

A Beginner's Guide to Scientific Method

Third Edition

STEPHEN S. CAREY
Portland Community College

^T|^HOCHSCHULE
•'^••"j^^ LIECHTENSTEIN
Bibhothek

THOMSON
*
WADSWORTH

Australia • Canada • Mexico • Singapore • Spain
United Kingdom • United States

Contents

PREFACE VIM

ONE SCIENCE 1

Just What Is Science? 1

Asking Why 2

Scientific Method 3

The Consequences of Science 5

Scientific Method in Daily Life 6

Things to Come 7

Exercises 7

TWO OBSERVATION 8

Making Accurate Observations 8

Anomalous Phenomena 14

Observation and Anomalous Phenomena 17

The Burden of Proof	19
Summary	21
Exercises	22

THREE PROPOSING EXPLANATIONS 26

^Explanation	26
Causes	30
Correlation	31
Causal Mechanisms	35
Underlying Processes	36
Laws	37
Function	38
The Interdependence of Explanatory Methods	40
Rival Explanations and Ockham's Razor	41
Explanation and Description	43
Summary	44
Exercises	44

FOUR TESTING EXPLANATIONS 52

The Basic Method	52
How to Test an Explanation	53
How Not to Test an Explanation	59
Testing Extraordinary Claims	60
Summary	64
Exercises	64

FIVE ESTABLISHING CAUSAL LINKS 70

Causal Studies	70
Limited Effect Levels	71
Multiple Causal Factors	80
Bias and Expectation	82
Types of Causal Study	83

Reading Between the Lines 89
 Summary 91
 Exercises 92

SIX FALLACIES IN THE NAME OF SCIENCE 107

What Is a Fallacy? 107
 False Anomalies 109
 Questionable Arguments by Elimination 111
 Illicit Causal Inferences 111
 Unsupported Analogies and Siimilarities 113
 Untestable Explanations 115
 Redundant Predictions 116
 Ad Hoc Rescues 117
 Science and Pseudoscience 119
 The Limits of Scientific Explanation 124
 Summary 125
 Exercises 126

FURTHER READING 137

INDEX 139