Everyday Practice of Science: Where Intuition and Passion Meet Objectivity and Logic

Book · January 2009

DOI: 10.1093/acprof:oso/9780195064575.001.0001

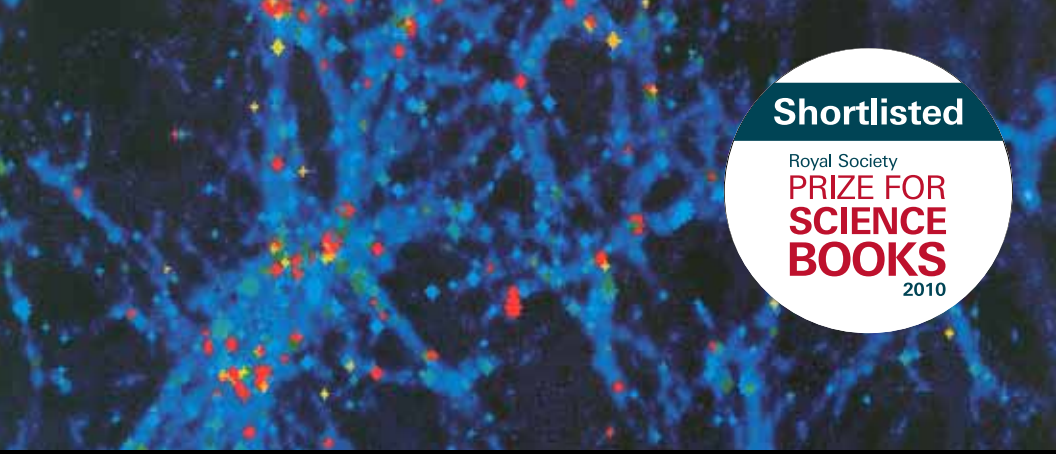
CITATIONS
28

READS
447

1 author:

Frederick Grinnell
University of Texas Southwestern Medical Center
238 PUBLICATIONS **14,987** CITATIONS

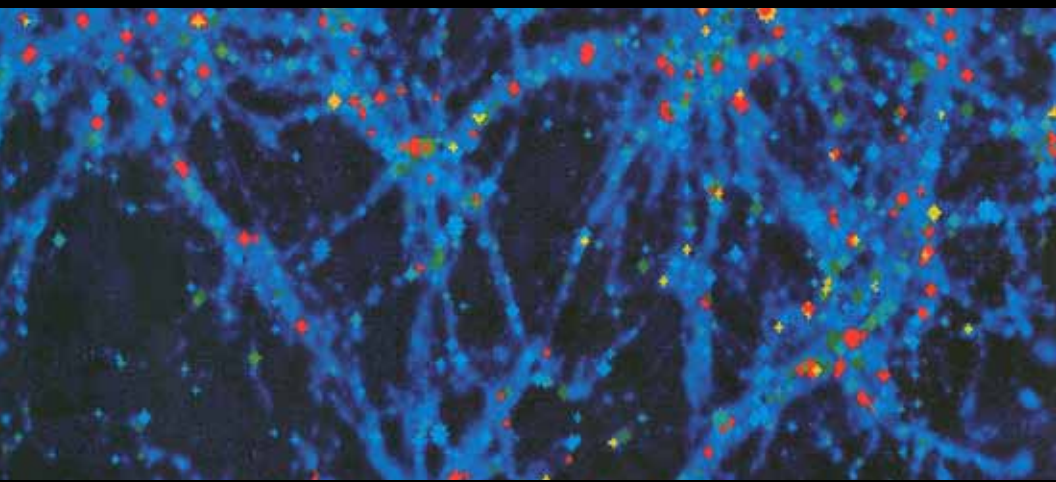
SEE PROFILE



Shortlisted
Royal Society
PRIZE FOR
SCIENCE
BOOKS
2010

Everyday Practice of Science

WHERE INTUITION AND PASSION MEET OBJECTIVITY AND LOGIC



Frederick Grinnell

EVERYDAY PRACTICE OF SCIENCE

Where Intuition and Passion Meet Objectivity and Logic

Frederick Grinnell

OXFORD
UNIVERSITY PRESS
2009

OXFORD
UNIVERSITY PRESS

Oxford University Press, Inc., publishes works that further
Oxford University's objective of excellence
in research, scholarship, and education.

