AWARD OF MEDALS

The Seventy seventh Annual Award of Medals was held on Monday, June 8, 1987, at 10:30 a.m., in the presence of His Majesty the Emperor.

The function was opened with an address by the President, in which he made a brief statement of each award. Then the Medals and Prizes were presented to the respective recipients.

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

The function was closed at 11:05 a.m.

THE RECIPIENTS OF PRIZES AND THE SUBJECTS OF THEIR STUDIES

Toshio FUKUYAMA

"Historical Studies of Buddhist Monuments" and
"Historical Studies of Shinto Monuments"
(Complete Works of History of Japanese Architecture
by FUKUYAMA Toshio, Vols. I–IV)

"Historical Studies of Buddhist Monuments" consists of three volumes—namely, I, II and III of "Complete Works of History of Japanese Architecture by FUKUYAMA Toshio".

In vol. I, the author takes up the Buddhist temples, *Shitennoji* (四天王寺), *Horyuji* (法隆寺), *Yakushiji* (薬師寺), *Kofukuji* (興福寺), *Taimadera* (当麻寺), etc. as an object of his historical study. He elucidates, among others, the history of *Yakushiji* temple, ranging from its foundation to its removal to the capital, Heijyokyo, by way of careful examination of the documents concerned. As to *Horyuji* temple, he deals with the ornamental patterns applied to edifices, canopies, wall paintings, etc., tracing their original forms back to Egypt and Greek, and also pursuing their transformations undergone on their way to their destination via India, Central Asia and China, further referring to the mutual relationship of the patterns observed in *Horyuji* and *Yakushiji* temples.

In vol. II, the author deals with *Todaiji* (東大寺), *Hokkeji* (法華寺), *Toshodaiji* (唐招提寺), *Ishiyamadera* (石山寺), *Eizanji* (栄山寺), etc., and his attention is particularly paid to *Shakyojo* (写経所—the Buddhist scripture transcribers' workroom) which so often appear, bearing various names, in *Shosoin* (正倉院) documents. As a result

of his close investigation into the said documents, he has found out a new fact that these workrooms, appearing under different names, were the affiliated ones put under the control of *Todaiji* temple.

In vol. III, the author takes up *Enryakuji* (延暦寺), *Toji* (東寺), *Jingoji* (神護寺), *Kanshinji* (観心寺), *Ninnaji* (仁和寺), *Daigoji* (醍醐寺), *Hosshoji* (法性寺), *Hojoji* (法成寺), *Rokushoji* (六勝寺), *Chusonji* (中尊寺) belonging to Heian period, *Komyobuji* (光明峰寺) belonging to Kamakura period and *Higashi Honganji* (東本願寺) belonging to Edo period, for discussion.

In the "Historical Studies of Shinto Monuments", vol. IV of the "Complete Works", the author deals with the Shinto shrine architecture, that is, *Izumo Taisha* (出雲大社), *Sumiyoshi Taisha* (住吉大社), *Ise Jingu* (伊勢神宮), *Saiguryo* (斎宮寮), *Tsurugaoka Hachimangu* (鶴岡八幡宮), *Yoshida-jinsha* (吉田神社) belonging to ancient and medieval ages. It is worthy of note that the author has succeeded in restoring the original plannings and styles of Shinto shrines, making use of various documents with careful and minute examinations.

To sum up, these studies treat the histories of our most important Shinto and Buddhist monuments from the remote antiquity to the medieval age. Their origin, foundation, planning, various organization of works, characteristics of style and transformations through events in long existence, all these matters are fully explained by his outstanding science of archives (archival knowledge), combined with architectural expertness. His sixty year researches elucidate many subtle meanings with which the monuments are endowed. Hitherto no one has ever given such deep and rich spiritual contents to the historical studies on architecture. He greatly enlarged the cultural background of histories of monuments, which are very highly appreciated by scholars in the fields of our national history, archaeology and art criticism.

Toshimitsu YAMAZAKI
Experimental Studies of Meson Physics

In 1935 Yukawa predicted the existence of a new particle which mediates the forces between nucleons. It is now called a pion. A pion decays into a muon and a neutrino, and a muon decays into an electron or a positron and neutrinos. Because of the unique masses and interactions of pions and muons they constitute a rich arena of exotic objects for scientists.

