AWARD OF MEDALS

The Seventy-ninth Annual Award of Medals was held on Monday, June 12, 1989, 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.

The Medals and Prizes were presented to the following recipients.

Imperial Prize and Academy Prize to Tomi SAEKI
for "Studies on the History of Salt Administration in China"

Imperial Prize and Academy Prize to Yorio HINUMA
for "Studies on Viral Etiology of Adult T-Cell Leukemia"

Academy Prize to Sengaku MAYEDA
for "Completion of the Critical Edition of Śaṅkara's *Upadeśasāhasrī* and Annotations on It"

Academy Prize to Tôru MORIYA
for "Theory of Spin Fluctuations in Itinerant Electron Magnetism"

Academy Prize to Susumu KATO
for "Observational and Theoretical Studies on Atmospheric Tide and Gravity Waves"

Academy Prize to Masatoshi KOSHIBA
for "Detection of Neutrino Burst from Supernova in the Large Magellanic Cloud (SN1987A)"

Academy Prize to Toshio FUJITA
for "Studies on Heat-Resistant Steel"

Academy Prize to Kikuo KUMAZAWA
for "Studies on the Determination of Small Amounts of ^{15}N by Emission Spectrometry and Its Application to Plant Nutrition"

Academy Prize to Hisayuki MATSUO
for "Studies on Biologically Active Peptides Involved in Biocommunication: Especially on Structure and Function of Atrial Natriuretic Peptides"

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 RECIPIENTS' WORKS

Tomi SAEKI

Studies on the History of Salt Administration in China

The main subject of this book is the history of salt administration in China from the earliest period to the Ch'ing Dynasty. The book consists of four chapters: 1 Introduction; 2 Salt and the Ancient Chinese Civilization; 3 Salt Administration in the Medieval Period, and 4 Salt Administration in the Premodern Period. The last chapter covers 80% of the book. Since salt is considered indispensable for life, it has historically been tightly related to the prosperity and decline of a state. As salt was produced in only limitted areas in China, and because of the vast land area of China, the system of salt distribution was complicated.

In the introduction the author points out the significance of salt in the course of the world history. In chapter 2 he describes its significance to Chinese history from the earliest period to the Han Dynasty. It was in this period that the salt lake of Chiehchou in the Shanhsi province became an important site of salt production, which led to its occupation by the Ch'in Dynasty, and which because of this became the starting point of the unification of China. Later in 119 B.C. under the reign of the Emperor Wu, the Han Dynasty monopolized the salt trade in order to compensate increasing military expenditure. From that time the monopoly became the main channel of salt administration. Chapter 3 deals with the period of the Three Kingdoms to the T'ang Dynasty. Because of further increases in military expenditure according to the Anshih revolt, the T'ang Dynasty was obliged from A.D. 758 to expand this monopoly throughout the empire. The monopoly was maintained from then until the end of Ch'ing Dynasty for 1155 years. The profit made by this monopoly was, on occasion, equivalent to approximately half of the national income. However, the high rises of the salt price led to a wide increase in illegal private dealing of salt, against which the government imposed very strict control and equally strict punishment. In the T'ang Dynasty the land of Middle China was cultivated and salt production from sea water was promoted along the lower Huai River.

The fourth chapter discusses the period between the Wutai and the Ch'ing Dynasties. In the Sung Dynasty salt administration became more effective: the production was administrated by the government while sales were placed in the hands of merchants and the area of sales was regulated according to the place of production. When the northern frontier came under threat of foreign invasion, the

merchants, who were ordered to transport war supplies to the frontier, were provided with bills by which to purchase salt on the spot. This system was also adopted by the Ming Dynasty. The merchants from Anhui province and Shanhsi province who were actively engaged in this trade had a special arrangement with the high officials and military factions of the Dynasty. They made such huge profits that salt administration by the government became again ineffective and thus put the economy of the state in some jeopardy. During this time private and illegal salt merchants organized secret societies which frequently rose in revolt against the government. During the Ch'ing Dynasty the salt traders in Yangchou district contributed to the development of culture by patronizing science and art with their profits from salt. These merchants, however, lost power during the time of the Opium War, a war which also led to the decline of the Dynasty due to its lack of a sound economic basis.

