

Contents

Part I What Is Science?

1	The Evolution of Science	3
1.1	Greece: The Dawn of Science	3
1.2	The Medieval Worldview	10
1.3	The Scientific Revolution	12
1.4	Theory of Science and Philosophy of Science	16
1.5	Summary	16
	Further Reading	17
2	Knowledge	19
2.1	Introduction	19
2.2	Knowing That, Knowing How and Acquaintance	19
2.3	The Definition of Propositional Knowledge	21
2.3.1	P Is True	22
2.3.2	Good Reasons for P	27
2.3.3	What Does It Mean to Believe That P?	28
2.4	Can One Know Without Knowing that One Knows?	30
2.5	Reliabilism	30
2.6	Data, Information, Knowledge	31
2.7	The Philosopher's Versus the Sociologist's Concept of Knowledge	34
2.8	The Expression 'It Is True for Me that...'	35
2.9	Knowledge of Religious Beliefs	38
2.10	Summary	38
	Further Reading	40
3	Hypotheses and Hypothesis Testing	41
3.1	Introduction	41
3.2	Unity of Science?	42
3.3	Hypothetical-Deductive Method	43

3.4	Hypothesis Testing in the Social Sciences	48
3.5	Hypothesis Testing in History: The Wallenberg Affair	49
3.6	Statistical Testing of Hypotheses	53
	3.6.1 Bayesianism	53
	3.6.2 Statistical Inference -Neyman-Pearson's Method	54
3.7	Unacceptable Auxiliary Assumptions: Ad Hoc-Hypotheses	56
3.8	Summary	59
	Further Reading	61
4	On Scientific Data	63
4.1	Measurement and Scales	63
4.2	Statistical Relations	65
4.3	Data, Observation, Observational Statement	69
4.4	On the Theory-Dependence of Observational Statements	72
4.5	Observations and History: On Source Criticism	77
4.6	Summary	79
	Further Reading	80
5	Qualitative Data and Methods	81
5.1	Introduction	81
5.2	Intentionality and Meaning	82
5.3	Hermeneutics	86
5.4	Grounded Theory	88
5.5	The Intentionality of Observations	90
5.6	Are Quantitative Methods Better than Qualitative?	93
5.7	Objectivity and the Use of Qualitative Methods	94
5.8	Searle on Brute and Social Facts	95
5.9	Social Constructions	99
5.10	Criteria for Correct Interpretations	100
5.11	Summary	102
	Further Reading	102
6	Theories About the Development of Science	103
6.1	Introduction	103
6.2	Logical Positivism	103
6.3	Falsificationism	106
6.4	Normal Science, Scientific Revolutions and Paradigm Shifts	109
6.5	Lakatos' Theory of Research Programmes	112
6.6	Methodological Anarchism: Anything Goes	115
6.7	Summary of the Debate	116
6.8	The Rationality of Science: A Model	118
	Further Reading	121

**Part II Philosophical Reflections on Four Core Concepts
in Science: Causes, Explanations, Laws and Models**

7	On Causes and Correlations	125
7.1	Causes Are INUS Conditions	125
7.2	Cause-Effect and Order in Time	129
7.3	Causes and Statistical Correlations	129
7.4	Risk Factors and Conditional Probabilities	134
7.5	Direct and Indirect Causes	136
7.6	Causes as Physical Effects	137
7.7	Cause and Effect in History	138
7.8	Summary	140
	Further Reading	141
8	Explanations	143
8.1	Explanation and Prediction	143
8.2	What Is Explained?	144
8.3	The D-N Model	146
	8.3.1 Problems with the D-N Model	147
8.4	Causal Explanations	149
8.5	Explanation as Unification	150
8.6	Statistical Explanations	151
8.7	Action Explanations	154
8.8	Pragmatic Explanations	156
8.9	Summary	158
	Further Reading	159
9	Explanation in the Humanities and Social Sciences	161
9.1	Methodological Collectivism Versus Methodological Individualism	161
9.2	Explanations of Historical Events	164
9.3	Explanation of Social Phenomena	166
9.4	Functional Explanations	168
9.5	Summary	170
	Further Reading	171
10	Scientific Laws	173
10.1	Introduction	173
10.2	Empirical Generalizations: Fundamental Laws	174
10.3	Deterministic and Statistical Laws	175
10.4	The Extension of the Concept of a Natural Law	176
10.5	Laws and Accidental Generalisations	177
10.6	van Fraassen's Alternative	181
10.7	A Proposal: Some Laws Are Implicit Definitions of Quantities	182
10.8	Summary	187
	Further Reading	187

11 Theories, Models and Reality	189
11.1 Introduction	189
11.2 Structural Similarity as a Mapping of Relations	191
11.3 Mathematical Models	191
11.4 Wave-Particle Dualism	193
11.5 Can One Measure Structural Similarity?	195
11.6 Ontology and Structural Similarity	195
Further Reading	196
Part III Some Auxiliaries	
12 The Mind-Body Problem	199
12.1 Introduction	199
12.2 Substance Dualism	200
12.3 Property Dualism	201
12.4 Monism	202
12.5 Monistic Theories	203
12.6 Three Important Problems for Reductionists	205
12.7 Mental Causes	210
12.8 Speculations	212
12.9 The Science of Man	213
Further Reading	216
13 Science and Values	217
13.1 Values and Their Role in Science	217
13.2 Value-Free and Value-Laden	219
13.3 Is Science Valuable?	220
13.4 Feminist Critique: Hidden Values in Science	222
13.5 Research Ethics	224
Further Reading	226
14 Some Recent Trends in Science	227
14.1 The Impact of University Mass Education	227
14.2 Publish or Perish: The Value of a Research Paper	228
14.3 Research Funding and Planning	229
14.4 Big Science	230
14.5 The Scientific Attitude and the Search for Meaning	231
Appendix: Logical Forms	233
Introduction	233
Logical Form 1: Sentences	234
Variables	236
Predicates	237
Logical Form 2: Argument	238
Some Common Valid Argument Forms	238
Some Invalid Argument Forms	239

The ‘if...then’ Construction	241
Necessary and Sufficient Conditions	244
Further Reading	244
Definitions of Some Core Concepts	245
Literature	249
Index	255