Yamazaki has made many important contributions in this arena of physics, of which this award refers to two particular subjects. The first is the experimental verification of mesonic effects in atomic

nuclei and the second is the development of novel methods of using muons as probes for studying physics of materials.

A. *Experimental verification of mesonic effects in anomalous orbital magnetic moments of nucleons in nuclei.* The Yukawa theory assumes that nucleons are changing their states as $p \rightarrow n + \pi^+$ and $n \rightarrow p + \pi^-$. This contributes to spin magnetic moments of a proton and neutron. Such pion exchange between nucleons should also be present when they form a nucleus. Miyazawa predicted in 1951 that the pion exchange produces anomalies of orbital magnetic moments of protons and neutrons in atomic nuclei. The effect is, however, usually masked by the many-body correlation effects so that the verification was thought to be almost impossible. In 1970, Yamazaki and his collaborators succeeded in observing the effect for the state 11^- of ^{210}Po by an ingenious method. This is the first clear evidence for the explicit role of pions in nuclei which gave a great impact to explore new aspects of nuclear physics which regard a nucleus as an entity composed of more fundamental constituents such as quarks.

B. *Studies of μSR.* Muon beams are obtained from pion beams from an accelerator. When muons are injected into a substance, they are quickly decelerated and are trapped in the material. The muon spins are originally polarized in the direction of their incidence and start precessing around the external magnetic field, if there is any, or around the local fields in the material. The latter effect produces depolarization of spins. The spin rotation and the spin depolarization are observed by detecting the asymmetry of decaying electrons or positrons from the muons. This is called the muon spin rotation, relaxation or resonance, or collectively μSR in abbreviation. Yamazaki made two important contributions to develop this novel method in the last ten years.

The first is the invention of the zero-field relaxation method in which the external magnetic field is kept to zero. In contrast to the more common method of μSR using a transverse magnetic field and also to other traditional methods like neutron scattering and nuclear magnetic resonance, this method is very appropriate to investigate relaxation processes which are caused by random perturbations characterized by correlation times ranging from 10^{-12} to 10^{-4} seconds. Yamazaki and his collaborators have applied this method to obtain new results for many problems of condensed matter physics such as spin glasses, itinerant ferromagnetism and diffusion of positive muons in copper.

The second is the development of μSR with pulsed muon beams using the booster synchrotron at the National Laboratory of High Energy Physics. This facility is called the BOOM and is the only one of this kind in the world. One can measure μ-e decay in a time range much wider than in any other place. Also one can apply

extreme external conditions pulsewise to investigate their effects on dynamic properties in various materials. This has thus been proved to be very unique and powerful.

Masamichi TSUBOI

Molecular Structures of Nucleic Acids and Multiple Conformations in their Aqueous Solutions

For more than twenty five years, Dr. Masamichi Tsuboi has been engaged in the study of three-dimensional molecular structures of nucleic acids and proteins. The characteristic points of his study are summarized as follows: (1) By extending the method established for simpler molecules and by designing a number of new devices, he attempted to determine the complex biopolymer structures as in detail as those for simpler molecules. (2) His emphasis is placed on determining the structures of biopolymers in aqueous solutions, rather than those in crystals. (3) His efforts have been directed to establish not only the static structures but also dynamical behaviors of biopolymers: namely, the modes and rates of their conformational changes, frequencies of their large-amplitude vibrations, and amplitudes and rates of structural fluctuations.

Such characteristics are clearly illustrated in his Raman spectroscopic study of the DNA structure. One of the advantages of Raman spectroscopy is that the sample can be either in an aqueous solution or a crystal. In addition, many of the Raman lines of DNA reflect its molecular structures. For establishing the structure-spectrum correlations he started from a set of simpler systems which constitute the DNA molecule or which are related with it. In the course of this study, he and his research group used a number of ^{5}N and ^{13}C isotopic molecules and intra-molecular force constants derived from ab-initio molecular orbital calculations.

The structure-spectrum correlations thus obtained were then confirmed by examining Raman spectra of 30 nucleotide crystals whose structures are known by X-ray crystallography. The correlations were finally proved to be useful in clarifying 27 sequence-controlled DNA structures (both local and global) in their aqueous solutions.

