The Culture of Science

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JENÉE WILDE AND STEVE RUST

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THE CULTURE OF SCIENCE

SECOND EDITION
EDITED BY JENÉE WILDE, PHD, AND STEVE RUST, PHD

The Culture of Science began in 2008 with editor Patricia Oman's important work developing the Composition Program's very first casebook. Like that first edition, this updated version opens up modes of inquiry into Western knowledge foundations, asking students to embrace epistemological uncertainty as a productive means of developing critical thinking skills.

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Preface to the Second Edition, by Jenée Wilde and Steve Rust

BEGINNINGS

The Culture of Science began in 2008 with editor Patricia Oman's important work developing the Composition Program's very first casebook. Like that first edition, this updated version opens up modes of inquiry into Western knowledge foundations, asking students to embrace epistemological uncertainty as a productive means of developing critical thinking skills. The new digital format also meets open access education priorities for free online textbooks and resources. Our goals with this edition are to address the University's priorities for inclusive, engaged, and research-led teaching by: (1) increasing the global scope of the readings as well as the diversity of the authors; (2) selecting readings that aim to improve scientific vocabulary and literacy for all students; and (3) making often difficult scientific topics approachable for students with a range of academic interests. When students read interesting articles, have engaging conversations, and are invited to question the assumptions behind what counts as knowledge in our culture, they learn to think critically, write better papers, and actively engage the rhetorical concepts we teach in the Composition Program.

RATIONALE

At the University of Oregon, our diverse students benefit greatly from understanding the broader culture of academia and their place as scholars within it. *The Culture of Science* allows students to see particular knowledge debates in the social and natural sciences as happening in the contexts of people who share ideas, argue claims, and through cooperative processes come to agreement over time about the information and methods that constitute "science," our best knowledge about ourselves and the world. As a result, rather than seeing themselves as merely receptors of information, students become active participants in this ongoing process of knowledge building. The casebook is particularly suited to addressing questions at issue that students will encounter across University courses and disciplines, such as: What are the boundaries of science and who gets to decide? How do researchers work through disagreements as a community in order to advance our knowledge about the world? What roles should science and scientists play in public discourses and policy-making? (See Reading Unit abstracts for additional questions.) These cultural processes involve discussions of acceptable research methods and ethical use of sources, the importance of peer review in academic discourse, and the values expressed in debates over the demarcation between scientific knowledge and other ways of perceiving the world, among other topics. In addition to giving students the language and skills to navigate a range of disciplinary approaches, *The Culture of Science* invites them to think about the academy as a culture and their own work within the writing classroom and their majors as participating within this culture.

OVERVIEW OF CONTENT

The casebook offers five reading units organized thematically around significant questions at issue. Reading Unit 1 grounds

students in contemporary questions of science and its boundaries, offering a blend of dense and approachable readings intended to spark class conversations on the topic of scientific culture. Units 2 and 3 extend discourses on scientific culture into areas of critical analysis such as gender, race and ethnicity, religion, ethics, and colonialism, as well as examining issues of language and perception. Unit 4 focuses on basic questions of fact, definition, and interpretation by exploring the discourse surrounding anomalies, pseudoscience, and skepticism, making it particularly useful for reviewing and extending students' understanding of skills learned in Writing 121. Finally, Unit 5 offers a case study on Frankenstein as a techno-moral lesson on overreaching ambition and how it applies to scientific culture today. While the Table of Contents is organized thematically, many readings have cross-unit (and cross-disciplinary) connections and relevance. We encourage instructors to make use of the Alternative Table of Contents and to feel welcome to assign the entire casebook in your courses and/or to use individual readings or units as launching points for individual and team research projects. Supplementary teaching resources can be found in the casebook bibliography.

Introduction: Reading, Reasoning, and Writing about Science, by James Crosswhite, Professor of Rhetoric and Composition at the University of Oregon

EXCERPT FROM READING, REASONING, AND WRITING ABOUT SCIENCE

Nothing is more familiar than science. Our daily lives are permeated with the results of modern science. . . . Our cars and buses and aircraft are all designed and tested using the best science available. We all expect this, and we are troubled to learn that scientifically established knowledge has been ignored when it comes to the design and use of the things we rely on every day.

