PREFACE

This book is focussed on the lipid membrane, since that structure is a key component of the way that living cells are able to maintain and organise their functions. Unlocking the secrets of those membranes provides important lessons that are valuable in guiding the construction of devices to be used for medical applications. That philosophy is a central theme for scientists and engineers working in the field of biomimetics. Indeed, throughout this book we emphasise that approach in order to define the discipline of nanobiotechnology.

We define nanobiotechnology to be an interdisciplinary field of research and development that integrates engineering, physical sciences, and biology through the development of very small physical and biological devices using biomimetically inspired nano-fabrication techniques. In that sense, biomimetically-inspired means that the fabrication processes are based on the way the natural systems are constructed, usually by self-assembly of molecules in an aqueous environment.

That approach is often termed bionanotechnology, rather than nanobiotechnology. However, it is more appropriate to term the discipline that we support in the pages of this book as being nanobiotechnology. We emphasise that a significant research outcome is to exploit an understanding of biological processes in order to guide and influence the creation of devices and processes for use in biomedical applications, and this is usually defined as biotechnology. The nano prefix is necessary to accurately describe the scale of the manipulations required of the proteins, lipids and other molecules in order to create those biomedical devices and processes.

We have not broadly included the myriad of aspects of nanobiotechnology that are often included in other books that describe this discipline. We deliberately focus on the lipid membrane due to its importance in the function of the natural cells of the living organisms. Indeed, the targets of the majority of drugs and pharmaceuticals are membrane-incorporated proteins. That targeting is not by chance, since nature utilises the membrane and membrane-incorporated proteins as key components in maintaining organisation and function in the body. The separation and compartmentalisation of electrolyte concentrations within the body is maintained by the lipid membranes

and the membrane-incorporated proteins. Amongst other vital functions, that separation of electrolyte concentrations provides the electrochemical driving force for propagation of electrical "action potential" signalling in nerves and muscles. Biomedical devices based around biomimetic lipid membranes will allow improved biocompatibility and connection of the devices with the natural cells of living organisms. Perhaps the practical realisation of Drexler's robots will not be built from metal and plastic, but rather from biomimetic components utilising the principles of lipid membrane nanobiotechnology described in this book.

The book develops the principles of membrane nanobiotechnology by discussing methods to produce lipid membranes, methods of characterising lipid membranes, and the application of membranes to produce biosensors. We have addressed those topics in some depth in order to produce a reference book that is useful for researchers and senior undergraduates. The chapters have been written by friends and colleagues who are expert in the disciplines of physics, engineering, chemistry, and biology. Nanobiotechnology is the interdisciplinary glue that unites us, and I am indebted to those friends and colleagues who have generously and enthusiastically contributed the ideas and concepts described within the pages of this book. On many occasions they have forgiven my indulgences with time.

I must extend a special acknowledgement to the International Science Linkages program under the Australian government's innovation statement Backing Australia's Ability. That program had the foresight to fund the $OzNano_2Life$ program (*www.ambafrance-au.org/oznano2life*) which has provided the international collegiality and "glue-funding" that has allowed nanobiotechnology research programs to flourish between Australian and international laboratories. That program of research-without-borders has been assisted significantly by the support of the Embassy of France in Australia, and notably by successive Science Attachés, M. Alain Moulet, and Professor Robert Farhi.

Donald K. Martin
Sydney, Australia
August, 2006

http://www.springer.com/978-0-387-37738-4

Nanobiotechnology of Biomimetic Membranes
Martin, D. (Ed.)
2007, XII, 174 p., Hardcover
ISBN: 978-0-387-37738-4