Dr. Saeki's book is a remarkable achievement. In it are collected 50 year's works on salt administration with a detailed examination of exhaustive historical sources through which he describes the history of the rise and decline of the Chinese state from ancient times to the Ch'ing Dynasty. There may remain some problems yet to be examined; however, this work represents a great contribution to the difficult and complicated problem which hitherto had been neglected.

Yorio HINUMA

Studies on Viral Etiology of Adult T-Cell Leukemia

Numerous attempts to determine the causative virus(es) particularly retrovirus of human tumors have been failed, although the etiological role of viruses in tumors has been confirmed in animals. Dr. Hinuma and his co-workers were the first to discover the etiological association of a retrovirus with a human leukemia.

Adult T-cell leukemia (ATL) has been recognized as a new disease entity which is most endemic southwest Japan since first reported in 1977. Its etiology, however, was unknown. With his working hypothesis that virus or virus specific markers would be detected in leukemic cells from ATL, if the leukemia was indeed caused by a certain virus, Dr. Hinuma and his co-workrs conducted the first experiments to find the putative virus in cells of an ATL-derived T-cell line, MT-1, in culture. Indirect immunofluorescence of sera from ATL patients demonstrated an antigen in the cytoplasm of the MT-1 cells. The antigen was called ATLA. Simultaneously,

using electron microscopy, type C virus particles that were morphologically characteristic of a retrovirus were detected in the cells cultured in the presence of 5-iodo-2′-deoxyuridine. The ATLA was not detected in the other 17 human cell lines tested including T-cell lines, B-cell lines and nonT- nonB-cell lines. It was also found that ATLA was not related to 6 known herpesviruses suspected of being associated with tumors. These findings suggested strongly that the ATLA was the retrovirus associated antigen. Antibodies to ATLA were found in all the patients with ATL but not with other leukemias. The antibodies were also detected in 26% of the healthy adults from the ATL-endemic areas but in only a few of those from ATL-non endemic areas. These findings suggested that ATL develops in adults infected with the retrovirus.

Following the discovery of the association of the retrovirus with ATL, Dr. Hinuma and his co-workers made further studies on the biological and biochemical characterization of the virus and the natural history of the viral infection or ATL. They demonstrated that the retrovirus has a transforming activity for human T-cells and that the virus or ATLA can be detected in peripheral lymphocytes from either patients with ATL or healthy individuals with antibody to ATLA. They also disclosed the primary transmission route of the virus, that is from mother to child via milk. Only one of 1000 to 2000 such infected individuals annually develop ATL and it is usually more than 40 years after infection. It was also demonstrated that the virus could be transmitted by blood transfusion at a high frequency. Dr. Hinuma and co-workers were successful in preparing a recombinant vaccinia virus vaccine having the env gene of the ATL retrovirus. Dr. Hinuma also conducted extensive studies on the seroepidemiology of the ATL retrovirus in Japan and many other countries. From the work of Dr. Hinuma and other investigators, it became apparent that ATL is caused by a retrovirus that is now called HTLV-1.

These studies by Dr. Hinuma have contributed to our understanding of the viral etiology of carcinogenesis in humans. For these creative studies he has received many honors: The Noguchi Hideyo Memorial Medical Prize (1983), Takeda Medical Award (1983), the Princess Takamatsu Cancer Research Foundation Award (1984), the Behring-Kitasato Prize (1984), the Hammer Prize for cancer research (1985), the decoration of Person of Cultural Merit (1986) and the Asahi Award (1987).

Sengaku MAYEDA

Completion of the Critical Edition of Śaṅkara's *Upadeśasāhasrī* and Annotations on It

The author's study of the *Upadeśasāhasrī* of Śaṅkara (ca. A.D. 700~750), the Indian exponent of Advaita Vedānta philosophy (non-dualism), has come to its completion by publishing the following three works:

Work A = *Śaṅkara's Upadeśasāhasrī, Critically Edited with Introduction and Indices* (Tokyo: The Hokuseido Press, 1973).

