

# Contents

Foreword by Francis Crick.....	xiii
Preface .....	xv
<b>1 Introduction to the Study of Consciousness .....</b>	<b>1</b>
1.1 What Needs to Be Explained? .....	1
1.2 A Spectrum of Answers .....	4
1.3 My Approach Is a Pragmatic, Empirical One .....	11
1.4 The Neuronal Correlates of Consciousness .....	16
1.5 Recapitulation .....	19
<b>2 Neurons, the Atoms of Perception .....</b>	<b>21</b>
2.1 The Machinery of the Cerebral Cortex .....	22
2.2 Explicit Representation, Columnar Organization, and Essential Nodes .....	25
2.3 Firing Rates, Oscillations, and Neuronal Synchronization .....	35
2.4 Recapitulation .....	47
<b>3 The First Steps in Seeing .....</b>	<b>49</b>
3.1 The Retina Is a Layered Structure .....	49
3.2 Color Vision Uses Three Types of Cones .....	52
3.3 A Hole in the Eye: The Blind Spot .....	53
3.4 Receptive Field: A Key Concept for Vision .....	55
3.5 Multiple Parallel Pathways Exit the Eye .....	57
3.6 The Superior Colliculus: Another Visual Brain .....	63
3.7 Eye Movements: Visual Saccades Are Ubiquitous .....	63
3.8 Recapitulation .....	68
<b>4 The Primary Visual Cortex as a Prototypical Neocortical Area ....</b>	<b>69</b>
4.1 Monkey Vision as a Model for Human Vision .....	70
4.2 The Neocortex Is a Layered, Sheet-Like Structure .....	71
4.3 A Plethora of Cortical Cell Types .....	72

4.4	V1: The Main Entry Point for Vision .....	77
4.5	Recapitulation .....	86
<b>5</b>	<b>What Are the Neuronal Correlates of Consciousness?.....</b>	<b>87</b>
5.1	Enabling Factors Necessary for Consciousness .....	88
5.2	Emotions and the Modulation of Consciousness .....	93
5.3	Anesthesia and Consciousness .....	94
5.4	A General Strategy for Circumscribing the NCC .....	96
5.5	Neuronal Specificity and the NCC.....	101
5.6	Recapitulation .....	104
<b>6</b>	<b>The Neuronal Correlates of Consciousness Are Not in the Primary Visual Cortex.....</b>	<b>105</b>
6.1	You Don't See without V1 .....	106
6.2	Even if You Can't See It, V1 Still Adapts to It .....	106
6.3	You Don't Dream with V1 .....	108
6.4	Directly Stimulating V1 .....	109
6.5	Monkey V1 Neurons Don't Follow Perception .....	110
6.6	Recapitulation .....	116
<b>7</b>	<b>The Architecture of the Cerebral Cortex .....</b>	<b>117</b>
7.1	If You Want to Understand Function, Seek to Understand Structure .....	117
7.2	The Cortex Contains a Hierarchical Structure .....	119
7.3	Thalamus and Cortex: A Tight Embrace .....	124
7.4	Driving and Modulatory Connections .....	126
7.5	Ventral and Dorsal Pathways as a Guiding Principle .....	127
7.6	The Prefrontal Cortex: The Seat of the Executive .....	129
7.7	Recapitulation .....	132
<b>8</b>	<b>Going Beyond the Primary Visual Cortex .....</b>	<b>133</b>
8.1	More Topographic Areas: V2, V3, V3A, and V4 .....	134
8.2	Color Perception and the Fusiform Gyrus .....	137
8.3	Cortical Area MT Is Specialized for Motion Processing .....	139
8.4	The Posterior Parietal Cortex, Action, and Spatial Position .....	145
8.5	The Inferior Temporal Cortex and Object Recognition .....	148
8.6	Recapitulation .....	151