However, science is also a matter of controversy. What is science? Is it one thing? What is the difference between good science and bad science? The best science and the rest of science? How do we evaluate scientific studies, observations, experiments, arguments, theories? How do we use science to develop good public policy or make good choices

about health care? What do we do when experimental results seem to point to opposite conclusions? How seriously should we take correlation studies? What should we do when scientific knowledge seems to conflict with religion, or with common sense? Can everything be explained scientifically? Are there other sources of knowledge besides science? If we are not ourselves scientific experts, at what point should we defer to the judgments of people who are? Scientists themselves struggle with these questions, and non-scientists find that they often do, too.

These issues make the culture of science an especially appropriate focus for a course in written reasoning, in which exploring, understanding, and acknowledging the different sides of an issue are essential parts of the writing process (xi-xii).

Full Text Link: Reading, Reasoning, and Writing for Science by James Crosswhite from The Culture of Science

Unit 1: Defining Science

INTRODUCTION

People often think of science as a static body of knowledge describing natural phenomena, the human body, and the technologies that improve our standard of living and help us discover new things about our world. But scientists themselves recognize that the word "science" means far more than the natural and social phenomena that they study. While "science" describes categories of knowledge and specific methods for determining fact from fiction, the term also plays a *normative* role in language and culture as the process secular society uses to determine what beliefs about the world are epistemically warranted.

All the selections in this unit address fundamental questions about how we define science, what counts as scientific knowledge, and how these distinctions are made. The four readings included here raise important questions within the culture of science such as:

1. How do scientists draw the boundaries between science and pseudoscience?
2. How do politics and science influence one another?
3. What role should science and scientists play in society?

4. What role does non-science play in scientific success?
5. Is the scientific method our best way of achieving new knowledge?
6. Should Western science be valued over other forms of knowledge?
7. Should students be taught to question accepted scientific principles?
8. Do you value objective knowledge more than subjective experience?
9. How do you determine truth?

READINGS

"Science and Pseudo-Science"

Hansson, Sven Ove. "Science and Pseudo-Science." *Stanford Encyclopedia of Philosophy*, Summer 2017 edition, edited by Edward N. Zalta.

What beliefs about the world can be justified as scientific knowledge? This encyclopedia article examines the demarcation between science and pseudoscience in order to answer this question.

"Weaving Traditional Ecological Knowledge into Biological Education: A Call to Action"

Kimmerer, Robin Wall. "Weaving Traditional Ecological Knowledge into Biological Education: A Call to Action."

BioScience, vol. 52, no. 5, May 2002, pp. 432-438.

Should Western science be valued over other forms of knowledge? In this peer-reviewed scientific article, plant ecologist Robin Wall Kimmerer explores why the traditional ecological knowledge of indigenous peoples should be recognized as "complementary and equivalent" to scientific knowledge and included in university science curricula.

Must be logged into UO library account to access article.

"Yes, Science is Political"

Lopato, Elizabeth. "Yes, Science is Political." *The Verge*, 21 April 2017.

In this 2017 article and video essay, The Verge *deputy editor Elizabeth Lopato considers the role of politics in science and science in politics as Trump enters the White House. The Verge is a multimedia online news magazine exploring "how technology will change life in the future for a massive mainstream audience."*

From *Against Method: Outline of an Anarchistic Theory of Knowledge*

Feyerabend, Paul. From *Against Method: Outline of an Anarchistic Theory of Knowledge*, first edition 1975. Marxists Internet Archive.

In his 1975 book, philosopher Paul Feyerabend argues that logic, reason, and the scientific method are not the processes by which scientific knowledge actually develops. Rather, when one looks closely at the events leading up to key scientific discoveries, one may conclude that "anything goes"—in other words, epistemological anarchism is how scientific progress actually occurs. Web page includes the book's analytical table of contents and concluding chapter.

