

# CONFERENCE REPORTS

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## 30th Euechem Stereochemistry Conference Bürgenstock, April 30–May 6, 1995

The 30th anniversary of the Euechem Stereochemistry Conference was celebrated not with many words or social activities, but with an excellent scientific program that covered almost the entire range of modern Organic Chemistry. The international participants, from both academic and industrial laboratories were pleased to have *André Dreiding* (Universität Zürich), the driving force and also President of the first Bürgenstock Conference in 1965 as guest-of-honor; he initiated a tradition, that surely belongs among the most outstanding meeting points of organic chemists in the world.

The generosity of both the European and the Swiss National Science Foundations permitted the invitation also of 16 young European chemists to participate in the Conference.

On the first evening, *Helmut Schwarz* (Technische Universität Berlin) welcomed us as Conference President with an enthusiastic speech which gave an overview of the excellent program he had arranged. At this occasion, he also mentioned what was thought to be a rule of the Conference but which became its running joke, namely, that each speaker was allowed to talk one hour, *plus a few femtoseconds...*

The first day was devoted to the topic of electron transfer and thus, the opening lecture given by *M.A. Fox* (University of Texas) and entitled 'Synthetic Polymers for Directional Electron Transfer', dealt with the possibility of achieving energetic gradients, charge separations and consequently electron transfer by use of carefully substituted polymers, anisotropic liquid crystals and

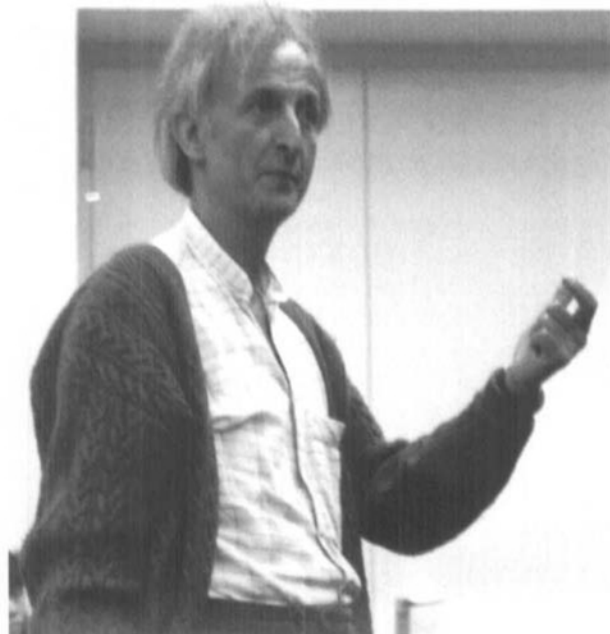
modified oligopeptides. She presented a large range of different synthetic approaches to obtain systems that could function as photocells, organic semiconductors or information storage devices.

The creation of chemical devices was also the subject of the second lecture, presented by *I. Willner* (Hebrew University, Jerusalem). In his experiments light is used to trigger (reversible) constitutional changes in organic molecules or reconstituted enzymes that interact with molecules on gold surfaces – the result is *e.g.* a different amperometric response. These systems allow the realization of photoimaging, electric communication, and artificial photosynthetic cycles and are a dramatic example, of how the manipulation of biomolecules can create new functions.

The evening lecture of the first day was presented by *M.N. Paddon-Row* (University of New South Wales, Australia) who demonstrated what he announced provocatively: 'The Character of Long-Range Intramolecular Electron Transfer – to be or not to be? That was the Question!' In order to do so, he synthesized in an elegant way a number of rigid organic molecules of different lengths and constitutions – but containing single bonds only – and observed quite efficient electron transfer occurring from one end of the molecule to the other. This work provides important knowledge for the understanding of intramolecular redox processes and *e.g.* for the construction of molecular devices.

The two morning lecturers of the second day showed in exciting presentations what elegant structural motives Nature uses and how thrilling it can be to discover them. *T.A. Steitz* (Yale University) found by means of X-ray crystallographic techniques what seems to be a common feature in phosphoryltransfer reactions catalyzed by nucleases and polymerases, namely the presence of two divalent metal-ions in the active site both acting as *Lewis* acids. One of them activates the phosphate group for nucleophilic attack and the second stabilizes the leaving group. The high-resolution structures of nuclease-template-primer complexes he has shown seem to hold promise in developing strategies that interfere with protein biosynthesis at the level of transcription.

Modern NMR spectroscopy, the other main analytical tool to deduce the structure of biopolymers, was used by *P.B. Moore* (Yale University) to uncover new structural motifs and hitherto unknown modes of base



H. Schwarz (*the President*)



M.N. Paddon-Row



M.A. Fox



G. Ertl



R.G. Bergman



P. Chen



B.K. Sharpless



K. Müller

pairing in loop regions of ribonucleic acids. His results show again the multitude of structural motifs in RNA. As he said in the introduction to his lecture: RNA is an exciting class of molecules, not much structural work has thus far been carried out, but all work will be important and interesting!

