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'Perspectives in Chemistry and Chemical Biology'

A Symposium Celebrating Prof. A. Eschenmoser's Contributions to Chemistry on the Occasion of the Spring Meeting 2000 of the New Swiss Chemical Society (NSCS)

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The first meeting of the New Swiss Chemical Society in this millennium was a birthday present for one of our most prominent and esteemed members, *Albert Eschenmoser*, who will soon celebrate his seventy-fifth birthday. The meeting was held at the ETH Zurich (March 27th and 28th, 2000) in the form of a symposium entitled 'Perspectives in Chemistry and Chemical Biology'. This event gathered some of the most successful and creative chemists of our time for two days of presentations honoring the achievements of Professor Eschenmoser.

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Photo: R. Hüfliger

A. Eschenmoser

The meeting opened with a warm welcome from *H.L. Senti*, President of the NSCS, who was clearly gratified by this auspicious event. *Donald Hilvert* (ETH Zürich) then summarized the life work of Albert Eschenmoser, which has encompassed investigations of the chemistry and biosynthesis of terpenes and steroids, insightful mechanistic studies of many fundamental chemical transformations, synthesis of complex natural products (including, notably, vitamin B12 in collaboration with the late R.B. Woodward!), and important contributions to prebiotic chemistry. By his keen intellect and through a deep understanding of chemical reactivity, Professor Eschenmoser has greatly influenced modern organic chemistry. Moreover, he has been a great and charismatic teacher, inspiring generations of chemists with his perspectives on science.

The lecture portion of the symposium was opened by *M. Eigen* (MPI für Bio-

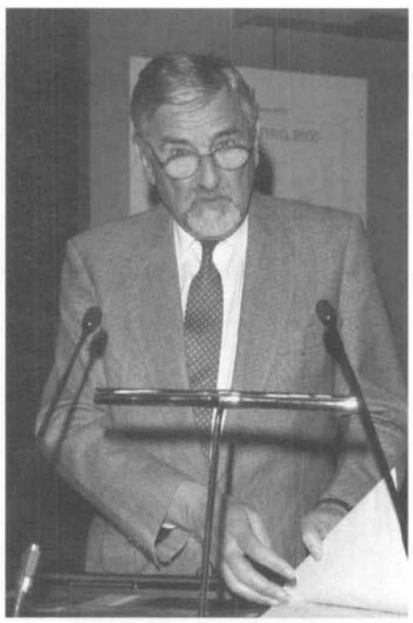

Photo: R. Häfliger

H.L. Senti

physikalische Chemie, Göttingen) on the topic 'Molecular Diagnostics'. Professor Eigen demonstrated how the problem of detecting 'a single molecule among many other molecules' has led to the development of new analytical tools with potentially vast applications. Examples of such applications range from detection of tiny concentrations of virus, sequencing of single DNA molecules, and early diagnosis of the prion-induced Creutzfeld-Jacob disease. Development of these methods was made possible through successful integration of chemistry, physics and biology.

Photo: R. Häfliger

M. Eigen

The second lecture, entitled 'Ribonucleotide Reductases: New Horizons', was offered by *J. Stubbe* (MIT, Cambridge). Professor Stubbe has investigated these proteins for many years, and her pioneering contributions have enabled deeper understanding of their fascinating mode of action. The ribonucleotide reductase-catalyzed deoxygenation of ribonucleotides is a premier example of a biological process occurring *via* radical intermediates, whose reaction cascades are so complex that their study is difficult. Impressively, Professor Stubbe demonstrated that methods related to organic chemistry, molecular biology, biochemistry and spectroscopy allow characterization and quantification of exotic intermediates, short-lived excited states and long-distance electron transfer processes.

Photo: R. Häfliger

J. Stubbe

After lunch and the NSCS general assembly, the scientific program continued with a lecture presented by *J. Rebek, Jr.* (The Scripps Research Institute, La Jolla). In 'Molecular Assembly and Encapsulation', Professor Rebek demonstrated a straightforward approach to the creation of tennis or softball-shaped molecules by self-assembly of appropriate building blocks. A variety of such structures, offering cavities of different shape and size, are able to encapsulate guest-molecules and, therefore, can serve as reaction chambers. While some entropy-driven reactions are significantly accelerated by encapsulation, others are prevented. Development of cavities with 'increasing asymmetry' bears the attractive potential of enantioselective recognition and product formation.

Photo: R. Häfliger

J. Rebek, Jr.

The first day of the symposium was brought to a close by *G.F. Joyce* (The Scripps Research Institute, La Jolla) who presented surprising results from his latest work on 'The Influence of Chemical Diversity on the Evolution of Catalytic Function'. In contrast to proteins consisting of twenty amino acids, catalytically active ribozymes consist of only four nucleosides which, additionally, contain but a very limited number of functional groups. Professor Joyce has succeeded in selecting and creating catalytically active ribozymes with additional or fewer functional groups, respectively. On the one hand, these studies demonstrate that the presence of additional functional groups results in catalytically more active and/or smaller ribozymes. On the other hand, catalytic activity can be achieved with ribozymes consisting of 2'-deoxyribonucleotides or even of only three ribonucleotides. These experiments beautifully illustrate the catalytic potential of nucleic acid-related compounds.