It has been shown by this pile of studies that the DNA conformations in aqueous solution are in general different from those in crystals, and that the differences depend upon the base sequence in the DNA molecules as well as upon the salt concentration of the medium. Such a set of conclusions are valuable for the study of biochemical activities, because the DNA functions depend upon the

base sequence and upon the molecular environment.

As one of the effective methods of elucidating the dynamical properties of the DNA molecules, he examined isotope exchange reactions. By rapid mixing of the DNA solution in H_2O with heavy water D_2O, the rate of deuteration was spectroscopically measured. This stopped-flow spectroscopic technique, which was applied to biopolymer deuteration problems first by Dr. Tsuboi, led to a number of important conclusions as for the amounts of base-pair opening portions and their movements along the DNA double helix.

His conclusions on the biopolymer structures, which were published as more than 200 original papers together with 16 review articles, have attracted a world-wide interest and reputation and have been frequently cited and used by a lot of researchers in this field of science.

Seiya UYEDA

Geothermic Studies on the Tectonics of Island Arcs

Geothermy is a branch of geophysics which deals with the geophysical and geological phenomena from the viewpoint that the earth is a giant heat engine. Dr. Uyeda, in the late 1950's, recognizing the importance of geothermy which at that time was still in its infancy, initiated the measurements of the terrestrial heat flow in and around the Japanese island arcs through developing necessary instruments. This investigation led to the discovery of the now well-known characteristic distribution of heat flow in subduction zones, namely low in the deep-sea trench zone and high in the zone landward of the volcanic front including backarc basin. This finding immediately refuted the then predominant theory that the high seismicity in trench zone was due to high supply of heat from beneath. In early 1960's, Dr. Uyeda, with Dr. R. P. von Herzen on a research vessel of the Scripps Institution of Oceanography, made some 300 heat flow measurements in the eastern Pacific Ocean and proved that the East Pacific Rise has remarkably high heat flow. These discoveries played a crucial role in establishing the theory of sea-floor spreading. Heat flow measurements both on land and sea has remained the major part of Dr. Uyeda's subsequent research activity. With the active cooperation of colleagues, the number of heat flow determinations in and around Japan now amounts to over 1,000, so that this region is now one of the best investigated regions in the world from the thermal point of view.

As achieving these observational results, Dr. Uyeda's interest was expanded to interpret them in terms of the earth's thermal

history and global tectonics. In the monograph "Island Arcs" (1969) co-authored by Dr. A. Sugimura, it was clearly stated that the origin of island arcs should be attributed to the downgoing mantle flow. This insight, if not predating, was amongst the then emerging new concepts of the earth, the plate tectonics. Dr. Uyeda has made first rate contributions to the development of the sea-floor spreading theory and plate tectonics. Large scale northward motion of the Pacific Ocean floor demonstrated by paleomagnetic studies of seamounts (1966) and the assertion that the gravitational pull of subducted oceanic plate is the major driving mechanism of plate motions (1975) are the notable examples.

After about 1978, his interests have been re-focused on the phenomenon of subduction. He has been establishing a new approach called "Comparative Subductology" in which he has proposed the existence of two basic modes of subduction, namely the Chilean and Mariana types of subduction based on the analysis of differences in the magnitude of great earthquakes, stress field in backarc regions, crustal deformations, volcanism, dip of Wadati zone and so forth among various Circum-Pacific subduction zones.

Shun-ichi IWASAKI

Studies for High Density Magnetic Recording

Dr. Iwasaki has made significant contributions in the field of magnetic recording over the past twenty five years. His innovative theories and interpretations of magnetic recording mechanisms and his inventions of metal alloy particulate recording tape in 1957 and perpendicular magnetic recording in 1975 are outstanding achievements which have greatly influenced the present state of magnetic recording technology and will guide the future of the entire magnetic recording industry.

1. Metal particulate recording media: His research had focused originally on the recording losses at short wavelengths in order to characterize the magnetizations mechanisms in conventional magnetic recording. He developed important criteria for characterizing high-density recording tapes. A Fe-Co-Ni alloy particle-coated recording tape with high output at short wavelengths was first fabricated in 1957. This work pioneered the development of metal particle tapes which are now available to consumers.