Work B = *A Thousand Teachings: The Upadeśasāhasrī of Śaṅkara, Translated with Introduction and Notes* (Tokyo: The University of Tokyo Press, 1979).

Work C = *The Upadeśasāhasrī: Search for the True Self* (『ウパデーシャ・サーハスリー —真実の自己の探求—』) (Tokyo: Iwanami Shoten, 1988).

Śaṅkara has usually been regarded as the greatest philosopher in the history of Indian philosophy. More than three hundred works —commentaries, expositions, and poetry—are traditionally attributed to him. However, most of them may not be accepted as authentic. The problems of authenticity of the works ascribed to him have been a hindrance to the advancement of a scientific study of Śaṅkara's philosophy.

The study of Śaṅkara has mostly centered around his chief work, the *Brahmasūtrabhāṣya*, and his other commentaries on Upaniṣads. The author, however, asserts that it should be carried out on the basis of the *Upadeśasāhasrī* (=*Upad*) from the following reasons: (1) the *Upad* is generally recognized as genuine; the author himself has proved its authenticity with reliable and ample evidence (Work A, pp. 22–64); (2) it cannot always be expected that Śaṅkara the commentator fully expresses his own philosophy in his commentaries on original texts. The *Upad*, however, is the only independent, non-commentary work which is evidently genuine and the other independent writings ascribed to him are probably all spurious; (3) the *Upad* occupies an important position in the history of Advaita Vedānta and is a very good introduction to Śaṅkara's philosophy.

No reliable and critical edition of the *Upad* has so far been published. Therefore, as the first step of his research, after examining 42 manuscripts and 14 printed editions in England and India, the author presented his Work A, a critical edition of the *Upad* accompanied by the Critical Apparatus and Index of Quotations and Index of Words. This edition which is one of the few Sanskrit works equipped with an exhaustive word index has been highly appreciated

by scholars of Indian philosophy in the world as a model of critical accuracy and has since served as the standard edition of the *Upad.*

His Work B, which is an English translation based on the above critical edition of the *Upad* with Introduction and Notes, was published four years later. In its ninety-five page introduction the author discusses various important problems in the Vedānta from an original point of view. In chapter I Saṅkara's life and works are described and in chapter II Śaṅkara's central doctrine and his position in the history of the Vedānta philosophy are explained. In chapter III the author elucidates elaborately and minutely the truth of *Ātman's* identity with *Brahman* in accordance with Śaṅkara's three different ways of approach to the truth, i.e. ① theological and cosmological approach, ② psychological and epistemological approach, and ③ exegetical approach. In chapter IV Śaṅkara's view of transmigration and final release is taken up for discussion.

The author's English translation of the *Upad* is characterized by its preciseness, correctness and thoroughness. His detailed notes are to the point and extremely helpful. These remarks are also true of his annotated Japanese translation which is his Work C.

Thus his critical edition, annotated English and Japanese translations of the *Upad* with an inspiring introduction are a remarkable scholarly achievement and a highly welcome addition to the literature in the field of Indian philosophy. They constitute a solid foundation on which the whole history of Indian philosophy as well as the Advaita Vedānta might be reconstructed.

Tôru MORIYA

Theory of Spin Fluctuations in Itinerant Electron Magnetism

In a crystalline magnetic body each constituent atom has a magnetic moment consisting of electron spins. These atomic moments or atomic spins fluctuate at a finite temperature due to their thermal motions and mutual interactions. A characteristic feature of a magnetic body is that below a certain critical temperature the atomic spins take an ordered arrangement. More precisely, the time-averaged atomic spins are ordered. In a ferromagnetic body these spins align parallel, in an antiferromagnetic body they align antiparallel, and in a helical magnetic body they describe a helix in space.

