

Contents

<b>1. Introduction</b>	1
<b>2. The Games of Life</b>	5
2.1 Excitable Media	5
2.2 Collective Amoebae	10
2.3 Fish Schools	15
2.4 Insect Societies	22
2.5 Further Reading	30
<b>3. Active Motion</b>	33
3.1 Elementary Mechanisms of Self-Motion	33
3.2 Self-Motion in External Fields	39
3.3 Hydrodynamics of Active Fluids	43
3.4 Traffic Flows	53
3.5 Further Reading	64
<b>4. Ridden by the Noise</b>	69
4.1 Demons and Ratchets	69
4.2 Navigation in Fluctuating Fields	76
4.3 Long Tails in Probability Distributions	85
4.4 Noise as a Resource	94
4.5 Further Reading	102
<b>5. Dynamics with Delays and Expectations</b>	105
5.1 The Age Dimension	105
5.2 Demographic Waves	108
5.3 A Model of the Market Crash	114
5.4 Further Reading	119
<b>6. Mutual Synchronization</b>	127
6.1 Interacting Clocks	127
6.2 The Synchronization Transition	131
6.3 The Influence of Noise	137
6.4 Noise-Induced Breakdown of Coherent Active Motion	140

6.5	Synchronous Chaos . . . . .	146
6.6	Further Reading . . . . .	151
<b>7.</b>	<b>Dynamical Clustering</b> . . . . .	155
7.1	Logistic Maps . . . . .	155
7.2	Rössler Oscillators . . . . .	164
7.3	Neural Networks . . . . .	171
7.4	Protein Machines . . . . .	179
7.5	Further Reading . . . . .	193
<b>8.</b>	<b>Hierarchical Organization</b> . . . . .	199
8.1	Hierarchies . . . . .	199
8.2	The Sherrington–Kirkpatrick Model . . . . .	205
8.3	Replica-Symmetry Breaking in Dynamical Glasses . . . . .	215
8.4	Fluid Turbulence . . . . .	220
8.5	Hierarchically Structured Swarms . . . . .	224
8.6	Further Reading . . . . .	228
<b>9.</b>	<b>Dynamics and Evolution of Networks</b> . . . . .	233
9.1	Societies . . . . .	234
9.2	Properties of Graphs . . . . .	238
9.3	Clustering and Synchronization in Dynamical Networks . . . . .	249
9.4	Evolution of Graphs . . . . .	262
9.5	Further Reading . . . . .	274
	<b>References</b> . . . . .	279
	<b>Subject Index</b> . . . . .	295