2. Magnetic recording theory: Classical magnetic recording theories had always taken into account only the longitudinal component of magnetization until he introduced the use of vector magnetization into his self-consistent theory of magnetic recording in 1968. This

self-consistent magnetization theory is now a widely used tool for analyzing magnetic recording processes. In 1974, he experimentally verified the vectorial magnetization by observing the circular mode of magnetization at short wavelengths. This circular magnetization mode was interpreted as the recording loss mechanism that had been limiting the density achievable by conventional longitudinal magnetic recording. He also discovered at the same time that the circular mode could be transformed into a perpendicular mode by applying a dc magnetic field nearly perpendicular to the medium surface. Following this discovery in 1974, he actively promoted the development of a novel recording method called perpendicular magnetic recording in which only the perpendicular magnetization component is used. Perpendicular magnetization is inherently suitable for ultra-high density recording, since the demagnetizing field decreases and the corresponding remanent magnetization increases as the recording density becomes very large.

3. Perpendicular magnetic recording: In 1976, he experimentally verified the feasibility of ultra-high density perpendicular magnetic recording at ten times higher density than that obtainable in conventional longitudinal recording by using a newly-developed RF-sputtered Co-Cr film having perpendicular magnetic anisotropy and a single-pole type recording head. In 1978, he invented an improved double-layer composite medium in which a highly permeable Ni-Fe layer was deposited under the Co-Cr layer resulting in a ten times improvement of the recording and reproducing sensitivities. This invention has greatly accelerated the research activities aimed at practical applications of perpendicular magnetic recording not only in Japan but also in the United States and Europe. As a result, prototype perpendicular disk recorders have been proposed by several companies during 1982 to 1986.

Dr. Iwasaki is presently chairman of the 144th Committee on Magnetic Recording in the Japan Society for the Promotion of Science and continues to provide outstanding leadership for the research and development of perpendicular magnetic recording all over the world. His pioneering research on perpendicular magnetic recording will have a major impact on the entire magnetic recording industry over the next twenty five years.

Yoshikatsu TSUBOI

Study of Shell Structure
and Its Application to Space Structures

Dr. Tsuboi, displaying his natural gift for mathematical analysis

and deep insight to structural mechanics, had become absorbed in the study of shell structure from early days, and not only clarified the basic properties theoretically, but applied it to the actual new structures, such as, the shell roof structures, the suspension roof structures, the air domes, and etc. He opened the door to the development of the technology in the field of shell structures in Japan, and at the same time promoted its growth and presented remarkable academic achievements.

His major achievements are as follows:

1. Pioneer in studies on the shell structural theory.

Since 1940, Dr. Tsuboi had commenced the study in this field, which was very uncommon in those days, and as a pioneer researcher established the analytical theories pertaining to the various shell structures, and attained many remarkable results.

Also, along with the theoretical researches, he conducted many model tests regarding the various types of the reinforced concrete shell structures, and verified by experiments the results of the theoretical analysis of their structural behaviors in elastic domain. Much of his studies have been published internationally, and have received high praises.

2. Design of large space structure.

Another one of Dr. Tsuboi's international achievements, especially emphasized, is that the foregoing studies of shell structures did not remain only in the domain of basic theory, but was also applied to practical structural field. And it was this remarkable achievement that brought high praises from all over the world. Dr. Tsuboi's belief that a structure must be strong and safe, as well as possessing formative elegance, became the motivation to create many famous architectures in the world, in coordination with many architects gifted with sense of beauty. Regarding the shell structures and the suspension structures which are in the realm of typical shell structures, some of the famous ones are as follows:

A) Shell Structure

Dr. Tsuboi was not satisfied with just the conventional use of reinforced concrete, from the viewpoint of the history of its development, so taking the worldwide initiative, he developed the structural steel truss shell. One of his famous work is the Tokyo International Trade Center Building No. 2. This building was not just a huge space structure, unprecedented in Japan at the time, having a plan diameter of over 100 meters, but also cut boldly the curved surface (sphere) which was customarily used in a closed shape, and utilized the cut section as the entrance and for the lighting. From this point it was a new international innovation.

B) Suspension Structure (Suspension Roof)

Dr. Tsuboi proposed the application of the suspension roof structure when executing the structural designing of the National Indoor Gymnasium for the Tokyo Olympic. He concentrated on the project with his knowledge and experiences on the shell structure, devoted himself to the execution of the plan and presented to the public the possibility of a remarkable harmony of the beautiful formation and splended structure. The high praises in Japan and overseas in relation to foregoing results can be seen in that he has received many awards.

