

# Preface

The prevalence of the Metabolic Syndrome (MetS), an entity defined as the co-incidence in the same individual of obesity, insulin resistance, dyslipidemia, hypertension and increased cardiovascular morbidity is increasing with a profile that could be considered of epidemic proportions. It is clear that on top of its undeniable genetic contribution other environmental factors such as lack of physical activity, diet, gut microflora and/or ageing are likely contributors to its progressive acceleration. Despite the obvious public health and economic implications of MetS as well as global research efforts to treat the disorder, the molecular and pathophysiological mechanisms linking the manifestations of MetS are still elusive. This may be in part because of the difficulty in elucidating the primary pathogenic events given the dynamic involvement of multiple interacting organ systems along the disease processes.

Systems biology views and studies the biological systems in the context of complex interactions between their building blocks and processes, as well as with the environment. Despite many traits which define the Metabolic Syndrome being highly heritable, it is evident that the genetic contribution to these traits is mediated via gene—gene and gene—environment interactions across several spatial and temporal scales, and that some of these traits may even be a product of long-term adaptation to the environmental factors including changes in energy balance. This makes the Metabolic Syndrome a strong case for the adoption of systems approach.

The aim of this book is to provide the readers an overview about how the Metabolic Syndrome can be tackled using a systems biology approach, identifying its challenges and opportunities. The emphasis is on pathophysiology of MetS, not on the role of genetic factors behind it. The specific aims correspond to the four main sections of the book: (1) to give an introduction to pathophysiology of the Metabolic Syndrome and medical systems biology, (2) to introduce the key biological processes involved in the pathophysiology of MetS, (3) to introduce the emerging technologies utilized using systems approach to study MetS, and (4) to introduce the novel mathematical modeling approaches to study metabolic syndrome.

The present volume has two main purposes. It brings together current hypotheses about the mechanisms of MetS and its co-morbidities as well as introduces emerging systems biology approaches to tackle the underlying complexity of MetS. This will

be of interest to researchers in the fields of medicine, biochemistry, biophysics and computational biology. The book also provides a convenient reference work summarizing published work in the area of medical systems biology. We hope that this will assist the research of a new generation of investigators drawn to this rapidly growing field.

While the work leading to this book was supported from several sources, ten of the chapters are from participants involved in the EU-funded project ‘Characterization and modelling of dietary effects mediated by gut microbiota on lipid metabolism’ — ETHERPATHS (FP7-KBBE-222639, <http://www.etherpaths.org/>). ETHERPATHS is a project aiming to develop a platform for nutritional systems biology. Special thanks therefore go to the European Commission for the financial support of the research which had a major impact on this volume.

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Matej Orešič and Antonio Vidal-Puig

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Oresic, M.; Vidal-Puig, A. (Eds.)

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