

IN MEMORIAM

Professor Toshio Goto
April 24, 1929–August 29, 1990



It is with our deepest regret that we inform our readers of the unexpected death of Professor Toshio Goto, Laboratory of Organic Chemistry, School of Agriculture, Nagoya University, Japan. He died on August 29, 1990, at the age of 61.

Many readers are probably quite familiar with Professor Goto's pioneering work in natural product chemistry and bioorganic chemistry. His remarkable activities in this field include studies of the molecular association of flower pigments, bioluminescence, gangliosides, nucleosides, biotoxins, and steroids. He was graduated from the Department of Chemistry, Nagoya University, in 1954 under the guidance of Professor Yoshimasa Hirata and obtained a position as Research Assistant in this department. In 1957, Professor Goto joined the group of Professor Louis Fieser at Harvard University and spent 2 years working on the chemistry of steroids. He returned to Nagoya University, received his Ph.D. in 1960, and became an Associate Professor in the Hirata group in the next year. While there, he made major contributions to the structure elucidation of tetrodotoxin of fugu fish

and luciferin of umihotaru, a crustacean *Cypridina hilgendorfi*. He was promoted to Professor of Organic Chemistry, School of Agriculture, Nagoya University, and he expanded his studies on bioluminescence to various other marine organisms. He uncovered the luminescence mechanism of the luciferins and their analogs and designed artificially chemiluminescent substances with high quantum yields. He concluded the syntheses of modified nucleosides such as nucleoside Q, biotoxins, gangliosides, functionally complex natural products, and many others.

Recently, Professor Goto devoted most of his interest to the molecular association of flower pigments, to clarify why the blue color is emitted and how it is stabilized in the flower petals under almost neutral conditions. There had been over several decades many hypotheses such as copigmentation and metal chelation. From his studies on flower pigments over a period of 20 years Professor Goto concluded that there were four types of stabilization mechanisms of anthocyanin in aqueous solutions, namely: (i) self-association, (ii) copigmentation, (iii) intramolecular sandwich-type stacking, and (iv) metal chelation associated with self-association and copigmentation. The driving force of these stackings was determined to be mainly hydrophobic interactions between the aromatic nuclei surrounded by hydrophilic sugar moieties. This most complicated mechanism was elucidated through X-ray structure analysis of a commelinin analogue containing cadmium instead of magnesium in the natural deep blue petals of *Commelina communis*.

Professor Toshio Goto guided about 170 students and research fellows who had finished courses of Bachelor, Master, or Ph.D. or who had joined his group as postdoctorate or research associates into the chemistry societies in Japan, as well as outside this country. He published more than 340 original papers and many review articles with these collaborators. Professor Goto's creative works were acknowledged by his fellow scientists. He was honored by receiving the highest prizes from the Chemical Society of Japan and the Society of Synthetic Organic Chemistry Japan, Chunichi Cultural Prize, Naito Prize, Yamaji Prize, etc. He was a plenary and invited lecturer to several outstanding chemical meetings, such as IUPAC symposia, Gordon Research Conferences, Buelgenstock meeting, and meetings of Chemical Societies of Japan, United States, China, and others. He was one of the regional editors of *Tetrahedron* and *Journal of Bioluminescence and Chemiluminescence* and, of course, was on the advisory board of this Journal. He was the vice-chairman of the organizing committee of the 32th IUPAC International Symposium on Natural Products Chemistry (Kyoto). His contributions to the chemical societies inside and outside Japan were prominent.

To rid natural product chemistry of its rather static nature, Professor Goto proposed that it be considered much more dynamically, creating a new field "Doteki Tennenbutsu Kagaku" (dynamic aspects of natural product chemistry). The focus of this new field is how organic molecules recognize the molecular structures of each other when they exhibit biological activities in living systems. His idea was appreciated and became one of the largest scientific projects supported by the Ministry of Education, Science and Culture of Japan. Approximately 70 scientists were invited to develop this field, and the project, to span a period of 3 years, was begun in April 1990 under the leadership of Professor Goto. The symbolic mark of this project was taken from the commelinin molecule.

The death of Professor Goto is a great loss to the field of natural product chemistry and organic chemistry. The Editors, the members of the Editorial Board, and the readers of this Journal mourn the passing of Professor Toshio Goto.

TERUO MATSUURA
Ryukoku University