A theory of magnetism has been developed since 1928 when Heisenberg presented the first quantum-mechanical theory of ferromagnetism. It turned out, however, that this theory is applicable

only to electrically insulating crystals in which electrons are not itinerant in the crystal but are localized on each atom. Anderson's superexchange interactions act among the localized atomic spins.

The spin-carrying electrons are itinerant in most magnetic metals, alloys, and intermetallic compounds. In these substances the number of electron spins on each atom also fluctuates due to itinerancy and electron-electron interaction. No satisfactory theory of magnetism has been developed for this case before Moriya, except for the state at the absolute zero of temperature and for spin-wave excitations there.

Moriya worked out his theory in two ways. In the first theory, which he called the self-consistent renormalization theory, the basic idea is as follows. An arbitrary state of fluctuating atomic spins is supposed first, and electrons interacting mutually and interacting with these fluctuating spins are considered. The spin fluctuations of the system of these electrons in thermal equilibrium are then put to be identical with the initially supposed spin fluctuations in order to achieve self-consistence. An approximation is here introduced. After decomposing spin fluctuations into waves, Moriya adopts only those waves whose wave-vectors are in the close neighborhood of a special wave-vector that characterizes the ordering of atomic spins below the critical temperature.

This theory was successfully applied to weakly magnetic substances which have small atomic magnetic moments and low critical temperatures, such as $ZrZn_2$, Sc_3In, MnSi, and other intermetallic compounds and alloys of low critical temperatures. The theory explains quantitatively a great variety of experimental results, including the observed Curie-Weiss law which has never been explained before. Also, direct observations of spin fluctuations in MnSi by means of neutron scattering support the validity of the theory.

The second theory of Moriya uses a sophisticated mathematics. No restriction is imposed on the wave-vectors of spin fluctuations but a certain assumption of adiabaticity is made. This theory gives a unified picture of magnetism, interpolating between the two limits of the localized spin system and the system of highly itinerant electrons as represented by the first theory.

Susumu KATO

Observational and Theoretical Studies on Atmospheric Tide and Gravity Waves

The atmospheric tide observed on the earth's surface was one

of unsolved problems in earth physics for a long time, because the solar semidiurnal component S_2 is predominant in the tidal variation. As for the atmospheric tide in the ionosphere, it was established by Dr. Kato's electrodynamical analyses of observed geomagnetic and ionospheric data that the solar diurnal component S_1 is predominant in the E-layer, indicating that the driving force for the tidal motion of the earth's atmosphere is mostly attributable to the solar radiation energy.

Then eigen oscillation modes of the classical ideal model of the earth's atmosphere, that is, a rotating earth's atmosphere with observed distributions of gravity, pressure and temperature, were precisely evaluated by Kato with the aid of newly developed mathematical calculation techniques. This theoretical result shows that gravity waves longer than a half solar day in period in the ionosphere have two eigen modes, one of which is an evanescent mode with respect to the vertical direction, while other waves of shorter periods have only one respective eigen modes, which correspond to the ordinary mode waves propagating vertically.

The evanescent S_1 wave in the ionosphere is much larger than S_1 wave of the ordinary mode, and is in good agreement in its characteristics with those of the S_1 wave derived from the observed data. Wave lengths of vertically propagating mode gravity waves are about 30 km for S_1 wave and about 200 km for S_2 wave respectively. Therefore, S_2 wave in the ionosphere can easily reach the earth's surface, while S_1 wave is disturbed by S_1 mode gravity waves of various different phases during its downward propagating process, resulting in a much reduced amplitude of S_1 tidal wave in the lower troposphere. This Kato's theoretical interpretation of the atmospheric tide is now generally accepted as the standard basic model for further studies in detail on the atmospheric tide and gravity waves.

Another significant contribution by Kato to recent progress of atmospheric physics is an invention and development of a new type radar system for atmospheric observation, MU Radar (Middle and Upper Atmosphere Radar), and extensive studies on dynamics of the whole atmosphere region from the ionosphere through the upper troposphere, particularly gravity wave characteristics.