Oxford New York
Auckland Cape Town Dar es Salaam Hong Kong Karachi
Kuala Lumpur Madrid Melbourne Mexico City Nairobi
New Delhi Shanghai Taipei Toronto

With offices in
Argentina Austria Brazil Chile Czech Republic France Greece
Guatemala Hungary Italy Japan Poland Portugal Singapore
South Korea Switzerland Thailand Turkey Ukraine Vietnam

Published by Oxford University Press, Inc.
198 Madison Avenue, New York, New York 10016

www.oup.com

Oxford is a registered trademark of Oxford University Press.

Library of Congress Cataloging-in-Publication Data
Grinnell, Frederick.
Everyday practice of science : where intuition and passion meet objectivity
and logic / Frederick Grinnell.
p. cm.
Includes bibliographical references and index.
ISBN 978-0-19-506457-5
1. Science—Methodology. 2. Science—Social aspects. I. Title.
Q175.G7538 2009
500—dc22 2008011104

1 3 5 7 9 8 6 4 2

Printed in the United States of America
on acid-free paper

Science is serious play.

Leon Perkins, seventh-grade science teacher
Ardmore Junior High School, Ardmore,
Pennsylvania, 1956–1957

Preface

This book is based on the premise that the underlying nature of everyday practice of science should be understandable to anyone interested in science. Modern science education tends to ignore everyday practice and focuses instead on the linear model of scientific discovery—the *scientific method*. Rather than linear, the path to discovery in everyday practice tends to be highly ambiguous and convoluted. Real-life scientists begin their work situated within particular interests and commitments. Success requires intuition and passion as much as objectivity and logic. Scratch the surface of the anonymous and somewhat boring linear model and one finds excitement, risk, and adventure. In this book I describe everyday practice of science in a fashion that embraces intuition and passion without abandoning logic and objectivity.

What is the importance of understanding everyday practice of science? Popular magazines often have provocative front covers with headlines such as "How Medical Testing Has Turned Millions of Us into Human Guinea Pigs" (*Time*, April 22, 2002) or "Should a Fetus Have Rights? How Science Is Changing the Debate" (*Newsweek*, June 9, 2003). Advances in science and technology have turned questions previously part of religious and philosophical speculation into practical concerns of everyday life. As a result, one now finds contemporary science at the center of social and legal debates about diverse issues ranging from when life begins to when life ends. At the same time, incidents involving scientific misconduct and conflicts of interest have raised concerns about the integrity of scientists. In response

to these developments, ordinary citizens, the mass media, and politicians want to know, "Are scientists doing research ethically?"

Many people accept the notion that the health, prosperity, and security of humankind depend on advances made possible by scientific research. Others are far less optimistic. They would argue that instead of further advances in science, changes in social and public policy will be necessary to have a positive impact on our common well-being. Moreover, the negative unanticipated consequences that sometimes accompany new scientific discoveries concern us all. Science brings about great benefits for humankind but also can lead to tragedy, such as the damage that technology has caused to our environment. Notwithstanding the potential for negative outcomes, an effective and innovative science and technology enterprise increasingly is viewed as prerequisite for maintaining national security, prosperity, and global competitiveness.

Two different perspectives inform my writing. I have an insider's knowledge of biomedical research based on more than 35 years of experience. My studies have been with subjects ranging from molecules to people. Over much the same period, I also have been studying philosophical issues at the interface of science, technology, and society, especially issues concerning biomedical ethics and research integrity. Combining these perspectives permits me to describe everyday practice of science and to integrate a philosophical and ethical dimension into my description. I frequently lecture on these subjects. My lectures form the basis for this book.

