Preface

Recognition receptors play a key role in the successful implementation of chemical and biosensors. Molecular recognition refers to non-covalent specific binding between molecules, one of which is typically a macromolecule or a molecular assembly, and the other is the target molecule (ligand or analyte). Biomolecular recognition is typically driven by many weak interactions such as hydrogen bonding, metal coordination, hydrophobic forces, van der Waals forces, pi-pi interactions and electrostatic interaction (due to permanent charges, dipoles, and quadrupoles) the polarization of charge distributions by the interaction partner leading to induction and dispersion forces, and Pauli-exclusion-principle-derived inter-atomic repulsion, and a strong, "attractive" force arising largely from the entropy of the solvent and termed the hydrophobic effect. In recent years, there has been much progress in understanding the forces that drive the formation of such complexes, and how these forces are relate to the physical properties of the interacting molecules and their environment allows rational design of molecules and materials that interact in specific and desired ways.

This book presents a significant and up-to-date review of the various recognition elements, their immobilization, characterization techniques by a panel of distinguished scientists. This work is a comprehensive approach to the recognition receptors area presenting a thorough knowledge of the subject and an effective integration of these receptors on sensor surfaces in order to appropriately convey the state-of the-art fundamentals and applications of the most innovative approaches.

This book is comprized of 21 chapters written by 32 researchers who are actively working in USA, Canada, France, Switzerland, Ireland, Germany, Spain, Italy and the United Kingdom. The authors were requested to adopt a pedagogical tone in order to accommodate the needs of novice researchers such as graduate students and post-doctoral scholars as well as of established researchers seeking new avenues. This has resulted in duplication of some material, which we have chosen to retain, because we know that many readers will pick only a specific chapter to read at a certain time.

We have divided this book into four sections. The first part comprises three chapters, which are devoted to introduce biomolecular recognition, surface sensitization and recognition receptors immobilization, and an overview of the analytical tools, which can be used for surface characterization. The second part (chapters 4–11) describe the different natural recognition receptors (enzymes, antibodies, cells, tissues, plants tissue, peptides, Carbohydrates, Nucelic acid and bacteriophages) used in biosensors. It covers the theory behind each technique and delivers a detailed state-of-the-art review for all the new technologies used. The third part (chapters 12–20) covers the recognition receptors which can be prepared and engineered by human to mimic natural molecules and used up to date in biosensors and microarrays arena. It describes in detail the use of engineered antibodies, genetically engineered proteins, genetically engineered cells, Photosynthetic proteins, oligonucleotides, aptamers, phage display, molecularly imprinted polymers and biomemetic as recognition elements. The fourth part contains one Chapter which covers briefly the kinetics and thermodynamics of association/dissociation of analytes to the recognition receptors.

This book is intended to be a primary source both on fundamental and practical information of where the recognition receptors area is now and where it is headed in the future. We anticipate that the book will be helpful to academics, practitioners and professionals working in various fields; to name a few biologist, biotechnologists, biochemists, analytical chemists, biomedical, physical, microsystems engineering, nanotechnology, veterinary science, medicine, food QA, bioterrorism and security. As well as allied health, healthcare and surveillance. Since the fundamentals were also reviewed, we believe that the book will appeal to advanced undergraduate and graduate students who study in areas related to chemical and biosensors.

We gratefully acknowledge all authors for their participation and contributions, which made this book a reality. We give many thanks to Olivier Laczka and Joseph Piliero for the book cover design. Last, but not least, I thank my family for their patience and enthusiastic support of this project.

May 2009 Mohammed Zourob