

Contents

Foreword	<i>page</i> xv
Preface	xvii
Acknowledgments	xix
1 Why Explanation Matters in Science	1
The Primary Aims of Science	1
Scientific Explanation	3
Scientific Understanding	5
Key Successes of Scientific Explanation	9
What's to Come	10
2 The General Nature of Explanation	13
We Always Look for Explanations	13
Explaining versus Explanation	14
Answering "Why" and "How" Questions	15
Must an Explanation Entail What It Explains?	18
Explanation as Dependence	22
What If Things Had Been Different?	25
Scientific Explanations versus Everyday Explanations	27
3 Specific Kinds of Scientific Explanations	29
Biological Explanations	29
Actual-Sequence Explanations versus Robust-Process Explanations	29
Experimental Explanations versus Historical Explanations	31

xii CONTENTS

Are Historical Explanations Scientific?	32
Aren't Experimental Explanations Superior to Historical Explanations?	34
How Can We Really Know That a Historical Explanation Is Correct? But, Can We Be Certain?	35
4 Explanation and Prediction	43
Aren't Explanation and Prediction the Same?	43
Is Prediction Only About the Future?	45
Good Predictions with Bad Explanations; and Good Explanations with Bad Predictions	46
Why Does Explanation and Prediction Come Apart?	48
How Explanation and Prediction Are Related	53
5 Evaluating Explanations	55
Better and Worse Explanations	55
Explanatory and Predictive Power	56
Conservatism	57
Simplicity	59
Beauty	61
Which Explanation Is Best?	64
Is the World Simple/Beautiful?	66
6 Explanatory Quality and Felt Understanding	69
Explanation Aims at Understanding	69
Kinds of Understanding	69
Nothing More than Feelings?	73
An Underlying Problem	76
Science Is Uncertain	77
Genuine Understanding and Accurate Explanations	78
7 False Theories, But Accurate Explanations?	80
Theories, Models, and Explanations	80
Getting Accurate Scientific Explanations from Idealizations	81
Does This Really Lead to Understanding?	82
Uncertainty Remains	85

	CONTENTS	xiii
8 From Explanation to Knowledge		86
Inference to the Best Explanation		86
Detectives, Mechanics, and the Rest of Us		88
Inference to the Best Explanation in Science		90
Can We Be Sure That the Best Is Good Enough?		92
What If There Are Lots of Good Explanations?		96
Aren't There Always Other Explanations That We Haven't Thought of Yet?		97
Can We Really Know?		99
Is It Really Science If It Doesn't Explain Everything?		100
Concluding Remarks		102
Summary of Common Misunderstandings		104
References and Further Reading		107
Figure Credits		115
Index		116