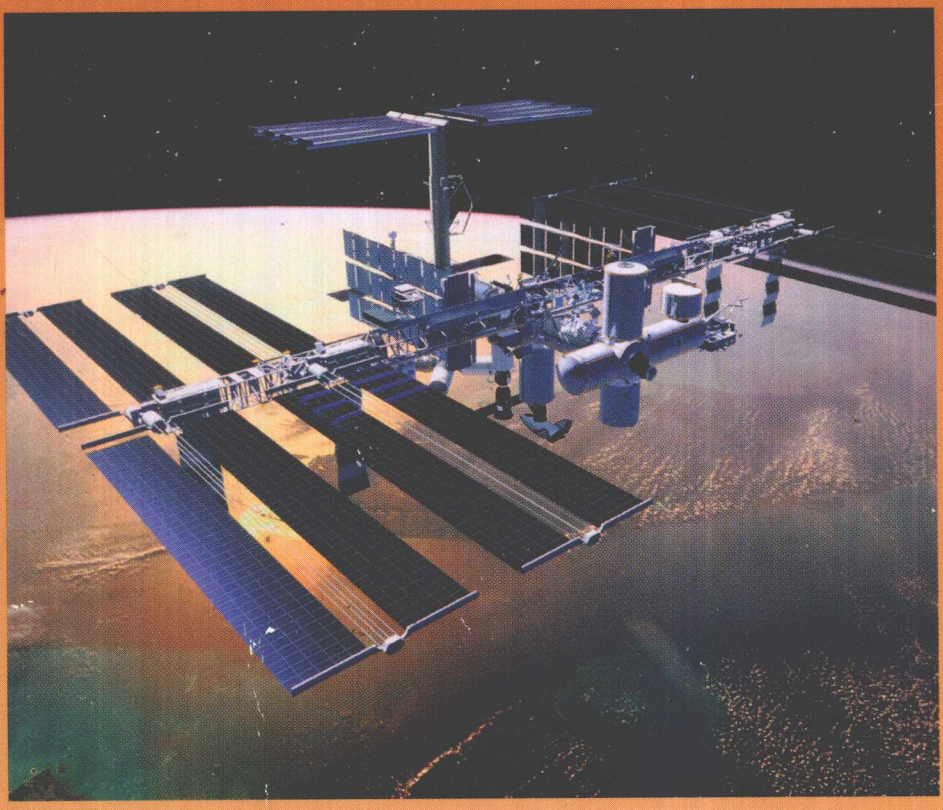
TAKING SIDES



Clashing Views on Controversial Issues in

Science, Technology, and Society

FIFTH EDITION

Thomas A. Easton

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Issues in Science, Technology, and Society

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Selected, Edited, and with Introductions by

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Preface

Those who must deal with scientific and technological issues—scientists, politicians, sociologists, business managers, and anyone who is concerned about a neighborhood dump or power plant, government intrusiveness, expensive space programs, or the morality of medical research, among many other issues—must be able to consider, evaluate, and choose among alternatives. Making choices is an essential aspect of the scientific method. It is also an inescapable feature of every public debate over a scientific or technological issue, for there can be no debate if there are no alternatives.

The ability to evaluate and to select among alternatives—as well as to know when the data do not permit selection—is called critical thinking. It is essential not only in science and technology but in every other aspect of life as well. *Taking Sides: Clashing Views on Controversial Issues in Science, Technology, and Society* is designed to stimulate and cultivate this ability by holding up for consideration 18 issues that have provoked substantial debate. Each of these issues has at least two sides, usually more. However, each issue is expressed in terms of a single question in order to draw the lines of debate more clearly. The ideas and answers that emerge from the clash of opposing points of view should be more complex than those offered by the students before the reading assignment.

The issues in this book were chosen because they are currently of particular concern to both science and society. They touch on the nature of science and research, the relationship between science and society, the uses of technology, and the potential threats that technological advances can pose to human survival. And they come from a variety of fields, including computer and space science, biology, environmentalism, law enforcement, and public health.

Organization of the book For each issue, I have provided an *issue introduction,* which provides some historical background and discusses why the issue is important. I then present two selections, one pro and one con, in which the authors make their cases. Each issue concludes with a *postscript* that brings the issue up to date and adds other voices and viewpoints. I have also provided relevant Internet site addresses (URLs) on the *On the Internet* page that accompanies each part opener. At the back of the book is a listing of all the *contributors to this volume,* which gives information on the scientists, technicians, professors, and social critics whose views are debated here.

