# AND THE WORLD

# PHILOSOPHICAL APPROACHES

EDITED BY JEFFREY FOSS

## SCENCE AND THE WORLD PHLOSOPHICAL APPROACHES



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### SCIENCE AND THE WORLD

To Christina Foss, my companion in life, love, and philosophy.

#### **Introduction for Students**

Science propelled humanity from the world of faith and steeples into a world of reason and the internet. It is a defining characteristic of our species at this point in history: We are not merely Homo sapiens, people who think, but Homo scientiae, people of science. Science has made us the sort of organism that we are. Nature molded us, but through science we now can (and often do) mold nature—both our own human nature and the nature of the world around us.

The readings in this text are some of the most interesting and important in all of philosophy for those of us who live in this scientific age. In it I offer my services as your guide to the intellectually intriguing and very timely subject matter of the philosophy of science. Though by no means a giant myself, please let me introduce you to the giants in this field, serving as your interpreter between their scientific and philosophical dialects and your own intellectual language as a student in college or university.

If the first commandment of philosophy is "Know thyself!", then any comprehensive philosophy today must include philosophy of science as an essential part. Understanding science is philosophically crucial not only for scientists themselves, but for artists, humanists, businesspeople, doctors, lawyers, politicians—indeed, for anyone who needs or seeks wisdom in these interesting times.

The second commandment of philosophy, if I may put forward a candidate, is to see the Big Picture. This is especially important as you set out on a philosophical journey, as we do here into the kingdom of science. In the Big Picture, science is a communal process that we human beings use to do two things: reveal the world to our understanding, and then through that understanding change the world to our purposes. These two primary aspects of science correspond to the two main sections of this book.

#### SECTION 1 HOW DOES SCIENCE REVEAL THE WORLD? SCIENCE & METHOD

For modern human beings, science reveals the world behind the appearances—the deeper truth. This is an amazing achievement, one which some may even deny. Yet most of us accept without question such commonplace scientific teachings as that our apparently seamless bodies are composed of individual living cells, that the apparently empty air is filled with radio waves, or that our apparently flat and motionless Earth is actually a sphere hurtling and spinning through space. How does science pull back the veil of appearance to reveal these deeper truths? What method does it use? Does this method really reveal a deeper truth—or merely the convenient designs of our own minds? Do viruses, photons, and the big bang really exist? Are all events linked to each other at the quantum level? If so, how does science reveal this to us? How do we know for ourselves?

These questions—which are shoved to the background in the science classes you've been taking since kindergarten—come to the forefront in philosophy. The answers given by scientists and other philosophers (for scientists truly are philosophers of a certain sort, namely philosophers of nature) will probably surprise you. In grasping their answers and turning them over in your mind—seeking your own answers—you will be investigating what is real (doing metaphysics) and investigating what is true (doing epistemology).

#### SECTION 2 HOW DOES SCIENCE CHANGE THE WORLD? SCIENCE & VALUES

We live in a world transformed by science. The mobile electronic device in your hand that instantly links you to your friends, the telescopes gazing out to the edges of the galaxy, the vaccine-modified antibodies that rush through your veins to kill microscopic invaders, are all aspects of our new and constantly transforming world, a world scarcely imaginable to our prescientific ancestors. But it is not just the world outside your mind that has been molded by science, but the world inside as well, for we see the world through the eyes of science.

One basic definition of science is this: official knowledge. Wherever we are, science gives us the socially approved and supported view of truth and reality. In school it teaches us that dinosaurs walked the earth; in the hospital it directs the hand of the surgeon opening us up to repair us; in the courtroom it decrees that the blood on a sleeve is that of the accused; and even in a hike through virgin wilderness a thousand miles from the nearest laboratory it whispers that the awesome beauties of nature were not created in an instant by a command of God, but gradually, over billions of years, by evolution and plate tectonics.

How does science change both the inner microcosm of our private reality and the outer macrocosm of our collective world as well? How did it get this power? Should it have it? Since it is we human beings who change the world—not science as such—how should we go about doing so to yield a force for good rather than for harm?

In reading the answers to questions such as these given by scientists and other philosophers, pondering them, and seeking your own answers, you will thereby be engaging in the ethics of science.

#### FOUR WAYS THIS TEXT HELPS YOU

- **1.** Carefully Chosen and Edited Readings: The central figures in the philosophy of science, past and present, are each represented by readings I have chosen for accessibility and edited to reveal the essence of what their authors have to say, and why.
- **2.** Simple Introductions: Each philosopher is introduced to you as a real person, and his or her philosophy is outlined briefly and clearly. Once you know where each philosopher is coming from, it is much easier to understand the view that he or she develops in the readings are also explained in plain language in the introduction: ideal for study-prep before exams!
- **3.** *Revealing Study Questions*: Every reading is followed by three sets of study questions that start easy and get harder.
- Set 1. Questions that reveal the main points of the reading.
- Set 2. Questions that reveal the deep issues.
- Set 3. Questions that reveal the bigger picture.
- **4. Dictionary:** Grasp the terminology frequently employed by philosophers of science and you'll know how to discuss the philosophy of science, answer questions about it, and write essays about it. Philosophy of science terminology is collected and defined for you for easy access at the back of the text. Crucial terms that are defined in the Dictionary are marked by bold font.