The MU radar which consists of 25 sets of individual antenna units composed of 19 dipole antennas can immediately work with any combination of these antenna sets for continuously observing atmospheric density fluctuations within 30 degrees in zenith angle. The MU radar with 46.5 MHz in emitting radio wave frequency has been efficiently applied for multipurpose atmospheric studies, such as ionosphere soundings by a single beam from the whole antenna system with its full power (1 MW), simultaneous observations of atmosphere

movements at separated spots, correlation among atmospheric turbulences at separated points, quick measurements of vertical temperature profile by pursuing the acoustic pulse velocity and simultaneous measurements of motions of falling rain drops and their background wind.

Main results of Kato's research works on atmospheric gravity waves with the aid of the MU radar may be summarized as follows;
(i) Vertical distribution of the wave number spectra of gravity waves and their time variation in the whole atmosphere:
(ii) Behaviours of vertically propagating gravity waves:
(iii) Breakdown phenomena of upward travelling gravity waves into the atmospheric turbulences at 60–80 km in height, and resistive effects of the produced turbulences on the atmospheric circulation in the middle atmosphere, which result in an anomalously high temperature zone in the middle atmosphere in the winter polar region.

Multipurpose utility of the MU radar system for atmosphere research, founded by Kato, has been experimentally confirmed, and his extensive research of gravity waves has shown their significant role in the middle atmosphere dynamics. Dr. Kato's research works on the atmospheric tide and gravity waves and the new MU radar system are now widely recognized, and a new research field "Radar Meteorology", founded by him, is going to expand as a worldwide network.

Masatoshi KOSHIBA

Detection of Neutrino Burst from Supernova in the Large Magellanic Cloud (SN1987A)

On February 23, 1987 in the Large Magellanic Cloud which is by 150,000 light years far from us a supernova appeared which was the first supernova since 1604 visible with naked eyes, and it is called SN1987A.

A supernova appears because of the eruption of a star in its final stage of the life, for which the central core collapses gravitationally and the gravitational energy released by the collapse blows off most part of the mass of the star. However, 99 percent of the released energy is brought out by neutrino created during the eruption and the remaining energy is used to brighten the star. The neutrino burst from the supernova was detected by the Kamiokande II detector located in the Kamioka mine 1,000 m deep in Gifu prefecture in the region of the Japan Alps.

The project to construct the Kamiokande was initiated by the

idea of Dr. Koshiba for nucleon decay experiment and the detector was constructed by the group led by him. The experiment was started in July, 1983. However, in 1985 it was upgraded to Kamiokande II in order to detect neutrino from the sun and the observation has been made since the beginning of 1986.

In the detector 948 photomultiplier tubes, each 0.5 m in diameter, are uniformly placed facing inward on a 1-m grid on the entire surface with dimensions 14.4 m in diameter by 13.1 m high, which contains 2,140 metric tons of water. An elaborate water purification system ensures that the attenuation length of the tank water for Cherenkov radiation (300–500 nm wavelength) exceeds 50 m at any time.

In fact if neutrino reacts with an electron in the water Cherenkov radiation is emitted. On February 23, 1987 12 neutrino-induced events were observed by the Kamiokande II for 12.4 seconds after 7 h 35 m 35 s (Universal Time). It was three hours before the first visual observation of SN1987A and was believed to be the epoch of the gravitational collapse of the supernova.

Of the 12 events the first two have additional informations for the direction from which the neutrino came and, therefore, one can know that they were from the supernova and the average energy for the 12 neutrinos is computed as (17 ± 1) MeV. And from these data the total energy of neutrinos emitted from the supernova is estimated as $1\sim3\times10^{53}$ erg. On the other hand the total energy of the radiation in the visual wavelength region from the supernova is computed as $1\sim3\times10^{51}$ erg.

As the ratio of the two values agrees with the theoretical estimate, it can be concluded that the lifetime of neutrino is sufficiently long for most of them to survive for more than 0.15 million years. And as the observations show that the speed of the neutrino is almost the same as the visual light, the upper limit of the mass of neutrino could be estimated. The data at the Kamiokande II already gave us also upper limits of electric charge, magnetic moment and so on for the neutrino and detailed mechanism of the supernova.