Unit 2: Interpreting Science

INTRODUCTION

We often assume that science is objective and that facts are concrete. Yet the discovery of new phenomena and new interpretations of known facts constantly reshape our accepted scientific truths. Moreover, historical and social contexts influence not only what scientists choose to study but also their disposition toward those objects of study. In other words, scientists bring their own backgrounds, experiences, and subjective perspectives to their research, wittingly or not. Over time, cultural bias can impact the work of individual scientists, resulting in issues such as gender inequity and scientific racism. Cultural bias can also impact how the public reacts to scientific advancement and rethinking, resulting in public controversies over issues that scientists may no longer consider to be controversial.

The selections in this unit ask us to question the way that science has categorized, labeled, and explained human, nonhuman, and celestial bodies. The four readings included here question the supposed objectivity of science by asking:

1. Can (or should) science always be objective?
2. How has human reproduction been explained in biology using language that diminishes the experiences of women?

3. How have the stains of racism and white supremacy infiltrated scientific understanding?
4. Why is the public often resistant to changes in established scientific "facts"?
5. What role do metaphors play in science writing?
6. How is it that metaphors help us extend knowledge by mapping what we know onto what we don't via language?
7. What are the benefits and costs of using metaphors in science writing?
8. Have you encountered gender and/or racial bias in your own science education?
9. Has your personal opinion ever clouded your willingness to accept a scientific claim?

READINGS

"The Egg and the Sperm: How Science Has Constructed a Romance Based on Stereotypical Male-Female Roles"

Martin, Emily. "The Egg and the Sperm: How Science Has Constructed a Romance Based on Stereotypical Male-Female Roles." *Signs: Journal of Women in Culture & Society*, vol. 16, no. 3, Spring 1991, pp. 485-501.

Anthropologist Emily Martin wrote this peer-reviewed linguistic analysis of biological research during the 1990s' "science wars," when long-held beliefs in the objectivity and realism of scientific

knowledge came under attack as social constructs. Contributing to this debate, Martin demonstrates how biased gender stereotypes have been imported into the purportedly objective language of reproductive biology, with far-reaching social implications.

Must be logged into UO library account to access article.

"Unnatural Selection: How Racism Warps Scientific Truths"

Beck, Abacki. "Unnatural Selection: How Racism Warps Scientific Truths." *Bitch Media*, 5 Oct. 2017.

In this article, social activist Abacki Beck critiques the assumption that scientific truths are "largely unbiased, nonpartisan, and universal" by examining how science is "wrought with violent, racist histories assumed as truth and presented as for the good of humanity." Bitch Media is an online media organization whose mission is "to provide and encourage an engaged, thoughtful feminist response to mainstream media and popular culture."

"Pluto, Perception & Planetary Politics"

Jewitt, David, and Luu, Jane X. "Pluto, Perception & Planetary Politics." *Daedalus*, vol. 136, no.1, Winter 2007, pp. 132-36.

In this peer-reviewed article,

astronomers David Jewitt and Jane X. Luu explore reasons behind the unexpected public outcry over Pluto's loss of planetary status in 2006. The controversy sheds light not only on the public's perception of science but also on the role of politics and public relations in science.

Must be logged into UO library account to access article.

"Natural Enemies: Metaphor or Misconception?"

Chew, Matthew K., and Manfred D. Laubichler. "Natural Enemies: Metaphor or Misconception?" *Science*, vol. 301, no. 5629, 2003, pp. 52–53.

Is the prevalence of metaphors in science writing helpful or harmful? In this peer-reviewed article published in Science*, biologists Manfred D. Laubichler and Matthew K. Chew examine the benefits and costs of metaphorical language within science writing, particularly within the natural sciences where objectivity is presumed.*

Must be logged into UO library account to access article.

Unit 3: Global Science

INTRODUCTION

In an increasingly interconnected world, science is happening 24-hours a day in every time-zone around the world. The Internet has contributed to a sharing of information and ideas unprecedented in world history, challenging Western frameworks for understanding what science is and what counts as scientific knowledge. In addition, scientific concerns with a global scope like climate change and species extinction require global partnerships and knowledge sharing if we are to address them meaningfully. These pressing issues raise significant questions about historical impacts of Western colonialization, the loss and suppression of traditional knowledge forms, and human attitudes toward other forms of life. These issues and others have set the stage for new modes of transhuman and transspecies cooperation and understanding in the twenty-first century but also remind us that humanity now faces a global environmental crisis of our own making that is unprecedented in the history of our planet.

