

Table of Contents

Foreword.....	vii
Table of Contents	ix
List of Figures.....	xiii
List of Tables.....	xv
Preface	xvii
1. Executive Summary and Introduction	
<i>Marvin Cassman</i>	
Background.....	1
Objectives of the WTEC Study	4
Panel Members	4
Study Scope	5
Plan of the Study	5
Principal Findings.....	7
References	12
2. Data and Databases	
<i>Fumiaki Katagiri and Adam Arkin</i>	
Introduction	15
Research Activities in the U.S.....	20
Research Activities in Europe	22
Research Activities in Japan.....	24
Modeling and Data Collection	25
References	29
3. Network Inference	
<i>Frank Doyle and Douglas Lauffenburger</i>	
Introduction	31
Network Inference and Model Structure	35
Validation, Iteration, Discrimination, and Identifiability.....	40
Regression	41
Comparison of Efforts in Europe, Japan, and the U.S.	42
Summary.....	43
References	44
4. Modeling and Network Organization	
<i>Cynthia Stokes and Adam Arkin</i>	
Introduction	47
Overview of Worldwide Efforts.....	51
Interest and Involvement of Industry	67
Infrastructure Supporting Modeling and Network Organization	
Analysis.....	70
Needs and Recommendations	75
Summary of Key Findings	77
References	77
5. Systems Biology in Plant Research	
<i>Fumiaki Katagiri</i>	
Introduction	83

Metabolic Networks	85
Regulatory Networks in Developmental Processes	86
Concluding Remarks	89
References	89
6. Education, National Programs, and Infrastructure in Systems Biology	
<i>Marvin Cassman, Douglas Lauffenburger, and Frank Doyle</i>	
Introduction	91
Education	91
National Programs for Support of Systems Biology	99
Infrastructure	105
References	109
APPENDICES	
A. Panelist Biographies	111
B. Site Reports—Europe	
Cambridge University	115
European Bioinformatics Institute (EBI)	117
European Commission (EC)	119
German Cancer Research Center (DKFZ)	123
Humboldt University	132
Max Planck Institute for Molecular Genetics	136
Max Planck Institute for Molecular Plant Physiology	139
Oxford Brookes University	144
Oxford University, Centre for Mathematical Biology/Mathematical Institute	147
Oxford University, Dept. of Physiology	151
Sheffield University	156
SystemsX—A New Systems Biology Institute in Switzerland	161
University College London	163
Université Libre de Bruxelles	166
University of Warwick	168
Vrije Universiteit (Free University) Amsterdam	172
C. Site Reports—Japan	
Computational Biology Research Center (CBRC)	177
Japan Biological Information Research Center (JBIRC)	181
Kazusa DNA Research Institute (KDRI)	186
Keio University, Institute for Advanced Biosciences (IAB)	190
Kitano Symbiotic Systems Project	194
Kyoto University, Bioinformatics Center	199
Kyoto University, Cell/Biodynamics Simulation Project	201
RIKEN Yokohama Institute	205
Tokyo Medical and Dental University	216

University of Tokyo, Department of Computational Biology	218
University of Tokyo, Institute of Medical Science	221
University of Tokyo, Laboratory of Systems Biology and Medicine.....	223
D. Summary of U.S. Workshop, June 4, 2004	229
E. Glossary	253
1.1. The stages in systems biology study and the types of useful experimental approaches for each stage.....	17
2.2. The importance of standardization and virtual consolidation of databases.....	19
3.1. A diverse spectrum of high-to-low modeling approaches	32
3.2. Approaches to the mathematical modeling of cellular networks.....	36
3.3. Network motifs found in the <i>E.Coli</i> transcriptional regulation network	38
4.1. Schematic of a chemical reaction system where chemical species A and B react together to form C, which further changes into D, and D inhibits the first reaction.....	49
4.2. Example of (A) a molecular interaction network involved in bacterial chemotaxis adapted from Alon et al. (1999) and (B) a single motif, the feed-forward loop, frequently found within intracellular molecular networks.	50
4.3. With the purpose of increasing understanding of a biological system function, one needs a set of data to develop the first model	76
5.1. A newly discovered pathway for re-fixation of CO ₂ released during conversion of carbohydrate to storage fat.....	85
5.2. Model for the central feedback in the <i>Arabidopsis</i> clock	87
5.3. Variation of theoretically generated plant architectures	88