Besides the Kamiokande II another detector, IMB (Irvine-Michigan-Brookhaven), detected the neutrino burst from SN1987A, however, it is believed that the observations of the Kamiokande II have the most valuable informations.

As the observation, which is the first one in history to detect neutrino burst from a supernova with data both of the energy and the incident direction, was made possible by the creative idea and initiative of Dr. Koshiba who contributed so much to the foundation of neutrino astronomy he is awarded the prize of the Japan Academy.

Toshio FUJITA

Studies on Heat-Resistant Steel

Improvement in the heat efficiency of thermal power generation has been sought worldwide since the days of the oil crisis. There has also been a demand for improvement in the ability to operate under higher temperatures and pressures (ultra super critical pressure), but these goals had not been realized as there was no heat-resistant steel available to meet such operating conditions. For this reason, Dr. Fujita thoroughly studied the matter of heat-resistant steel and developed an epock-making type of steel. Because of his contribution, thermal power plants subject to ultra super critical pressure have now been made possible.

As early as 1956 Dr. Fujita developed "TAF steel", a type of ferritic heat-resistant steel. The high temperature strength of this steel is two or three times that of the "H46 steel" developed in the U.K., which, up to that time, had been widely recognized as the strongest ferritic heat-resistant steel.

In 1979, the study on steel for steam turbine rotor shafts was commenced, and it was successfully concluded in 1983 with the development of the "TR1100 steel", which could be used at an operating temperature of 593°C, a temperature 30 degrees higher than that which could be withstood by the steel developed by General Electric, the most heat-resistant steel which had been developed up to that time. The "TR1100 steel" was adopted for use in the Wakamatsu power plant, the world's first ultra super critical thermal power facility. The Wakamatsu project is regarded as an important milestone in the planning of power plants throughout the world. In addition, "TR1200 steel", which can be used in an operating temperature of 650°C, was also developed during the course of the research.

The deep understanding of the strengthening mechanism involved with alloying elements obtained during the studies has lead to the development of a whole new series of heat-resistant steels, which include "TB9" and "TB12" steels developed in 1979 for boiler tubes. These steels have twice the high temperature strength as that of the "T91 steel" which was co-developed in the U.S. by the Oak Ridge National Laboratory and Combustion Engineering. It was also widely held that ferritic steel was inferior to austenitic steel in temperatures exceeding 600°C. However, both the "TB9" and "TB12" steels showed higher strength than that of austenitic steel at a temperature of 650°C and is, therefore, regarded as an epochal development. A four-year application study of "TB9 steel" for boilers at the newest thermal power plant in Drakelow, England will commence this month.

Since ferritic heat-resistant steels show good resistance to fast neutrons, "TB12 steel" is expected to be used as a material for fast breeder reactors, and "TB9 steel" for nuclear fusion reactors. If these steels are adopted in place of the conventional austenitic "SUS316 stainless steel", the life of the materials used will be prolonged several times over.

Kikuo KUMAZAWA

Studies on the Determination of Small Amounts of ^{15}N by Emission Spectrometry and Its Application to Plant Nutrition

Nitrogen is the most important nutrient to obtain high agricultural yields. Therefore, to trace the physiological function of nitrogen in the plant is one of the important processes in the study of agriculture, especially of plant nutrition.

For this purpose, ^{15}N is usually used as a tracer and mass-spectrometer has been used to determine its presence. However, this method requires a large amount of nitrogen and is not applicable for ordinary research.

Dr. Kumazawa has developed a new method using emission spectrometry to determine the amount of ^{15}N in a small plant sample. He applied this method for the analysis of ^{15}N in a trace amount of plant samples, such as amino acids or amides separated by silica-gel thin layer chromatography. Using this method, he elucidated the absorption, assimilation and translocation process of the inorganic nitrogen in the plant as well as the metabolic pathway of the absorbed or symbiotically fixed nitrogen in soybean nodules.