Which answer to the issue question—yes or no—is the correct answer? Perhaps neither. Perhaps both. Students should read, think about, and discuss the readings and then come to their own conclusions without letting my or their instructor's opinions (which perhaps show at least some of the time!) dictate theirs. The additional readings mentioned in both the introductions and the postscripts should prove helpful. It is worth stressing that the issues

covered in this book are all *live* issues; that is, the debates they represent are active and ongoing.

Changes to this edition This fifth edition represents a considerable revision. There are five completely new issues: *Should Creationism and Evolution Get Equal Time in Schools?* (Issue 3); *Do Cell Phones Cause Cancer?* (Issue 7); *Does Law Enforcement Technology Threaten the Fourth Amendment?* (Issue 12); *Will Screens Replace Pages?* (Issue 13); and *Should Genetically Modified Foods Be Banned?* (Issue 16).

For the issues on population (Issue 4) and global warming (Issue 5), the issue title has been changed and the readings have been replaced, bringing the debate up to date and changing the focus. In addition, for four of the issues retained from the previous edition, one reading has been replaced to update the debate: *Should Peer Review Dominate Decision Making About Science?* (Issue 1); *Is Irradiated Food Safe to Eat?* (Issue 8); *Is It Ethical to Sell Human Tissue?* (Issue 17); and *Is It Ethically Permissible to Clone Human Beings?* (Issue 18). In all, there are 18 new selections. The issue introductions and postscripts for the retained issues have been revised and updated where necessary.

A word to the instructor An *Instructor's Manual With Test Questions* (multiple-choice and essay) is available through the publisher for the instructor using *Taking Sides* in the classroom. It includes suggestions for stimulating in-class discussion for each issue. A general guidebook, *Using Taking Sides in the Classroom,* which discusses methods and techniques for integrating the pro-con approach into any classroom setting, is also available. An online version of *Using Taking Sides in the Classroom* and a correspondence service for *Taking Sides* adopters can be found at `http://www.dushkin.com/usingts/`.

Taking Sides: Clashing Views on Controversial Issues in Science, Technology, and Society is only one title in the Taking Sides series. If you are interested in seeing the table of contents for any of the other titles, please visit the Taking Sides Web site at `http://www.dushkin.com/takingsides/`.

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Contents In Brief

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PART 1

The Place of Science and Technology in Society

The partnership between human society and science and technology is an uneasy one. Science and technology offer undoubted benefits, in both the short and long term, but they also challenge received wisdom and present us with new worries. The issues in this section deal with the best way to ensure that society benefits from science and technology, the best way to ensure that the citizenry understands the science and technology that pervade their lives, the conflict between science and traditional elements of society, and the debate over creationism versus evolution.

- Should Peer Review Dominate Decision Making About Science?
- Is Science a Faith?
- Should Creationism and Evolution Get Equal Time in Schools?

ISSUE 1

Should Peer Review Dominate Decision Making About Science?

YES: George Conrades, from "Basic Research: Long-Term Problems Facing a Long-Term Investment," *Vital Speeches of the Day* (May 15, 1999)

NO: David H. Guston and Kenneth Keniston, from "Updating the Social Contract for Science," *Technology Review* (November/December 1994)

ISSUE SUMMARY

YES: George Conrades, chairman of the Committee for Economic Development's Subcommittee on Sustaining American Basic Research, contends that the American economy has thrived because of public investments in basic research guided by peer review and that attempts to bypass peer review must be resisted.

NO: Assistant professor of public policy David H. Guston and professor of human development Kenneth Keniston argue that science can no longer set its own path. They conclude that public participation must be increased at all levels of decision making about science.

What scientists do as they apply their methods is called research. Scientists who perform basic or fundamental research seek no specific result. Basic research is motivated essentially by curiosity. It is the study of some intriguing aspect of nature for its own sake. Basic researchers have revealed vast amounts of detail about the chemistry and function of genes, explored the behavior of electrons in semiconductors, revealed the structure of the atom, discovered radioactivity, and opened our minds to the immensity in both time and space of the universe in which we live.