The second day's evening lecture was presented by *R.W. Hoffmann* (Philipps-Universität Marburg, Germany) and was entitled 'Flexible Molecules with Defined Shape'. In spite of their aliphatic nature, these molecules should have a high preference for one or a limited set of conformations and hence could act as building blocks for the construction of molecules with predictable spatial alignment. He is approaching this goal by introducing substituents (e.g. methyl groups) along the backbone that restrict free rotation due to steric interactions.

The third day of the meeting began with an impressive lecture by *G. Ertl* (Fritz Haber Institut, Germany) who showed us how complex kinetic systems can operate in surface reactions and how you can take im-

ages, even video of continuous concentration changes on such surfaces, revealing patterns of a great aesthetic appeal.

*M. McBride* (Yale University) presented to us his studies of the 'Low Temperature Decomposition of Crystalline High Explosives'. He was able to identify some primary products of the reactions occurring after subsequent photolysis and thermolysis of commercial explosives in the solid state. He even distinguished between molecules and radicals of different position within the crystals (showing consequently different spectroscopic features) and thereby introduced the concept of 'position isomerism'.

Following tradition, no lecture was given on Wednesday evening but we instead relaxed by enjoying compositions by *Mozart* and *Schubert*. This wonderful concert was again selected by our President.

The next day was devoted to the marvellous things that metals do in interaction with organic molecules. *E.C. Constable* (Universität Basel) demonstrated how to wind organic molecules around metal ions thus

creating helical, supramolecular structures that eventually will lead to the synthesis of new materials.

*R.G. Bergman* (University of California, Berkeley) presented us metallo-organic complexes, which insert so effectively into nonactivated CH bonds that only noble gases can be used as solvents. A great scope of potential applications were presented together with many kinetical studies, but he reminded us that these metal complexes can (unfortunately) not be used in a catalytic way so far.

In his lecture, *S.J. Lippard* (Massachusetts Institute of Technology) showed highly resolved X-ray structures of an enzyme that catalyzes the oxidation of methane in some bacteria that utilize it as their only energy source. The active site of this huge enzyme complex contains two iron-centers connected by two water molecules. He discussed possible mechanisms for the transport of methane to the active site and in great detail of what the active center of the oxidized form of the enzyme might look like.

The last day of the Conference

began with a lecture by *P. Chen* (ETH-Zürich) who demonstrated how powerful the combination of computational methods and experimental measurements can be in order to understand the reactivity of even highly activated organic molecules. His research determines the calorimetric data of carbenes, radicals, and diradicals by fitting the data obtained from experiments in custom-built spectrometers with the qualitative spectra he gets from quantum calculations. His interest in 1,4-biradicals points towards improvement of the enediyne antitumor antibiotics as pharmaceuticals by understanding how substitution around the central unit affects the reactivity of the activated intermediate.

*J. Michl* (University of Colorado, Boulder) continued with a lecture entitled 'The Molecular Construction Kit Approach to Covalent Thin-Layer Materials'. Drawing an analogy to 'Lego' he has sought to develop molecules that serve as common building blocks for the synthesis of defined two-dimensional polymers on surfaces. He also intends to substitute his networks with mi-

cromechanical devices and construct e.g. a nano-turbine that is driven by a gas-flow.

The last lecture of this conference was given by *B.K. Sharpless* (The Scripps Research Institute). He confronted us with the enormous possibilities his catalytic, enantioselective dihydroxylation reaction has and presented examples that ranged from

the high yielding enantio- and diastereoselective five-fold dihydroxylation of squalene, to the construction of chiral dendrimers and even the optical resolution of  $C_{70}$  by selective destruction of one enantiomer. Expanding his 'few femto-seconds' to about half an hour, he showed us the course of the development of the catalyst and present-

ed some mechanical aspects of this very important and useful reaction.

The Bürgenstock Conference of 1995 was closed by *K. Müller* (F. Hoffmann-La Roche AG, Basel) who traditionally summarized all lectures in his own unique way and also introduced *F. Diederich* (ETH-Zürich) as President of the next Sym-

posium to take place from April 28th to May 4th next year – again at the same, wonderful location and with a similarly extraordinary scientific program guaranteed.

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## CHiral2-Workshop, Gwatt, 29./30. März 1995

CHiral2 ist, nach Supra2, die zweite, im April 1993 gestartete thematische Forschungsinitiative, mit welcher die Abteilung II des Schweizerischen Nationalfonds einem durch seine Aktualität herausragenden Forschungsbereich, in diesem Fall der Forschung auf dem Gebiet chiraler Systeme, zusätzliche Impulse verleihen möchte. Dabei sollen neue Forschungsunternehmen initiiert, bestehende gefördert und Nachwuchsforschern ein Einstieg in das Gebiet erleichtert werden.