The second day of the symposium was opened by 'local matador' *D. Seebach* (ETH Zürich) who presented his latest achievements under the title 'The Brave New World of β-Peptides'. This exciting lecture revealed that peptides assembled from β-amino acids are structurally organized by secondary structure elements such as helices and sheets. These elements are significantly more stable

Photo: R. Häfliger

G.F. Joyce

than those found in the corresponding natural analogues, β-amino acids. Moreover, a greater variety of peptide conformations can be accessed simply by varying the substitution pattern within the constituent β-amino acids. This novel class of molecules is stable towards peptidases and has an enormous number of potential applications, ranging from new pharmaceuticals to new materials and new catalysts. 'Homologation of amino acids does not cause chaos but increases structural order in peptides', stated Professor Seebach. In this context, a β-peptide inhibiting the uptake of cholesterol has already been found.

The second lecture of the day was held by *P.G. Schultz* (Novartis Institute for Functional Genomics and The Scripps Research Institute, La Jolla). It provided an excellent overview of numerous research activities. As suggested by the title 'Generating New Molecular Function: A Lesson from the Immune System', the research program of Professor Schultz is directed toward the study of molecular function and the creation of functional molecules. This focus was illustrated by pioneering contributions to the development of catalytic antibodies and by methods for incorporating unnatural amino acids into proteins. Also presented were new base pairs based on hydrophobic interactions, a theory about the molecular basis of the aging process, novel strategies for the creation of pharmaceuticals by combinatorial substitution of purines, and automated procedures for screening libraries and growing single crystals.

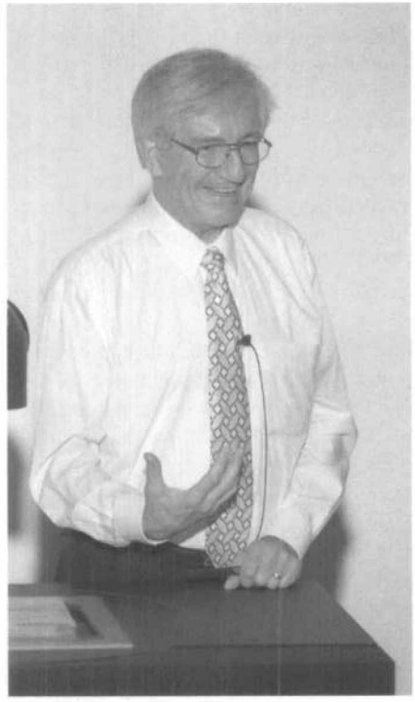

Photo: R. Häfliger

D. Seebach

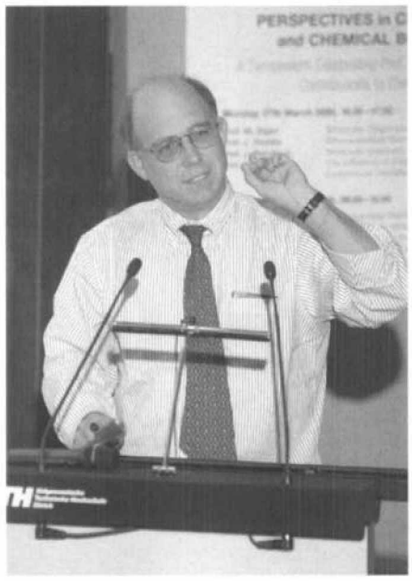

Photo: R. Häfliger

P.G. Schultz

The symposium's final lecture bore the title 'Meso-Scale Self-Assembly', and was presented by *G.M. Whitesides* (Harvard University, Cambridge). After an amusing and deeply felt introductory address to Professor Eschenmoser, Professor Whitesides described a study in which 'no molecules' were manipulated. Instead of atoms and molecules, small, sophisticated units were used to create organized, complex structures by self-assembly. Instead of chemical bonds, capillary forces or 'sticky edges' cause adhesion of these particles. These concepts clearly demonstrate fundamental principles of chemistry and may be successfully used in teaching. As Whitesides pointed out, applications of these small self-organizing structures also extend to miniature electronic devices.

Photo: R. Häfliger

G.M. Whitesides

Following this series of exciting lectures, *C. Leumann* (University of Bern) addressed a few personal words to his teacher Albert Eschenmoser. Lastly, in the symposium's final speech, *Professor Eschenmoser* himself thanked all lecturers individually for their outstanding contributions to science today. Expressing himself moved by this celebratory event, Professor Eschenmoser referred to the participants' research as 'evolutionary chemistry'.

In summary, the New Swiss Chemical Society Spring meeting 2000 presented a most stimulating symposium reflecting some of the latest approaches and directions in chemistry. Overall, this event made a very strong statement on the importance of inderdisciplinary research. *Donald Hilvert* (ETH Zürich) and *Christian Leumann* (University of Bern) are to be acknowledged and thanked for organizing a most successful meeting. In closing, we send you, dear Professor Eschenmoser, all sincere best wishes in your anniversary year. We are very much looking forward to many continued achievements in chemistry and chemical biology.

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