Preface

Reasoning in terms of molecular recognition may be traced back to Emil Fischer, who practiced the art of chemistry at Humboldt University in Prussian Berlin a century ago. He was a man of seminal vision when he postulated in 1894 that enzymes recognize their substrates according to the lock-and-key principle. I am quite convinced that he was fully aware of the future impact of this principle, which he enunciated far ahead of its time. It was actually ignored for almost 30 years before being rediscovered by others and given its rightfully important stature and influence. My conviction is based on the unique instinct of Fischer in many other matters; remember that he correctly predicted the absolute configuration of D-glyceraldehyde and thus of the carbohydrates 50 years before the Bijvoet X-ray structure of the sodium-rubidium salt of (+)-tartaric acid was elucidated.

Today, it is clearly recognized that molecular recognition impacts and determines all life processes. It has become a key research field in both chemistry and biology and the emerging interface of what now is being called "chemical biology."

When browsing through the December 1997 issue of *Angew. Chem.*, for example, 22 out of 43 contributions could be classified as dealing with various aspects of supramolecular chemistry and molecular recognition. This is representative for all major journals such as *Chem. Commun.*, *Angew. Chem.*, *J. Am. Chem. Soc.*, and, when including biomolecular recognition, it is to a large extent also true for *Nature* and *Science*.

Molecular recognition research pursues the atomistic understanding of individual intermolecular interactions in molecular complexes and

The Participants of the workshop

large assemblies of chemical or biological small macromolecules. The technological advances derived from this knowledge are particularly important, diverse, and directly evident in the pharmaceutical industry in areas such as:

- Rational, X-ray, or NMR structure-based drug design and lead optimization.
- Identification through genomics, of well-defined enzymes and receptors as future targets for drug discovery. It will be increasingly relevant, given the extremely large number of possible targets opened up by genomics (e.g., more than 1500 protein kinases alone) to rapidly identify "well-behaved" future targets, such as those that bind their substrates in strongly concave/convex relationships and not based on large protein surface interactions.
- Antisense technology and DNA binding and cleavage towards controlling gene expression are ambitious yet equally important targets in the pharmaceutical and biotech industry as is increasingly the search for rational interfering though small molecules with protein-saccharide recognition.

- Biological transport and bioavailability are important processes that depend on intermolecular interactions and the partitioning of small molecules between various biotissues and require enhanced molecular understanding.
- Bulk chemical production will need more efficient, economic and ecologically balanced synthetic methods. Basically all chemical conversions should be made catalytic and, if needed, stereoselective. The development of stereoselective synthesis and asymmetric catalysis increasingly sees principles of molecular recognition applied to the design of more efficient reagents, catalysts, and templates.

Under the auspices of the Ernst Schering Research Foundation, a 2-day workshop held in Berlin in February 1998 entitled "Recent Trends in Molecular Recognition" addressed novel basic developments of potential relevance to drug research efforts in the pharmaceutical industry. Eleven lectures delivered during this event by a multidisciplinary international panel of renowned scholars are documented in this volume. Although a workshop of this size cannot touch upon all the facets of the subject, readers of this monograph will find a balanced coverage of timely research topics in molecular recognition.

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