This text gives you everything you need for an intellectually satisfying tour of the most fascinating landmarks of philosophy and science. If you seek wisdom about science—and perhaps to formulate your very own philosophical views of science—this book is a great place to start.

#### **Introduction for Instructors**

This book is a philosophical introduction to science—the cognitive method that transformed our world—in the words of the best-respected philosophers of science, ready-to-read by the average freshman straight out of high school. From historical giants such as Galileo, Newton, Hume, Popper, and Kuhn, to contemporary figures like Harding, Giere, Dennett, van Fraassen, and Churchland, this is a collection of carefully chosen works, carefully edited and explained, that each student can read at his or her own depth.

Since this book is designed for the beginning college or university student, it is an ideal introduction to the philosophical issues surrounding science, not only for students of philosophy, but for students in other disciplines as well. Philosophy is a quest for true understanding guided only by reason and evidence. Although no one is more mindful of the difficulties inherent in this quest than philosophers themselves, anyone of any theoretical orientation may sometimes feel the cognitive need for research that does not elevate any theoretical commitment to the level of the sacrosanct. Philosophy treats all factual and evaluative claims as subject to critical examination and doubt, whether inside or outside of philosophy itself. As just one philosopher among the many who has found the philosophical quest invigorating, I invite my colleagues and students from other disciplines to sample the philosophical nourishment on offer in this textbook, in the faith that you, too, will be edified, as have so many thinkers before you—especially in this era of pronounced theoretical divisions.

Why is science so interesting philosophically? Professional philosophers are well-aware of the numerous intriguing insights modern science has given us into epistemology, metaphysics, and methodology. Indeed, the lion's share of philosophical work on science has addressed these three topics. Nevertheless, I propose that the philosophical interest of science is much, much broader than these three traditional topics. Science is philosophically interesting because it has reshaped nearly all aspects of human culture—and in so doing has reshaped humanity as well.

Accordingly, this text has two sections. The first section is devoted to scientific method and logic. The second section is concerned with the bigger picture, philosophically speaking,

and investigates science from the point of view of ethics, political theory, and theory of human nature.

Thus this book can serve as a text in three sorts of courses in today's college or university curriculum:

- A humanities elective or non-science option for those legions of students, from every faculty, who have a philosophical interest in science, but cannot make philosophy of science a major component of their studies;
- An introduction to the philosophy of science for those students who may go on to further philosophical study;
- A first course in philosophy, based on one of its most intriguing specialties, the philosophy of science.

The first and third options offer new possibilities for the contemporary philosophy curriculum—particularly where maintaining enrolments is so important. Many of my best honours and majors students in philosophy got their first taste of the pursuit of wisdom in the class in which I developed this text. As I have discovered, philosophical interest in science is one of the most common, and most *reliable*, indicators of the Socratic mind-set.

#### FOUR WAYS THIS TEXT HELPS YOU

- 1. Carefully Chosen and Edited Readings: Many of the most important philosophical views in the philosophy of science are collected here, and edited to emphasize the core ideas, as well as to provide plenty of challenges for those students who want to go beyond the core ideas to either matters of finer detail or issues of broader scope.
- **2.** Easy-to-Read Introductions: Each reading is preceded by a short introduction which defines and contextualizes the main issues addressed, with one main goal in mind: clarity. Because the introductions turn on the personal philosophy of the author of the reading, students are naturally drawn in. Furthermore, because each introduction lets students know what to expect before they begin reading, they read with greater comprehension.
- **3. Revealing Study Questions:** Every reading is followed by three sets of study questions that begin with simple but essential points, then build upon these points, becoming progressively more penetrating, more challenging, and more philosophically sophisticated. The three sets of questions are designed to accomplish three different things for the instructor:
- Set 1. Exegetical questions that reveal the main points of the reading.
- Set 2. Questions of interpretation and analysis that reveal the deep issues.
- Set 3. Questions stemming from broader philosophical issues that reveal the bigger picture.

#### INTRODUCTION FOR INSTRUCTORS

Because the first questions of each set are quite easily answered, students of all abilities and degrees of studiousness can grasp the thesis of the reading and its main supporting arguments. Because the questions that follow are progressively more challenging, even the best students will be intrigued and engaged in discovering the answers.

Since there are many questions in each set, you, the instructor, can choose the ones that you judge best suited to your pedagogical goals. You decide what counts as an adequate answer. In addition, the question sets will help you design reading quizzes by drawing from Set 1, design exams by drawing from Set 2, and design essay assignments by drawing from Set 3.

**4.** A Dictionary: Terms used in the philosophy of science are collected and defined at the back of the text for your students' easy access.

This text is designed to be complete and self-contained: all of the reading materials needed for a well-rounded first course in the philosophy of science are here between two covers. Most importantly, it includes not only the most crucial readings in scientific method and logic, but a fine selection of readings addressing the issues about science that are topmost in the minds of most students—and most professors—across the academy as a whole.

### SECTION ONE

### SCIENCE AND METHOD: FROM PROOF TO MODELS