Applied or strategic research is more mission oriented. Applied research scientists turn basic discoveries into devices and processes, such as transistors, computers, antibiotics, vaccines, nuclear weapons and power plants, and communications and weather satellites. There are thousands of such examples, all of which are answers to specific problems or needs, and many of which were quite

surprising to the basic researchers who first gained the raw knowledge that led to these developments.

There was a time when both types of research were performed mostly by individual scientists and small teams, often working with very small budgets. But the payoffs have proved so useful that today research has become an enterprise for large teams and ample funding.

It is easy to see what drives the movement to put science to work. Society has a host of problems that cry out for immediate solutions. Yet there is also a need for research that is not tied to explicit need because such research undeniably supplies a great many of the ideas, facts, and techniques that problem-solving researchers then use in solving society's problems. Basic researchers, of course, use the same ideas, facts, and techniques as they continue their probings into the way nature works.

There is also an increasing pressure for public participation in deciding on what scientists work. Science, say some, must be removed from control by social, political, and intellectual elites, and scientists must be held accountable if they expect society to fund their work. Politicians expect a guarantee of results; the public craves guarantees of safety and of benefit to all society, not just the elite.

Yet scientists have long insisted that decisions about what research should be performed, funded, and published are properly made by scientists alone in the process known as "peer review." The National Research Council (NRC) believes that this should continue. Its 1995 report *Allocating Federal Funds for Science and Technology* argued that "panels of the nation's leading experts" should advise science policymakers. Working scientists—the "peers" in the peer review system—should decide what specific projects get funded. Except for unavoidable politicians and bureaucrats, nonexperts should stay out of the way, the report concluded.

In 1998 the Committee for Economic Development (CED) published *America's Basic Research: Prosperity Through Discovery* (available at `http://www.ced.org/projects/basic.htm`). That report defended the value of basic research to the American economy, warned against attempts to divert funding (as by congressional "earmarks") to research that is not supported by the peer review system, and stated that "science, itself, often trumps attempts to better organize our investments in the discovery process. This creates both problems and opportunities we can't predict," but the value of the opportunities greatly outweighs the hazards of the problems. In the following selection, which is from an address to the American Chemical Society, George Conrades summarizes the CED report.

David H. Guston and Kenneth Keniston recognize that public attitudes toward scientific research are a product of the past successes of science and technology, the vast expense of the scientific enterprise, and a few spectacular technological failures. In the second selection, they say that in a democracy, the public should not be excluded from decision making about science. That is, decisions should not be left to the experts alone.

George Conrades

Basic Research: Long-Term Problems Facing a Long-Term Investment

Delivered to the American Chemical Society's 217th National Meeting, Anaheim, California, March 23, 1999

... [Recently] CED [Committee for Economic Development] released our policy statement, "America's Basic Research: Prosperity through Discovery." (If I can make a brief plug, it's available on the CED Web site at www.ced.org.)

The report was the culmination of an intensive effort by a distinguished group of business and academic leaders, and its quality is directly attributable to the expertise of all the participants. Members of this group were impressive, not only for whom they represented–including Procter & Gamble, Merck, Pfizer, and Harvard and Columbia universities, to name just a few–but also for the depth of knowledge and experience each brought to the table.

In fact, the make-up of the subcommittee was befitting–given the subject we were dealing with–since it is this same kind of diversity of ideas and insights that makes basic research one of our greatest national assets.

Our economic growth and prosperity owe much to our support for innovation in fundamental science and engineering. And we owe it to future generations to not just maintain, but foster that support well into the next century.

I'm sure you agree, since many of the policy priorities we arrived at in our report are consistent with those championed by the American Chemical Society [ACS]. As a "voice of the business community," CED hopes our efforts help the ACS as you work to keep research high on Washington's policy agenda.

When we started this project, our decision to focus on basic research–rather than the R&D [research and development] process overall–was based on our understanding that basic research is a uniquely important component of R&D.

For one thing, basic research is rarely confined to a single discipline. It crosses a multitude of subject matters that span the entire gamut of science and engineering.

Unlike applied or development research, it's also a lot harder to predict specific outcomes of basic research. That's because it may take as much as a

From George Conrades, "Basic Research: Long-Term Problems Facing a Long-Term Investment," *Vital Speeches of the Day*, vol. 65, no. 15 (May 15, 1999).

generation, or more, before practical advantages of new breakthroughs become apparent. And because the benefits are often spread across economic sectors and industries.

