

Contents

Foreword	
<i>George A. Cowan and David Pines</i>	xv
Conference Opening Remarks	
<i>George A. Cowan</i>	1
Fundamental Concepts	5
The Eightfold Way to the Theory of Complexity: A Prologue	
<i>Philip W. Anderson</i>	7
Complex Adaptive Systems	
<i>Murray Gell-Mann</i>	17
On the Complexity of Cultural Transmission and Evolution	
<i>Marcus Feldman, Luigi L. Cavalli-Sforza, and Lev. A. Zhivotovsky</i>	47
On the Evolution of Complexity	
<i>W. Brian Arthur</i>	65
Whispers from Carnot: The Origins of Order and Principles of Adaptation in Complex Nonequilibrium Systems	
<i>Stuart A. Kauffman</i>	83
Evolution and Complexity	
<i>Tom S. Ray</i>	161

Examples of Complex Adaptive Systems	177
Proteins as Adaptive Complex Systems <i>Hans Frauenfelder</i>	179
The Theoretical Problems in Immunology: AIDS and Epitopes <i>Alan S. Perelson</i>	185
Developmental Complexity and Evolutionary Order <i>Brian Goodwin</i>	205
What Would be Conserved if “The Tape Were Played Twice?” <i>Walter Fontana and Leo Buss</i>	223
Complexity of Brain Circuits <i>Charles Stevens</i>	245
The Schema <i>Ben Martin</i>	263
A Complex Systems Approach to Computational Molecular Biology <i>Alan Lapedes</i>	287
Echoing Emergence: Objectives, Rough Definitions, and Speculations for ECHO-Class Models <i>John H. Holland</i>	309
Prediction and Adaptation in an Evolving Chaotic Environment <i>Alfred Hübler and David Pines</i>	343
How do RNA Molecules and Viruses Explore Their Worlds? <i>Peter Schuster</i>	383
Complex Ecological Systems <i>James H. Brown</i>	419
Beyond General Equilibrium <i>Kenneth Arrow</i>	451
The Major Transitions in Evolution <i>John Maynard Smith</i>	457

Nonadaptive Systems, Scaling, Self-Similarity, and Measures of Complexity	471
Cellular Automata: Complex Nonadaptive Systems <i>Erica Jen</i>	473
Self-Organized Criticality: A Holistic View of Nature <i>Per Bak</i>	477
Dynamics, Computation, and the “Edge of Chaos”: A Re-Examination <i>Melanie Mitchell, James P. Crutchfield, and Peter T. Hraber</i>	497
Is Anything Ever New? Considering Emergence <i>James P. Crutchfield</i>	515
General Discussion	539
Review and Remarks on Applications <i>John H. Holland</i>	541
Interactions Between Theory, Models, and Observations <i>Erica Jen</i>	553
Search for Consensual Views <i>David Pines</i>	577
What are the Important Questions? <i>George A. Cowan</i>	589
Summary Remarks <i>George A. Cowan</i>	661
Afterwords	707
From Metaphors to Reality? <i>George A. Cowan and David Pines</i>	709
Index	719