CONTENTS

Foreword page xi
Preface xv

1 INTRODUCTION
   A Controversial Idea 3
   The AAAS Vision of Science 5
   Primary and Secondary Benefits 7
   Beyond the Basics 10
   A Timely Opportunity 13
   Personal Experience 15
   Summary 19

2 SCIENCE IN PERSPECTIVE
   Science as a Liberal Art 21
   Four Bold Claims 27
   A Brief History of Truth 40
   Summary 72

3 SCIENCE WARS
   Auditors and Attitudes 74
   Four Deadly Woes 78
   Reactions from Scientists 89
   Two Rules of Engagement 105
   Summary 110

4 SCIENCE'S PRESUPPOSITIONS
   Historical Perspective on Présuppositions 113
   The PEL Model of Full Disclosure 124
   What Are Presuppositions? 131
Disclosure of Presuppositions | 134
Sensible Questions | 143
Science's Credibility and Audience | 147
Science’s Realism and Faith | 150
A Reflective Overview | 153
Summary | 154

5 DEDUCTIVE LOGIC | 156
Deduction and Induction | 157
Historical Perspective on Deduction | 160
Elementary Propositional Logic | 165
Formal Propositional Logic | 171
Predicate Logic | 173
Arithmetic | 175
Common Fallacies | 178
Material Logic | 187
Summary | 189

6 PROBABILITY | 191
Probability Concepts | 192
Two Fundamental Requirements | 197
Eight General Rules | 198
Probability Axioms and Rules | 199
Probability Theorems | 204
Bayes’s Theorem | 207
Permutations and Combinations | 210
Common Blunders | 211
Summary | 215

7 INDUCTIVE LOGIC AND STATISTICS | 217
Awesome Responsibilities | 217
Induction and Deduction | 218
Historical Perspective on Induction | 219
Presuppositions of Induction | 225
Bayesian Example | 226
Bayesian Inference | 232
Bayesian Decision | 240
The Frequentist Paradigm | 245
Paradigms and Questions | 257
Induction Lost | 264
Induction Regained | 266
Summary | 268
Contents

8 PARSIMONY AND EFFICIENCY
  Historical Perspective on Parsimony 269
  Preview of Basic Principles 270
  Example 1: Mendel’s Peas 288
  Example 2: Cubic Equation 291
  Example 3: Equivalent Conductivity 296
  Example 4: Crop Yields 303
  Explanation of Accuracy Gain 312
  Efficiency and Economics 316
  Philosophical Perspective on Parsimony 318
  Summary 325

9 CASE STUDIES
  Intuitive Physics 327
  Parsimony and Physics 334
    by Millard Baublitz
  Molecule Shape and Drug Design 345
    with P. Andrew Karplus
  Electronics Testing 353
  Statistics in Medicine 355
  Discussion 365

10 SCIENCE’S POWERS AND LIMITS
  Obvious Limitations 368
  Science and Its Preconditions 369
  Science and Worldviews 370
  Personal Rewards from Science 373
  Summary 376

11 SCIENCE EDUCATION
  Six Benefits 378
  The Good, the Bad, and the Ugly 387
  Constructivism in the Third World 396
  A Modest Experiment 399
  Future Prospects 401
  Summary 405

12 CONCLUSIONS
  References 410
  Index 430