Spectrographic determination of the amount of ^{15}N present is based on the measurement of the intensity ratio of the peaks of the emission spectra of $^{14}N_2$, $^{14}N^{15}N$ and $^{15}N_2$ molecules, which appear in the wavelengths between 287 and 299 nm. As a result of Kumazawa's new method, ^{15}N-analyzer has been manufactured and is now used widely throughout the world. He has also developed a series of discharge tube preparation systems for various kinds and sizes of samples analyzed by emission spectrometry.

With the use of ^{15}N labeled ammonium and nitrate, he proved that the first step of ammonium assimilation is the incorporation of the amide-group of glutamine by glutamicsynthetase, and glutamic acid was formed from glutamine and 2-oxoglutaric acid by glutamate synthase. He also demonstrated that ammonium and a part of nitrate nitrogen is converted mainly into amides and amino acids in the roots.

The organic nitrogeneous compounds are transported upward from the roots through the xylem, and partly transferred into the phloem at the nodes, then further distributed into the shoot through both xylem and phloem streams. The transport of the organic nitrogen is greater to the upper leaves than to the lower leaves. On the other hand, most of the nitrate is transported from the root through the xylem stream to the shoot, where reduction takes place.

In soybean nodules, the $^{15}N_2$ feeding experiments clearly showed that most of the symbiotically fixed nitrogen was transferred to the cytosol following fixation. The fixed ammonia is first incorporated into glutamine, especially the amido-N group, and successively into glutamic acid by the GS/GOGAT system rather than GDH. Allantoin synthesis is carried out mainly in the cytosol in connection with the formation and decomposition of purine. Allantoin was found to be the characteristic compound involved in the transport of fixed nitrogen from the nodules to the shoots. A portion of the nitrate absorbed by the roots is transported in this manner. Asparagine is formed both from nitrogen sources and transported to the upper tissue of the plant. Symbiotically fixed nitrogen preferentially distributes to the developing organs, young leaves, and developing pods taking a direct pathway, compared with that from nitrate absorbed in the roots.

It should be noted that through the accomplishments of Dr. Kumazawa's work, not only the research in plant nutrition but also in nitrogen fertilization technology has been stimulated and developed remarkably.

Hisayuki MATSUO

Studies on Biologically Active Peptides Involved in Bio-communication: Especially on Structure and Function of Atrial Natriuretic Peptides

A complex network of peptidergic bio-communication is thought to function for maintaining homeostatic balance in living body. In order to clarify the subtle mechanisms of cell-to-cell communication through peptides in neuronal and hormonal systems, it is very important that still unknown bioactive peptides be discovered. For this purpose, Dr. Matsuo established his own methodology for the systematic survey and identification of the endogenous peptides in sub-nanomole level. Utilizing the methodology, he has isolated and identified more than 40 novel bioactive peptides in mammalian central nervous system. These include opioid peptides, hypothalamic releasing hormones, and a series of smooth-muscle stimulant peptides, desig-

nated "neuromedins".

Dr. Matsuo's most important contributions have been in the identification of "atrial natriuretic peptides (ANP)" in cardiac atrium of various mammals, such as human, rat, dog and rabbit. His works revealed that ANP is synthesized in and secreted from cardiac atrium to regulate the electrolyte balance and blood pressure. His research has emcompassed not only biochemical but also physiological characterization of the role of ANP in the cardiovascular regulation.

Furthermore, Dr. Matsuo has recently discovered in mammalian brain a series of new natriuretic peptides, designated "brain natriuretic peptides (BNP)", which are structurally very similar to but quite distinct from the known ANP.

Occurrence of BNP along with ANP in mammals strongly suggests the possibility that physiological functions so far thought to be mediated by ANP may be regulated through a dual mechanism involving both ANP and BNP. Thus, Dr. Matsuo's identification of the twin peptides of natriuretic activity has now lent a new dimension to cardiovascular as well as brain research.