Chiralitätsforschung hat in der Schweiz Tradition, und durch diese thematische Forschungsinitiative sind vorwiegend, wenn auch nicht ausschliesslich, die Chemiker der schweizerischen Hochschulen angesprochen. Dennoch war es von Beginn weg erklärtes Ziel der Initianten, auch die industrielle Forschung auf dem Gebiet chiraler Verbindungen in einer geeigneten Form in die Aktion miteinzubeziehen. Dies kam auch im zweiten der jährlich durchgeführten Workshops, welcher am 29./30. März im Zentrum Gwatt stattfand, zum Ausdruck. In einem der drei Gastvorträge gab Herr Dr. *R. Schmid* von *F. Hoffmann-La Roche AG* einen Einblick in die Bedeutung und die Problematik der industriellen Herstellung enantiomerenreiner Verbindungen. Sein Thema: 'Asymmetric Hydrogenation in Process Research of Pharmaceuticals, Vitamins, and Fine Chemicals'. Wie weit der Bereich der Chiralität reichen kann zeigte Prof. *H.-G. Kubal* von der Universität Kaiserslautern im zweiten Gastvortrag: 'From Chiral Molecules to the Cholesteric Phase – Intra- and Intermolecular Chirality Transfer'. Im dritten Vortrag

schliesslich gab Prof. *I. Patterson* von der University of Cambridge einen eindrucklichen Einblick in die hohe Kunst der selektiven Synthese komplexer Naturstoffe: 'Asymmetric Synthesis of Bioactive Marine Natural Products Using Sterecontrolled Aldol Reactions'.

Hauptziel des Workshops aber war die Bestandesaufnahme der Fortschritte, welche in den zur Zeit im Rahmen von CHiral2 laufenden 29 Projekten erzielt wurden. 23 Kurzvorträge und ebensoviele Posterbeiträge gaben darüber Rechenschaft. Dabei dürften diese Beiträge wohl nicht nur für die im Rahmen von CHiral2 geförderten Arbeiten, sondern für den gesamten Bereich der Chiralitätsforschung in der Schweiz repräsentativ sein.

Zwei Feststellungen drängen sich auf. Einerseits ist unverkennbar, dass die Forschungsinitiative des Nationalfonds zur Durchführung von Projekten verholfen hat, die sonst nicht, oder nur in reduziertem Masse hätten realisiert werden können. Andererseits lassen sich, ohne dabei eigentliche Highlights herausgreifen zu wollen, deutlich die Forschungslinien erkennen, welche die Chiralitätsforschung in der Schweiz auch in Zukunft verfolgen wird. Dass dabei eine produktorientierte Sicht grosses Gewicht hat, ist nicht erstaunlich. Diese ist aber sehr breit gefächert und reicht von der hochspezifischen Synthese komplexer Verbindungen bis zur kostengünstigen Verfügbarkeit einfacher chiraler Moleküle, dem chiralen Pool. Dabei ist natürlich die Entwicklung neuer katalytischer Systeme und das Verständnis ihrer Wirkungsweise von ungebrochener Aktualität. Neu

ist dabei, dass auch radikalische Reagenzien stereoselektiv reagieren können und dass heterogene Katalysatoren wieder vermehrt Interesse finden.

Neben diesen eher klassischen Bereichen der Chiralitätsforschung ist es interessant festzustellen, wie sich das Interesse vermehrt dem Problem der Chiralitätsübertragung vom einfachen Molekül auf Makromoleküle, auf supramolekulare Verbände und auf ganze chemische Systeme wendet. Mehrere Beiträge haben deutlich gemacht, wie sehr sich gerade auf diesem Gebiet die traditionellen Grenzen zwischen Koordinationschemie, organischer Synthetik und Molekularbiologie verwischen. Hier erfüllt die thematische Forschungsinitiative eine besonders wichtige Funktion, indem sie deutlich macht, wie entscheidend ein fachübergreifendes Verständnis sein kann, wenn nicht mehr Fragestellungen der atomaren Zusammensetzung, sondern solche struktureller Eigenschaften im Vordergrund stehen. Diese Tendenz dürfte sich in Zukunft weiterhin verstärken, einerseits auf Grund der Entwicklung neuer analytischer Techniken, die sich auch im Bereich der Chiralität einer molekularen Auflösung nähern, und andererseits durch die zunehmende Verfeinerung der Methoden zur theoretischen Modellierung chemischer Systeme.

CHiral2 ist kein Mittel zur Forschungsprogrammierung. Der Workshop hat gezeigt, dass die thematische Forschungsinitiative – ein Förderungsinstrument, welches der Nationalfonds auch in Zukunft nur sehr zurückhaltend einzusetzen gedenkt – einen Rahmen bildet, in

welchem die interessierten Forscher selbst die Themen gestalten und so dazu beitragen, in einem zukunftsorientierten Bereich ein Forschungspotential zu erhalten und zu erweitern, mit dem Ziel, die Stellung des Forschungsplatzes Schweiz in diesem Bereich auch weiterhin, und in einer verschärften Konkurrenzsituation, zu behaupten.

Am 1. Oktober tritt CHiral2 in die dritte Phase, welche vorwiegend der Konsolidierung und der Detailausarbeitung der bisher erzielten Ergebnisse dienen soll. Neue Projekte sollen nur noch in beschränktem Ausmass aufgenommen werden. Nach Abschluss der laufenden Projekte soll in einem zusammenfassenden Bericht aufgezeigt werden, was erreicht werden konnte und wie das Erreichte für eine weiterführende Forschung auf dem Gebiet der Chiralität fruchtbar gemacht werden kann.

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(Mitglied der Expertengruppe  
CHiral2)