of organ and species specificities in the structures of *N*-linked sugar chains.

Dr. Kobata studied the structures of oligosaccharides excreted in the urine of patients with exoglycosidase deficiencies. Through these studies, the whole feature of the catabolism of glycoproteins including the role of an endo- β -*N*-acetylglucosaminidase was elucidated. Mammalian endo- β -*N*-acetylglucosaminidase is different from microbial enzymes in that it cleaves both high mannose type and complex type *N*-linked sugar chains. The enzyme, however, cannot act on the sugar chains, in which the proximal *N*-acetylglucosamine residue is substituted by a fucose. The substrate specificity of the enzyme explains why large amounts of glycopeptides are excreted in the urine of patients with fucosidosis. Studies of GM1-gangliosidosis revealed the biochemical basis of the difference of Type 1 and Type 2 subgroups of this congenital disease.

Altered glycosylation of glycoconjugates in tumor cells is one of the important target of cancer research. Dr. Kobata has been energetically involved in this field. Studies on the serum transferrin of patients with hepatoma, and human chorionic gonadotropin of trophoblastic diseases were counted as the most fruitful series of his studies. Furthermore, he elucidated the molecular and enzymatic bases of Warren-Glick phenomenon, which is now expected to correlate with the metastatic potential of tumor cells. He recently elucidated the whole sugar chain structures of carcinoembryonic antigen and its normal counterpart: NCA-2. Structural difference found in these antigens will improve the diagnostic value of this well known

tumor marker. Together with these studies, his another series of investigation on the function and pathology of the sugar chains of immunoglobulin G are considered very important contribution, because they opened a new research field: glycopathology.

In order to elucidate the functional roles of the *N*-linked sugar chains of glycoproteins, Dr. Kobata has been investigating the sugar chains of many glycoproteins with biological activities such as blood coagulation factors, complements, cell adhesive glycoproteins, hormones and growth factors, etc. Among them, two projects which have given very productive results are “the role of *N*-linked sugar chains in hormonal action of human chorionic gonadotropin” and “the relationship between *N*-linked sugar structures and biological activities of recombinant human erythropoietins,” which indicated that the functional role of sugar chains resides in *N*-linked ones and the outer chain moieties of the complex type sugar chains are important for the expression of the hormonal activities *in vivo*.

As depicted above, contribution of Dr. Kobata in the research of the *N*-linked sugar chains of glycoproteins covers almost all area related to them. The structural information reported by his studies has been always reliable and merit organic chemists to design their target of synthesis. It is not too much to say that he should be called as “Sugar Daddy.”

Nobukiyo TAKAHASHI

Research and Activities Related to Natural Forest Management and Natural Environment Preservation

Upon completing his studies in the Department of Forestry, Faculty of Agriculture, Nobukiyo Takahashi graduated from the University of Tokyo in 1937. For the next 36 years, he conducted experiments on forest management in the Tokyo University Forest in Hokkaido. These forests cover 23,000 hectares and comprise a variety of conifers and broad leaved trees belonging to cool temperate and boreal coniferous forest types. The results of his research were compiled in *Method of Natural Forest Management—Theory and Practice*, published in 1971.

This management method is now well known and, in natural forests, provides specific techniques for managing a spectrum of forest types. The theoretical basis of this management method—forest ecology—enhances environmental and social benefits and improves economic benefits, e.g., timber. It permits the coexistence and reproduction of a diversity of flora and fauna, and preserves genetic resources.

The Tokyo University Forest in Hokkaido is a rare example of a forest managed in the manner noted above and is largely the result of Professor Takahashi's research programme. This management system is highly regarded by researchers in Japan and throughout the world as a model for

the twenty-first century. Professor Takahashi has received many prizes in Japan for his work.

In addition to conducting research in management methods, and in the preservation of genetic resources, Professor Takahashi concurrently established a gene bank of circumboreal species of trees and shrubs. This collection, initiated in 1952, is highly regarded and recognized as the largest genetic resource collection in Japan. It has been used by researchers in Japan, North America and Europe.

Professor Takahashi also understood early on the importance of a genetic resource conservation and set aside 1,300 hectares of natural forest with altitudinally varying environmental conditions. Data collected from this forest are now crucial to natural forest research.

Professor Takahashi has succeeded in producing an aesthetically pleasing Tokyo University Forest in Hokkaido which he wishes to bequeath to succeeding generations. In celebration of the Centennial of Hokkaido in 1968, he planned the creation of a monument from which there is a splendid view of 11,000 hectares of Ezo-spruce, Todo-fir and broad-leaved forests with remote areas dedicated to the preservation of birds and animals. This forest is reminiscent of Hokkaido's primeval forests, and was selected by the Asahi Newspaper Company and the Forestry Culture Society as one of the one hundred natural sites which should be preserved for the twenty-first century. It is a popular site visited by many people.

In June-July 1991, Professor Takahashi travelled to Germany and Czechoslovakia with colleagues from the University of Tokyo to investigate acid rain and forest die-back. This trip is reported in a December 1991 publication which describes management methods and requisite policies for environmental preservation.