PROCEEDINGS AT THE 830TH GENERAL MEETING

The 830th General Meeting of the Academy was held on Tuesday, June 13, 1989, at 1:05 p.m., Dr. Yoshitaro WAKIMURA, President, taking the chair. Eighty-seven members were present, and the following communications were made:

Über die Bestimmungen des Irrtums in dem Entwurf eines einheitlichen Gesetzes über die materielle Gültigkeit internationaler Kaufverträge über bewegliche Sachen . . . . . Tetsu ISOMURA, M. J. A.

Estimates for degenerate Schrödinger operators and an application for infinitely degenerate hypoelliptic operators . . Yoshinori MORIMOTO

On the inverse scattering on the line and the Darboux transformation . . . . . Mayumi OHMIYA

On convolution theorems . . . . . Shigeyoshi OWA

A sufficient condition for univalence and starlikeness . . . . . Mamoru NUNOKAWA

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

A general principle of increasing protein thermostability . . . . . Yuzuru SUZUKI

Communicated by Hisateru MITSUDA, M. J. A.

Effects of brassinosteroids on growth and yields of crops . . . . . Tetsuo TAKEMATSU and Yasutomo TAKEUCHI

Communicated by Masanao MATSUI, M. J. A.

A novel method for real-time structural monitoring of molecular beam epitaxy (MBE) processes . . . . . Masakazu AONO and Mitsuhiro KATAYAMA

Communicated by Ryukiti HASIGUTI, M. J. A.

Tetrataenite in chondritic meteorites . . . . . Takesi NAGATA, M. J. A., and Barbara J. CARLETON

Ordered grains produced by coalescence of Fe and Ni smoke grains . . . . . Chihiro KAITO and Yoshio SAITO

Communicated by Takesi NAGATA, M. J. A.

A note on irreducible representations of profinite nilpotent groups . . . . . Katsuya MIYAKE and Hans OPOLKA

Zonal spherical functions on the quantum homogeneous space $SU_q(n+1)/SU_q(n)$ . . . . . Masatoshi NOUMI, Hirofumi YAMADA, and Katsuhisa MIMACHI

Compactness criteria for an operator constraint in the Arkin-Levin variational problem . . . . . Toru MARUYAMA

Regular near-rings without non-zero nilpotent elements . . . . . Iwao YAKABE

A note on a recent paper of Iwasawa on the capitulation problem . . . . . R. W. K. ODONI

A note on capitulation problem for number fields. II . . . . . Kenkichi IWASAWA

Loop groups and related affine Lie algebras . . . . . Kiyokazu SUTO

A discrepancy problem with applications to linear recurrences. II . . . . . Péter KISS and Robert F. TICHY

The Galois representation of type E_8 arising from certain Mordell-Weil groups . . . . . Tetsuji SHIODA

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

Re-evaluation of Nikuradse's experimental data for rough pipes . . .

. . . . . Itiro TANI, M. J. A.
Isothermal compression and stability of perovskite-type $CaSiO_3$ . . .
. . . . . Takehiko
YAGI, Susumu KUSANAGI, Yoshihiko TSUCHIDA, and Yuh FUKAI
Communicated by Syun-iti AKIMOTO, M. J. A.
Spiral vector theory of AC circuit and machine . . . . . .
. . . . . Sakae YAMAMURA, 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. Taizo TAKAHASHI, M. J. A., had passed away on May 22, 1989. The members rose from their seats in silence, expressing profound sense of grief.

Next, Dr. Itiro TANI, M. J. A., paid a tribute of admiration to the late Dr. Takayuki SOMIYA'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, Shigemitsu DANDO, Tsutomu OUCHI, Takeo NAGAMIYA, Masao YOSHIKI, Naohide HIRATSUKA, and Kyosuke TSUDA.

The meeting adjourned at 5:05 p.m.

日本学士院紀要

平成元年六月　第六十五巻A　第六号

平成元年七月五日　印刷
平成元年七月八日　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

CONTENTS

(Continued from Front Cover)