Preface

Biomarkers are indicators of disease occurrence and progression. Biomarkers can be used to predict clinical responses to treatments, and in some cases they may represent potential drug targets. Biomarkers can be derived from solid tissues and bio-fluids. Also they can refer to non-molecular risk or clinical factors, such as life-style information and physiological signals. Different types of biomarkers have been used in clinical practice to detect disease and predict clinical outcomes.

Advanced laboratory instruments and computing systems developed to decipher the structure and function of genes, proteins and other substances in the human body offer a great variety of imperfect yet potentially useful data. Such data can be used to describe systems and processes with diverse degrees of accuracy and uncertainty. These limitations and the complexity of biomedical problems represent natural obstacles to the idea of bringing new knowledge from the laboratory to the bedside.

The greatest challenge in biomarker discovery is not the discovery of powerful predictors of disease. Nor is it the design of sophisticated algorithms and tools. The greatest test is to demonstrate its potential relevance in a clinical setting. This requires strong evidence of improvements in the health or quality of life of patients. This also means that potential biomarkers should stand the challenge of independent validations and reproducibility of results.

Advances in this area have traditionally been driven at the intersection of the medical and biological sciences. Nevertheless, it is evident that current and future progress will also depend on the combination of skills and resources originating from the physical and computational sciences and engineering. In particular, bioinformatics and computational biology have the mission to bring new capacities and possibilities to understand and solve problems.

The promise of new advances based on the synergy of these disciplines will also depend on the growth and maturation of a new generation of researchers, managers and policy makers. This will be accomplished only through new and diverse training opportunities, ranging from pre-college, through undergraduate and post-graduate, to post-doctoral and life-long education.

One of the crucial challenges for bioinformaticians and computational biologists is the need to continuously accumulate a great diversity of knowledge and skills. Moreover, despite the fact that almost everyone in the clinical and biological sciences would agree on the importance of computational research in translational biomedical research, there are still major socio-cultural obstacles that must be overcome. Such obstacles mirror the complexity and speed of unprecedented changes in technology, scientific culture and human relations.

Bioinformaticians and computational biologists have a mission that goes beyond the provision of technical support or the implementation of standard computing solutions. Their mission is to contribute to the generation and verification of new knowledge, which can be used to detect, prevent or cure disease. In the longer term, this may result in a more effective fight against human suffering and poverty. This demands from us a continuous improvement of skills and changes in attitude. Skills and attitudes that can prepare us to cooperate and lead in this endeavour.

This book aims to support efforts in that direction. It represents an attempt to introduce readers to some of the crucial problems, tools and opportunities in bioinformatics and biomarker research. I hope that its content will at least serve to foster new conversations between and within research teams across disciplines, or even to help to recognize new value and purpose of ongoing interactions.