Reflecting his strong belief in the importance of public interest in forestry matters, Professor Takahashi has produced two films that show the results of his forest management research. These films named "Jukai" have won many prizes from organizations, such as, the Ministry of Education's Scientific and Technical Film Festival, Tokyo Metropolitan Educational Film Festival, and Educational Film Competition, and have been widely acclaimed.

Professor Takahashi has recently given lectures and taught urbanites about the forest world, emphasizing the importance and necessity of maintaining the environment and loving nature. His lectures have been collected and published, including the titles, *Mr. Dirty Turtle and His Friends* and *The Poems of Mr. Dirty Turtle*.

Professor Takahashi continues to pursue development of forest management in Hokkaido and to increase the level of knowledge and competence of both public and private foresters. He remains an honoured and senior member of many forestry organizations, including the Hokkaido Tree Breeding Association, Hokkaido Forest Council and Northern Forestry Corporation.

PROCEEDINGS AT THE 860TH GENERAL MEETING

The 860th General Meeting of the Academy was held on Tuesday, June 9, 1992, at 1:00 p.m., Dr. Yoshitaro WAKIMURA, President, taking the chair. Eighty members were present, and the following communications were made:

- Decision-Making process in Japan for the Pacific War; Reexamined after 50 years. Chihiro HOSOYA, M. J. A.
- Der Streit um die Bedeutung der deutschen Kaiserpolitik im Mittelalter Shiro MASUDA, M. J. A.
- On the universality of Baum-Fulton-MacPherson's Riemann-Roch for singular varieties. Shoji YOKURA
Communicated by Kunihiko KODAIRA, M. J. A.
- Closed regular curves and the fundamental form on the projective spaces Kōjun ABE
Communicated by Heisuke HIRONAKA, M. J. A.
- Retractive nil-extensions of regular semigroups. II. Stojan BOGDANOVIĆ and Miroslav ĆIRIĆ
- Some problems of diophantine approximation in the theory of the Riemann zeta function Akio FUJII
- Notes on some classical series associated with discrete subgroups of $U(1, n; \mathbf{C})$ on $\partial B^n \times \partial B^n \times \partial B^n$ Shigeyasu KAMIYA
- Generating functions for the spherical functions on some classical Gelfand pairs Shigeru WATANABE
- Families of rational maps and convergence basins of Newton's method Kiyoko NISHIZAWA and Masayo FUJIMURA
- The centralizer algebras of mixed tensor representations of $\mathcal{U}_q(\mathfrak{gl}_n)$ and the HOMFLY polynomial of links Masashi KOSUDA and Jun MURAKAMI
Above six, communicated by Shokichi IYANAGA, M. J. A.
- Measurement of thermal diffusivity at high pressures and high temperatures Tomoo KATSURA
Communicated by Syun-iti AKIMOTO, M. J. A.
- On properties of non-Carathéodory functions Mamoru NUNOKAWA
- Singular variation of non-linear eigenvalues Shin OZAWA
Above two, communicated by Kiyosi ITÔ, M. J. A.
- Epitaxial polymerization of polyester as studied by scanning tunneling microscopy Masahito SANO, Darryl Y. SASAKI, and Toyoki KUNITAKE
Communicated by Seizo OKAMURA, M. J. A.
- Essential role of extracellular Ca^{2+} for the maintenance of the Ca^{2+} activated K^+ channel activity in guinea pig vas deferens Izuo TSUTSUI, Kenichi KATO, and Shunichi YAMAGISHI
Communicated by Setsuro EBASHI, M. J. A.

After a recess during which the members present met in their respect Sections, the General Meeting was resumed for business transactions.

First, the President announced that Dr. Takeyoshi KAWASHIMA, M. J. A., had passed away on May 21, 1992. The members rose from their seats in silence, expressing profound sense of grief.

Next, Dr. Setsuro EBASHI, M. J. A., paid a tribute of admiration to the late Dr. Shigeo OKINAKA's meritorious services to academic circles.

Then, the chairmen of both Sections made reports of the matters dealt with at the respective Sectional Meetings.

After that, the President reported that the sixteenth meeting of the Japan Academy Public Lectures was opened to the public in the Academy Auditorium at 2:00 p.m. on Saturday, May 30, 1992, with Dr. Motoo KIMURA, M. J. A., and Dr. Sakae YAMAMURA, M.J.A., as speakers, whose respective subjects were:

“Recent Development of the Neutral Theory of Molecular Evolution.
—Existence of “Non-Darwinian” World in Evolution—”.

“New Electric Power Generations in the 21st Century”.

Then, the President reported that Dr. Naohide HIRATSUKA was elected Chairman of Section II.

Finally, it was reported on the result of election of half the members of the Administrative Committee, which had taken place at the Sectional Meetings. The Committee members elected are: Hajime NAKAMURA, Sueo IKEHARA, Mikio SUMIYA, Saburo NAGAKURA, Shunzo OKAMOTO, Masanao MATSUI, Setsuro EBASHI.

The Meeting was adjourned at 4:55 p.m.

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