The use of enzymes in synthetic detergents, for example, started in the 1960s, when they were first used as cleaning agents. But they trace their roots all the way back to the original work of Louis Pasteur, more than a century ago.

Likewise, most people think of the Internet as a new phenomenon. They'd be surprised to learn that it's celebrating its 30th anniversary later this year. Or that it had its mathematical origins—or "DNA"—in work done in the 1800s.

As the former CEO of BBN—one of the principal companies that built the ARPANET, the forerunner of the Internet—I have the honor to know many of its inventors. I can tell you, these guys are as amazed at the size and scope of the Internet's success as the rest of us.

Let me also say, I don't think the Internet would have been possible without the support of government. At CED, we believe the role of government and public policy are most critical in basic research... especially when compared to other areas of innovation. That is certainly the case in the commercialization of technology.

Government-funded research often lays the groundwork for new technologies that are then developed by private industry. Industrial research, in turn, contributes to the growing stock of knowledge in many different areas of science. And though its primary objective is to support product development, it often stimulates additional research efforts.

This non-linear, multifaceted combination of publicly and privately funded research has sustained America's leadership in many areas of science. What's more, it has brought us enviable economic benefits.

As you well know, investment in basic research is no game of chance. Most research investments are systematic, quality-driven, and outcome- and mission-oriented.

As a result, they have long provided an excellent return on both public and private dollars.

Indeed, there is a consensus of opinion that holds that returns on overall R&D activities are generally double the historical returns on stocks.

But the real payback comes from investments in basic research that consume less than one half of one percent of GDP [gross domestic product] to create long-term, far-reaching, economic and social gains.

Let me bring the point closer to home.

In the Boston area, where I live, a BankBoston study shows that MIT research has had an enormous impact on the region. The study estimates that more than a thousand MIT-related companies in the state employ more than 125,000 people, and generate more than $50 billion in global sales.

These same companies employ nearly a quarter-of-a-million additional workers around the world.

If you live near Silicon Valley, or the Research Triangle in North Carolina, you know what I'm talking about, because it's happening there too. There's no question that the economic benefits of basic research are considerable.

In CED's view then, the core strengths of the American basic research enterprise include:

- a healthy industrial basic research sector;
- an even larger group of publicly-supported, university-based, (and I might add) world-class basic research institutions that serve as training grounds for future scientists and engineers;
- and a highly-competitive, highly-productive method of allocating public funds to individual researchers and projects, based on peer-review.

There's also no doubt that the United States will continue to see pay-offs from its basic research investments, as it has throughout the century. But America's basic research enterprise must constantly renew itself to keep up with changing scientific, economic, and political trends.

Raising a cautionary note about the future of basic research in today's productive environment is no easy task. Nevertheless, CED has identified a number of potential trouble spots on the horizon. Among these are:

- the growing claims on public research dollars—and on the federal budget in general—that could be better spent on a balanced portfolio of peer-reviewed basic research;
- an education system that is ill-equipped to serve the needs of the scientific community;
- a growing, complex relationship between universities and industry;
- and an expanding global context for our national research enterprise.

If these emerging issues are left unchecked—or misunderstood—we believe they can severely undermine our efforts in the years ahead. And that's what I'd like to talk to you about today.

The hallmark of the American basic research enterprise has been its system of peer reviewed competition for federal research grants... primarily among university researchers and individual investigators. Peer review is typically associated with the National Institutes of Health [NIH] and the National Science Foundation—two of the largest federal agencies for basic research. Both are recognized for their ability to identify high-quality science and for establishing funding priorities based on scientific merit.

We believe the success of NIH-sponsored research, in recent years, is hardly surprising, since the agency has relied extensively on the peer review process in allocating funds. But an increasing amount of government-funded research is not subject to peer review. Instead, the process is being circumvented through congressional "earmarks."

That's Washington-speak for the designation of public moneys for specific research projects that often have less to do with science, and more to do with securing funding for constituent institutions.

Last year, federal earmarks to universities and colleges grew to nearly half-a-billion dollars. And while not all earmarked research is bad research, it's just not in the interest of good science to allocate money this way.