As the world-wide praises overseas, in 1976, the "Edward Torroja Medal" was awarded from the International Association of Shell and Special Structure (IASS), and in 1979 the "Special Pioneer Award" was presented to Dr. Tsuboi. With these distinguished services to the IASS and the evaluations of his excellent works in the shell structure field for many years, he was nominated as the 5th Chairman of the IASS in September 1986.

In summary, Dr. Tsuboi, both in the development of the basic theories of the shell structure and in the practical application of the theories to the space structures, has always led the world and making a great contribution to the structural field in our country and also to the world. And today, Dr. Tsuboi is still maintaining his steady leadership as the forefront researcher and structural designer in his field.

Toshio SAWADA

Studies on Design of Storage Dams

Dr. Toshio Sawada's study covers a wide range of problems concerning the planning, design and construction of dams, and his achievements are highly evaluated especially in the following areas:

(1) New design method of hollow and arch dams

In regard to the V-shaped hollow dam which is constructed at a narrow valley as well as to the arch dam which, on the other hand, is constructed at the broader valley, Dr. Sawada proposed the methods of static deformation analysis and those of response analysis during earthquakes. From the overall synthesis of the results of these analyses, he obtained those new findings for the rational designing of hollow and arch dams, which were applied to many practical projects with great success.

(2) Effects of mobile-loading upon filltype dams

The frequent traffic of heavy trucks on the crest of a dam is considered to give unfavorable influences on its structure. Dr. Sawada conducted investigations in this problem, together with the analysis

of relevant field data, and obtained useful results which are regarded as one of his remarkable achievements.

(3) Seepage flow through dams and the base ground

One of the major concerns regarding a storage dam is how to reduce the leakage to the minimum and to keep the embankment in safety from the unfavorable conditions to be caused by the seepage flow. Dr. Sawada conducted his original studies in this area and succeeded in the establishment of an analytical method to solve the problem. This method has been applied in practice and proved to be effective.

(4) New design method of the contact zone of a combined dam

At the interface between the concrete zone and earthfill zone in a combined dam or between the earthfill zone and rock mass at the abutments, the most difficult problem lies in the combination or close contact between the zones with different properties from each other. Dr. Sawada succeeded in finding out theoretical stress conditions to let slides concentrate at the interface in order to prevent the development of cracks or fractures, which would give the fatal damage to the dam. Thus, Dr. Sawada proposed a reasonable geometrical shape of the interface, from which a new design method was introduced and applied in many practical cases successfully in and out of Japan.

(5) Earthquake-resistance of filltype dams

The most important in the designing of a dam is the estimation of its dynamic behavior during a severe earthquake. Therefore, Dr. Sawada performed a series of experiments including comprehensive ones on the actual location. Through the computer simulation of the results of these experiments, he clarified the characteristics of dynamic responses of filltype dams during an earthquake. In particular, he examined the liquefaction phenomena in an embankment from various points of view and obtained many useful findings.

The characteristics of Dr. Sawada's achievements as mentioned above are summarized as follows: (a) Dr. Sawada has been concerned mainly with static deformation, dynamic behavior and seepage flow of dams, which are all classical and fundamental subjects in dam engineering. (b) He took up various problems concerned with the storage dam and worked out eminent and effective solutions for these problems. (c) Each subject of Dr. Sawada's research was related to practical design and analysis, and his findings and methods have been applied to many projects with effective results.

Dr. Sawada has devoted his academic life to the development of design methods of dams as mentioned above.

It is considered therefore that these achievements have been produced not only from his innate abilities but also through his steady efforts of many years and his capacity as a supervisor and organizer of research activities.

Nakao ISHIDA

Discovery of Sendai Virus and Studies on its Structure and Function

Almost 35 years have passed since a paper by Kuroya, Ishida and Shiratori announced the discovery of Sendai virus in the city for which it was named. In the virological field since that time, Sendai virus has become the prototype virus of the Paramyxoviridae. The study performed by Nakao Ishida on the relation of the biological function of the virus to its structural composition documented its characteristics sufficiently clearly for the subsequent discrimination of paramyxoviruses from orthomyxoviruses and metamyxoviruses. In biology, Sendai virus has become a widely used tool in the investigation of cell fusion; the membrane fusion activity of the virus, well characterized in the original account, permits study of the molecular dynamics of membrane fluidity.

