Preface

Until 25 years ago it was thought that proteins were the only macromolecular catalysts in the cell. The discovery that RNA could also act in this role was a great paradigm shift in molecular biology. This had important implications for thinking about how life emerged on the planet, supplying one of the prerequisites of the hypothetical RNA world. And while it initially seemed that ribozymes were confined to some relatively obscure corners of biology, we now know that this was not true at all. Some extremely important cellular reactions such as the condensation of amino acids to form polypeptides and probably the splicing of mRNA are catalysed by RNA molecules. So far from being confined to a few reactions in some slimy pond-dwellers and the like, catalytic RNA is very important in biology generally.

RNA catalysis also threw down a fascinating challenge to the biological chemist. Proteins have all the advantages as catalysts – decorated with chemically contrasting side chains that make them Nature's chemistry set. By comparison, RNA is chemically much less adventurous, yet ribozymes perform some impressive feats of catalysis. So just what are the mechanistic origins of chemical catalysis in ribozymes? That is the essence of this volume.

It is ten years since we edited a volume on essentially the same topic. In that time huge advances have been made. The atomic structures of most ribozymes have been determined over this period, and we know much more about the folding of these species. But at the same time our mechanistic understanding of ribozymes has advanced greatly, providing insight into the origins of catalysis. This can never reach a final conclusion. Probably no protein enzyme can be said to be totally understood, and chemists have been studying these for much longer. But some consensus on general mechanisms of RNA catalysis is now developing, and thus it is a good moment to review the area again.

To do this we have assembled a list of authors who are unquestionably the world leaders in each topic. They have provided a comprehensive view of ribozyme mechanism at this time. In each case these present the personal viewpoint of the authors. Of course the subject will develop further, and some things will change. Some aspects may prove to be wrong in time. But we believe that most of the general principles will survive. We are indebted to our authors who have written a wonderful set of reviews, both clear and authoritative. Finally, we are very pleased that Tom Cech has written the Foreword to this volume, providing some historical perspective – so appropriately since he started us on this journey 25 years ago.

We hope this volume will serve as a resource for the RNA community, and an inspiration for the next generation of scientists who will go on to take this fascinating field further.

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