Science is not a monolithic activity, nor is there a single scientific community. What gets called science and how science is practiced have changed throughout history. In current issues of *Science* or *Nature*, articles can be found ranging from cosmology to economics. Biology research programs vary from highly descriptive to mathematical and theoretical. Despite the differences, practicing any kind of science requires value judgments: what to do, when to do it, how to

do it, who should pay for it, and—after the work is completed—what the findings mean. I hope to provide insight into just these sorts of issues, even though most of the examples I discuss come from the biomedical sciences and the biomedical research community.

I organized *Everyday Practice of Science* into two parts: "Science" and "Science and Society." Each part has three chapters. Part I provides a description of practice: first an overview in chapter 1, and then a detailed account of the central activities of practice—discovery and credibility—in chapters 2 and 3. Discovery means learning new things about the world. Credibility means trying to convince others that the new findings are correct. Discovery and credibility circle around the researcher, whose biography and personality influence every step of these processes. Part II then turns to an analysis of several issues concerning science and society that in recent years have received significant national attention. Chapter 4 discusses integrity in science, from the societal level of science policy to the individual level of responsible conduct and conflict of interest. Chapter 5 focuses on informed consent and risk at the interface between human research and genetics. Finally, chapter 6 analyzes the relationship between science and religion. I suggest that science and religion represent distinct human attitudes toward experience based on different types of faith.

I wrote this book for a broad audience, including students, scholars, and the public interested in science. Individuals concerned about science education and science policy should find the work especially useful. Throughout the text, I avoid the use of jargon as much as possible. I include numerous citations to previously published material, more so than might be expected in a book written for a diverse audience. Rather than aiming for a detailed scholarly review of the recent literature in science studies, many of these references serve a more personal function. Most scientists I know complain about not having their discoveries appropriately cited by others. I often feel that

way myself. Therefore, when I use ideas that I learned from others, I feel obliged to cite the relevant work if I still remember the original source. However, so as not to disrupt the flow of the chapters, these references are collected together at the end of the book.

I also include more quotations in the text than is common in a book about science. Many of the quotations that I use either come from the writings of Nobel laureates or concern Nobel Prize–winning research. I do not mean to imply that Nobel laureates are more knowledgeable about science than the overwhelming majority of researchers who have not achieved such recognition. I do not mean to imply that the Nobel Committee always is correct in its judgments about what scientists or scientific discoveries are most deserving of the Nobel Prize. Nevertheless, precisely because of their recognition, the Nobel laureates often have an opportunity to write memoirs about their lives in science. Nobel Prize–winning research often is the subject of analysis. I use these memoirs and analyses to illustrate key features of everyday practice of science. Their descriptions usually confirm my own experiences.

Acknowledgments

My thanks to Mark Frankel, Kenneth Pimple, William Snell, and Lee Zwanziger, who read and commented on the manuscript as the book evolved. Peter Farnham, Daniel Foster, David Hull, Stephen Jenkins, Mihai Nadin, Michael Ruse, Daniel Sarewitz, and Ken Yamada provided useful comments and suggestions. Charles Currin and the Southern Methodist University Ethics Colloquy offered important insights, as well. Former Oxford University Press editor William Curtis encouraged me to undertake this project. OUP editor Peter Prescott was of great help finalizing the work.

I am indebted to Richard Zaner, with whom I studied philosophy at Southern Methodist University in the 1970s, which was shortly after I joined the faculty at the University of Texas Southwestern Medical Center. Years later, Zaner arranged for me to study with his teacher Maurice Natanson when I was on sabbatical at Yale University. Together, Zaner and Natanson had a profound influence on my philosophical approach to understanding practice of science.

Finally, I thank Gayle Roth for her love and support during the final years of this project, and my children, Laura, Phillip, and Aviva, for their encouragement over the long time required to bring the book to completion.

Preparation of the manuscript was made possible by a grant from the National Library of Medicine (LM07526) and facilitated by a MERIT award from the National Institute of General Medical Sciences (GM031321). The ideas that I discuss are my own and do not represent the official views of the National Institutes of Health.