The present account will refer mainly to the structure of Sendai virus in relation to its infectivity and to cell fusion activity. Sendai virus grows in multiple steps in the chorioallantoic cavity of fertile chicken eggs; the progeny virus (egg Sendai) has all of the parent biological activities (hemagglutinin, neuraminidase, infectivity for eggs and L cells, hemolytic activity, cell fusion activity). However, when cell cultures such as L and HeLa were infected with egg Sendai, the new progeny viruses (L Sendai, for example) were not infectious for L cells and lacked cell fusion activity. Nevertheless, L Sendai was still infectious for eggs; the discovery that the virus recovered from the eggs had acquired all the properties of egg Sendai gave considerable impetus to the concept of host-induced modification.

In 1971, it was found that when infected L cells were dispersed by trypsin before plating, the virus spread to adjacent recipient cells, where the synthesis of viral antigens was readily detectable. Kinetic experiments showed that treatment of L Sendai particles with 0.0004% crystalline trypsin induced maximal activation of all biological activities. The discovery that the infectivity of L Sendai could be activated by trypsin was the single most important finding of the whole of this study. Penetration of cells by Sendai virus is achieved by fusion of the viral envelope with the host cell membrane, for which a proteolytic cleavage of an envelope glycoprotein F (the fusion spike) into two glycoprotein subunits, F_1 and F_2, is responsible. The biologically defective L Sendai was characterized as having considerable amounts of F and smaller amounts of F_1 and F_2 as compared with the biologically active egg Sendai, which was devoid of F but rich in F_1 and F_2. F (M.W. 65,000) $\rightarrow$ F_1 (M.W. 51,000) + F_2 (M.W.

15,000).

Further biochemical studies by other workers revealed that the cleavage not only generates two disulfide-bonded sequences, but that the N-terminus of F_1 is extremely hydrophobic, and has six of its first 15 residues in common with HA2 of influenza virus. These similarities are significant for the biochemical understanding of the processes of virus-cell fusion at the time of myxovirus infection. The overall results also suggested that there must be some activating mechanism in the host side and that the principle (activator) responsible for this phenomenon had a character similar to trypsin. Thus a new concept of virus tropism was established.

Other components of Sendai virus were also biochemically and biologically well characterized by Ishida and his associates. For example, Sendai virus was shown to have, as distinct from influenza virus, a second spike on the surface of the virion designated as HANA from the coexistence in it of hemagglutinin (HA) and neuraminidase (NA) activities. It is the presence of the two characteristic spikes, F and HANA, which makes possible the discrimination of paramyxovirus from orthomyxovirus.

It should also be emphasized that the studies of Nakao Ishida and his associates established a new biochemical method for the collection and fractionation of a large quantity of enveloped virus components.

Kumao TOYOSHIMA

Studies on *src*-Family Oncogenes

The mechanism of oncogenesis has long been one of the most attractive targets of cancer research. In 1969, Dr. Toyoshima isolated two temperature-sensitive mutants of B77 strain of Rous sarcoma virus. These mutants induce transformed cell foci in chick embryo fibroblast culture, which are sensitive to culture temperature and those induced at lower temperature of 36° reverted to normal cell type after the shift of culture temperature to 41°. These observations clearly indicate that there is a gene which is required to maintain transformed state of cultured cells. This phenomenon was confirmed in many laboratories and led to present prosperity of oncogene study. He also isolated transformation-defective mutants. This mutation was again confirmed in other laboratories and one of the later isolates was used for selection of cDNA specific to the transforming gene of Rous sarcoma virus, v-*src*.

Dr. Toyoshima analyzed Y73 sarcoma virus and found the v-*yes* gene which encoded a protein-tyrosine kinase. Upon the elucidation

of total nucleotide sequence of Y73 sarcoma virus, the v-*yes* gene was found to have remarkably high homology to the v-*src* gene. The products of these two genes have even higher homology compared to that of the nucleotide sequences as a result of many neutral mutations at the third letter of each codon during the evolutionary process of these two related genes. These findings led to a classification of the *src*-family oncogenes.