The readings in this unit ask:

1. What issues and problems regarding scientific research and cultural (mis)understanding exist around the world?
2. What role does (or should) belief play in science?

3. Should Western science be valued over other forms of knowledge?
4. Should science value objectivity over humanistic and/or transhuman concerns?
5. How are traditional knowledge forms being incorporated into scientific research/education?
6. How should modern scientific culture address problems resulting from Western civilization's colonial past?
7. Is rational scientific understanding enough to create a better world/future?
8. Have you ever had a pet or met an animal you would consider "intelligent"?
9. Do you think science fiction stories can lead to future scientific or technological breakthroughs?

READINGS

"When the East Meets the West: The Future of Traditional Chinese Medicine in the 21st Century"

Qiu, Jane. "When the East Meets the West: The Future of Traditional Chinese Medicine in the 21st Century." *National Science Review*, vol. 2, no. 3, 1 Sept. 2015, pp. 377–380.

Does Traditional Chinese Medicine (TCM) have anything to offer Western science and medicine, or should its philosophy and approaches to healthcare be considered pseudoscientific? In this forum, six panelists from diverse medical,

governmental, and scientific backgrounds discuss "the differences between [Traditional Chinese Medicine] and Western science and medicine, recent progress in TCM research, and key challenges in modernizing this ancient practice."

Must be logged into UO library account to access article.

"Climate Change and the Significance of Religion."

Hulme, Mike. "Climate Change and the Significance of Religion." *Economic and Political Weekly*, 15 July 2017.

In this essay, Mike Hulme, professor of climate and culture at King's College in London, argues that religions matter when it comes to addressing the major environmental problems facing society today. He suggests that national and international climate policies need to tap into the "intrinsic, deeply-held values and motives" of religious communities as a political resource "if cultural innovation and change are to be lasting and effective."

"*Black Panther* and the Politics of Afrofuturism"

Murray, Rubin. "*Black Panther* and the Politics of Afrofuturism." *International Policy Digest*, 10 March 2018.

In this article, Rubin Murray explores

how the film Black Panther *is influenced by Afrofuturism, an aesthetic and philosophical movement that challenges Western colonial "representations of the future world, setting it in conjunction with African and black culture." He compares the film's imagined Wakandan society with historical and present economic, political, and technological conditions on the continent.*

"Minds of Their Own: Animals are Smarter Than You Think"

Morell, Virginia and Jennifer S. Holland, "Minds of Their Own: Animals are Smarter Than You Think." *National Geographic,* vol. 213, no. 3, March 2008, pp. 36-61.

This popular magazine article explores how some scientists are using innovative, collaborative methods for researching animal cognition, as well as the implied threat of these findings toward what many scientists have long believed made human beings distinctive.

Must be logged into UO library account to access article.

Unit 4: Science, Anomalies, and Skepticism

INTRODUCTION

In general, scientists do three things: document or discover facts, apply research methods, and draw conclusions. We think of facts as data, the raw material gathered from observations and experiments. Methods refer to the discipline-specific practices that scientists use to go about gathering, analyzing, and reporting that data. Conclusions or findings are the ways that scientists explain the facts and the theories behind those explanations, as well as potential applications of the information.

So how does the culture of science respond to claims that fall outside the normative boundaries of mainstream scientific research and knowledge? Sometimes scientists and proponents of fringe scientific theories disagree over whether or not anomalistic phenomena can be legitimately studied as science. These debates over the borders of science and pseudoscience frame the five readings in this unit:

1. Are there reasonable arguments for why research into paranormal or anomalistic experiences should be taken more seriously as scientific investigations?
2. Are there reasonable arguments for why anomalistic

claims should be rejected as science?