<b>9</b>	<b>Attention and Consciousness</b> .....	153
9.1	Change Blindness, or How a Magician Fools You.....	155
9.2	Attending to a Region, Feature, or Object .....	157
9.3	Does Consciousness Require Attention?.....	163
9.4	The Binding Problem .....	167
9.5	Recapitulation .....	170
<b>10</b>	<b>The Neuronal Underpinnings of Attention</b> .....	173
10.1	Mechanistic Accounts of Attention .....	174
10.2	Attentional Influences Occur Throughout the Visual Hierarchy.....	178
10.3	Neglect, or Patients Who Are Not Blind and Yet Can't See.....	181
10.4	Recapitulation .....	184
<b>11</b>	<b>Memories and Consciousness</b> .....	187
11.1	A Fundamental Distinction.....	188
11.2	A Taxonomy of Long-Term Memory.....	189
11.3	Short-Term Memory.....	196
11.4	Fleeting or Iconic Memory .....	201
11.5	Recapitulation .....	204
<b>12</b>	<b>What You Can Do Without Being Conscious: The Zombie Within</b> .....	205
12.1	Zombie Agents in Everyday Life.....	207
12.2	Vision-for-Perception Is Different from Vision-for-Action .....	211
12.3	Your Zombie Acts Faster Than You See .....	213
12.4	Can Zombies Smell?.....	214
12.5	Recapitulation .....	216
<b>13</b>	<b>Agnosia, Blindsight, Epilepsy, and Sleep Walking: Clinical Evidence for Zombies</b> .....	217
13.1	Visual Agnosia .....	217
13.2	Blindsight .....	220
13.3	Complex, Focal Epileptic Seizures .....	222
13.4	Sleepwalking .....	224
13.5	Zombie Agents and the NCC .....	226
13.6	A Turing Test for Consciousness?.....	227
13.7	Recapitulation .....	228

<b>14</b>	<b>Some Speculations on the Functions of Consciousness</b> .....	<b>231</b>
14.1	Consciousness as an Executive Summary .....	233
14.2	Consciousness and the Training of Sensory-Motor Agents .....	235
14.3	Why the Brain Is Not Just a Bundle of Zombie Agents .....	237
14.4	Do Feelings Matter? .....	237
14.5	Meaning and Neurons .....	239
14.6	Qualia Are Symbols .....	242
14.7	What Does This Imply about the Location of the NCC? .....	244
14.8	Recapitulation .....	246
<b>15</b>	<b>On Time and Consciousness</b> .....	<b>249</b>
15.1	How Swift Is Vision? .....	250
15.2	The All-Or-None Character of Perception .....	251
15.3	Masking Wipes a Stimulus from Consciousness .....	256
15.4	Integration and Direct Brain Stimulation .....	262
15.5	Is Perception Discrete or Continuous? .....	264
15.6	Recapitulation .....	268
<b>16</b>	<b>When the Mind Flips: Following the Footprints of Consciousness</b> .....	<b>269</b>
16.1	Binocular Rivalry: When the Two Eyes Disagree .....	271
16.2	Where Does Perceptual Suppression Occur? .....	273
16.3	The Footprints of Consciousness Lead to the Inferior Temporal Cortex .....	277
16.4	Open Questions and Future Experiments .....	281
16.5	Recapitulation .....	285
<b>17</b>	<b>Splitting the Brain Splits Consciousness</b> .....	<b>287</b>
17.1	On the Difficulty of Finding Something if You Don't Know What To Look For .....	288
17.2	The Two Cerebral Hemispheres Do Not Subserve the Same Functions .....	290
17.3	Two Conscious Minds in One Body .....	291
17.4	Recapitulation .....	294

<b>18</b>	<b>Further Speculations on Thoughts and the Nonconscious Homunculus</b> .....	<b>295</b>
18.1	The Intermediate-Level Theory of Consciousness .....	296
18.2	The Nonconscious Homunculus .....	298
18.3	The Nature of Qualia .....	300
18.4	Recapitulation .....	302
<b>19</b>	<b>A Framework for Consciousness</b> .....	<b>303</b>
19.1	Ten Working Assumptions to Understand the Mind-Body Problem .....	304
19.2	Relationship to the Work of Others .....	310
19.3	Where Do We Go From Here? .....	312
19.4	Recapitulation .....	314
<b>20</b>	<b>An Interview</b> .....	<b>315</b>
	<b>Glossary</b> .....	<b>329</b>
	<b>Bibliography</b> .....	<b>349</b>
	<b>Index</b> .....	<b>411</b>