He also analyzed R strain of avian erythroblastosis virus. The genome was found to encode two different proteins. The second gene called *erbB*, had not been known before, however, it was found to play a crucial role for transformation by avian erythroblastosis virus. This gene was found to encode a transmembrane protein with kinase domain. When the structure of the epidermal growth factor receptor was analyzed by Waterfield and others, the product of the *erbB* gene was proved to encode a truncated form of the epidermal growth factor receptor. This was the first evidence of the correlation between a growth factor receptor and an oncogene. He also found frequent amplification of this gene in relation to epidermal carcinoma.

The third gene analyzed by his group was found by molecular hybridization with cDNA^{erbB} and was called *erbB*-2. The *erbB*-2 gene encode a receptor type protein closely related to the epidermal growth factor receptor. Although the ligand to this putative receptor has not been found yet, this gene appeared to be a proto-oncogene related to adenocarcinoma, since amplification of this gene as well as unusual expressions are often observed in gastric cancers and in breast cancers.

In relation to the *src* and the *yes* genes, he also analyzed the *fgr* gene and found the *syn* and the *lyn* genes. These five genes encode protein-tyrosine kinases possessing similar molecular size and closely related structures. On the other hand, *erbB* and *erbB*-2 encode receptor type tyrosine kinases closely related each other, but are distinct from *src* gene product. These observations raise new concepts on gene evolution.

PROCEEDINGS AT THE 810TH GENERAL MEETING

The 810th General Meeting of the Academy was held on Tuesday, June 9, 1987, at 1:00 p.m., Dr. Toshio KUROKAWA, President, taking the chair. Eighty-eight members were present, and the following communications were made:

On some problems concerning 'The burden of the public debt' . . . . . Hisao KUMAGAI, M. J. A.

Spontaneous and mitomycin-C induced the sister chromatid exchanges in lymphocytes from patients with cri du chat syndrome . . . . . Zentaro YAMAGATA, Sumio IIJIMA, and Makoto HIGURASHI

The chromosome in the primitive or microlepidopterous moth-groups. III . . . . . Akito KAWAZOÉ

The fragile sites in chromosomes on a case with Prader-Willi syndrome . . . . . Suzue KANATA, Tetsuji KADOTANI, Yoko WATANABE, Noriko KUROSAKI, Toshio KUMADA, and Ichiro TAKEMURA

Karyotypes of a gobiesociform and two perciform fishes (Teleostei) . . . . . Yoshio OJIMA and Tsukasa KIKUNO

Karyotypic study of two species in Atheriniformes and Perciformes (Teleostei, Pisces) . . . . . Tsukasa KIKUNO and Yoshio OJIMA

Karyological kinship of two species of Mustelids, *Mustela erminea nippon* and *Martes melampus melampus* . . . . . Yoshitaka OBARA

Above six, communicated by Sajiro MAKINO, M. J. A.

Crystal chemistry of $Ba_2YCu_{3-x}O_{7-y}$ ($x=0\sim0.12$, $y=0\sim1.0$) . . . . . Fujio P. OKAMURA, Shigeho SUENO, Izumi NAKAI, and Akira ONO

Communicated by Ryoichi SADANAGA, M. J. A.

A result on the scattering theory for first order systems with long-range perturbations . . . . . Koji KIKUCHI

Limiting behaviour of linear cellular automata . . Satoshi TAKAHASHI

The Steffensen iteration method for systems of nonlinear equations. II . . . . . Tatsuo NODA

On the existence of solutions for the boundary value problem of quasi-linear differential equations on an infinite interval . . . . . Seiji SAITO and Minoru YAMAMOTO

Whittaker models for highest weight representations of semisimple Lie groups and embeddings into the principal series . . . . . Hiroshi YAMASHITA

Completely integrable symplectic mapping . . . . . Shigeru MAEDA

Above six, communicated by Kôsaku YOSIDA, M. J. A.

Secondary plant products from cultured hybrid cells . . . . . Yasuyuki YAMADA, Hiromichi MORIKAWA, Fumihiko SATO, and Yoshikazu YAMAMOTO

Communicated by Hisateru MITSUDA, M. J. A.

Relationship between thermotropic properties of isolated plasma membrane vesicles and freezing resistance of cultured green *Lavandula vera* cells . . . . . Saburo UENO, Katsumi WATANABE, Shizuo YOSHIDA, and Hisateru MITSUDA, M. J. A.