3. How do these debates provide insight into how we define and interpret science?
4. What pseudoscientific claims have been debated in scientific circles?
5. Has society become too skeptical of scientific findings? When does skepticism go too far?
6. Should society place more trust in science?
7. Do you think scientists should take anomalistic claims more seriously?
8. Have you ever experienced something science cannot explain?

READINGS

"Separating the Pseudo from Science"

Gordin, Michael D., "Separating the Pseudo from Science." *The Chronicle of Higher Education*, 17 Sept. 2012.

In this trade newspaper article, Princeton University history professor Michael D. Gordin explores the "emotive work" performed by the label "pseudoscience" in demarcating certain ideas, and the individuals who perpetuate them, as threatening to the empirical authority of science.

"Two Wrongs Make A Right: Using Pseudoscience and Reasoning Fallacies to Complement Primary Literature."

Stover, Shawn. "Two Wrongs Make A Right: Using Pseudoscience and Reasoning Fallacies to Complement Primary Literature." *Journal of College Science Teaching*, Jan. 2016, p. 23+.

In this peer-reviewed article, biology professor Shawn Stover explains how some university science programs are incorporating pseudoscience case studies into coursework to teach the hierarchy of scientific evidence and how common reasoning mistakes are made by the general public when topics like global warming and evolution are debated.

Must be logged into UO library account to access article.

"The Perspective of Anomalistics"

Truzzi, Marcello. "The Perspective of Anomalistics." *Skeptical Investigations*, The Association for Skeptical Investigations, 2008.

Should scientists take research into the paranormal and other unexplained phenomena more seriously? In this article, sociology professor Marcello Truzzi defines the key features of Anomalistics, an "emerging interdisciplinary study of scientific anomalies," and explains how researchers in the field are serving scientific aims.

"An Anomalistic Psychologist"

French, Chris. "An Anomalistic Psychologist." Interview by Lance Workman. *Psychologist*, vol. 27, no. 1, Jan. 2014, pp. 26-27.

In this interview, neuropsychologist Chris French tells Lance Workman how he became interested in investigating the psychology of paranormal beliefs and experiences, as well as the insights such research gives into scientific culture and the scientific process itself.

Must be logged into UO library account to access article.

"Abuses of Skepticism"

Mooney, Chris. "Abuses of Skepticism." *Skeptical Inquirer,* Committee for Skeptical Inquiry, 5 Dec. 2003.

In this article, science writer Chris Mooney explores how the skeptical impulse, when taken to extremes, "can lose its usefulness and even lead to perverse outcomes."

Unit 5: The Scientific Imagination

INTRODUCTION

This reading unit focuses on the Prometheus myth via Mary Shelly's 1818 novel *Frankenstein, Or The Modern Prometheus* and the question of whether scientists today should seek to create and use new technologies to reshape life as we know it. With modern advances in nuclear energy, robotics and artificial intelligence, genome editing, space exploration and more, modern science has the potential to radically change the world for better or worse. This unit asks questions about the role of technology in the culture of science by asking:

1. What makes us human?
2. Is human a biological or social category?
3. What is monstrosity?
4. Is knowledge gathering always a positive pursuit?
5. Should there be limits for what we can know and do with science and technology?
6. How do anthropocentrism and anthropomorphism influence our understanding of the natural world?

7. Do you think a doctor should be allowed to use genetic engineering technology to alter a fetus if doing so could prevent a child from inheriting a life-threatening genetic malady or disease?
8. Would you let a doctor genetically alter your child to increase its intelligence or alter its physical characteristics such as sex, height, eye color, or skin pigmentation, if that were possible?

READINGS

"Outrage Intensifies Over Claims of Gene-Edited Babies"

Stein, Rob. "Outrage Intensifies Over Claims of Gene-Edited Babies." *NPR*, National Public Radio, 7 Dec. 2018.

This news story reports on the outrage of international scientists in the wake of an announcement that the world's first gene-edited twin girls have been born in China.

Frankenstein, or the Modern Prometheus: Annotated for Scientists, Engineers, and Creators of All Kinds

Guston, David H. et al. *Frankenstein, or the Modern Prometheus: Annotated for Scientists, Engineers, and Creators of All Kinds.* MIT Press, 2017.

Excerpt from the Editors' Preface: *Mary Shelly's landmark fusion of science, ethics, and literary expression provides an opportunity both to reflect on how science*

is framed and understood by the public and to contextualize new scientific and technological innovations, especially in an era of synthetic biology, genome editing, robotics, machine learning, and regenerative medicine. Although Frankenstein *is infused with the exhilaration of seemingly unbounded human creativity, it also prompts serious reflection about our individual and collective responsibility for nurturing the products of our creativity and imposing constraints on our capacities to change the world around us (xi-xii).*

Suggested reading selections for Guston et al.:

Excerpts from Mary Shelley, *Frankenstein or The Modern Prometheus* (pp. 28-44, 97-109, 120-125, and 138-146): *How does Shelley's novel relate to the Prometheus myth? What views of science does M. Krempe and M. Waldman represent? How does Victor Frankenstein respond to those views (pages 29-30)? How are we to understand Victor's scientific progress on pages 37-41? Compared to Shelley's understanding of monstrosity, how do the editors understand monstrosity (see footnote no. 43 on page 38). How does the creature learn about humanity? How does he react to this knowledge? On pages 107-108, why and how does the creature compare*

himself to Adam? Why does the creature ask Victor to make him a mate? Are his pleas convincing? As Victor works on the female mate (page 139), what are his fears? How are his thought processes different when creating the second creature? Why does he choose to destroy the female creature he is creating? What is the creature's response to Victor's refusal? Is the creature's response justified? Additional reading discussion questions are included in the ebook's appendixes.

Heather E. Douglas, "The Bitter Aftertaste of Technical Sweetness" (pp. 247-251): *In this essay, science and society professor Heather E. Douglass explores how the pursuit of "technical sweetness" affected both Victor Frankenstein's work and the work of the atomic scientists in the 1930s and 1940s.*

Alfred Nordmann, "Undisturbed by Reality: Victor Frankenstein's Technoscientific Dream of Reason" (pp. 223-228): *In this essay, philosophy professor Alfred Nordmann suggests that "Frankenfoods" and "Frankenmaterials" that have no corollary to nature are not scientific outcomes but a throwback to alchemy and the supernatural, where the end results do not resemble the reality we perceive.*

Alternative Table of Contents

THE LIMITS OF KNOWLEDGE, "FACTS AND FICTIONS"

Hansson, "Science and Pseudo-science" (2017)

Stover, "Two Wrongs Make A Right: Using Pseudoscience and Reasoning Fallacies to Complement Primary Literature" (2016)

French, "An Anomalistic Psychologist" (2014)

Jewitt and Luu, "Pluto, Perception, and Planetary Politics" (2007)

FRANKENSTEIN AND PROMETHEUS, "METAPHORS AND MONSTROSITY"

Shelley, selections from *Frankenstein*. (Guston et al. pp. 28-44, 97-109, and 120-125, 138-146)

Douglas, "The Bitter Aftertaste of Technical Sweetness" (Guston et al. pp. 247-251)

Nordmann, "Undisturbed by Reality: Victor Frankenstein's Technoscientific

Dream of Reason" (Guston et al. pp. 223-228)

Chew and Laubichler, "Natural Enemies—Metaphor or Misconception?" (2003)

Martin, "The Egg and the Sperm: How Science Has Created a Romance Based on Stereotypical Male-Female Roles" (1991)

Stein, Rob. "Outrage Intensifies Over Claims of Gene-Edited Babies" (2018)

UN/DOING KNOWLEDGE, "ANYTHING GOES?"

Feyerabend, from *Against Method* (1975)

Kimmerer, "Weaving Traditional Ecological Knowledge into Biological Education: A Call to Action" (2002)

Qiu, "When the East meets the West: The future of traditional Chinese medicine in the 21st century" (2015)

Beck, "Unnatural Selection: How Racism Warps Scientific Truths" (2017)

Lopato, "Yes, Science is Political" (2017)