Discovery of *Otoceras boreale* Spath from West Spitsbergen . . . . . Keiji NAKAZAWA, Koji NAKAMURA, and Gaku KIMURA

Preliminary notes on the multicarpelous female flower with conduplicate carpels from the Upper Cretaceous of Hokkaido, Japan . . . . . Tamiko OHANA and Tatsuaki KIMURA

Sphenobaiera coreanica Kim et Kimura sp. nov., from the Bansong Group in the Danyang Coal-Field, Korea . . . . . Jong Heon KIM and Tatsuaki KIMURA

Cuticle of *Sagenopteris* (Caytoniales), an extinct gymnospermous plant, first observed in Japan . . . Jong Heon KIM and Tatsuaki KIMURA

Above four, communicated by Teiichi KOBAYASHI, M. J. A.

Emission spectroscopic determination of heavy nitrogen ^{15}N in trace amounts of sample . . . . . Kikuo KUMAZAWA

Assimilation of nitrogen by rice plant as revealed with ^{15}N . . . . . Kikuo KUMAZAWA, Tadakatsu YONEYAMA, Yasuhiro ARIMA, and S. Muhammad SHAH

Assimilation and transport of fixed nitrogen in soybean nodule as revealed with ^{15}N . . . . . Kikuo KUMAZAWA, Yasuhiro ARIMA, Takuji OHYAMA, and Kiwamu MINAMISAWA

Above three, communicated by Shingo MITSUI, M. J. A.

Therapeutic effect of tetrahydrobiopterin in infantile autism . . . . . Hiroshi NARUSE, Tokishi HAYASHI, Masashi TAKESADA, Akifumi NAKANE, Kousuke YAMAZAKI, Teruhisa NOGUCHI, Yasuyoshi WATANABE, and Osamu HAYAISHI, M. J. A.

Nucleotide sequence of rice dwarf virus genome segment 10 . . . . . Ichiro UYEDA, Takeshi MATSUMURA, Teruo SANO, Kazusato OHSHIMA, and Eishiro SHIKATA

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Sur certaines fonctions définies par les chiffres des entiers . . . . . Jean Loup MAUCLAIRE

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On a problem of R. Brauer on zeta-functions of algebraic number fields. II . . . . . Ken-ichi SATO

The irreducible decomposition of the unramified principal series . . . . . Takao WATANABE

On the value of the Dedekind sum . . . . . Kiyoshi KATASE

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Differentiable vectors and analytic vectors in completions of certain representation spaces of a Kac-Moody algebra . . . Kiyokazu SUTO

Above eight, communicated by Shokichi IYANAGA, M. J. A.

Casson's invariant for homology 3-spheres and characteristic classes of surface bundles . . . . . Shigeyuki MORITA

A generalization of Lefschetz theorem . . . . . Takao FUJITA

Above two, communicated by Kunihiko KODAIRA, M. J. A.

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

First, the President announced that Dr. Tsugio MIKAMI, M. J. A., had passed away on June 6, 1987. The members rose from their seats in silence, expressing profound sense of grief.

Next, Dr. Shigeo TAKAHARA, M. J. A., and Dr. Kiyoaki TSUJI, M. J. A., paid a tribute of admiration to the late Dr. Kenji YAMAOKA's and the late Dr. Nobushige UKAI's meritorious services to academic circles.

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

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: Tatsuro YAMAMOTO, Tsunahiro KIKUI, Mataji MIYAMOTO, Kôsaku YOSIDA, Itiro TANI, Naohide HIRATSUKA, and Kô HIRASAWA.

The meeting adjourned at 5:20 p.m.

日本学士院紀要

昭和六十二年六月　第六十三巻A　第六号

昭和六十二年七月五日 印刷
昭和六十二年七月八日 発行

編集兼発行者　日本学士院
東京都台東区上野公園七の三十二

印刷所　株式会社東京プレス
東京都板橋区桜川二丁目二十七の十二

印刷者　依田高夫
東京都板橋区桜川二丁目二十七の十二

Printed by
TOKYO PRESS COMPANY LIMITED
No. 27-12, Sakuragawa 2-chome, Itabashi-ku,
Tokyo 174 Japan
Tel.: (932) 9291～4

JUNE, 1987 VOL. LXIII, Ser. A, No. 6

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