TEACHER'S GUIDE TO

HOW TO FAKE A MOON LANDING

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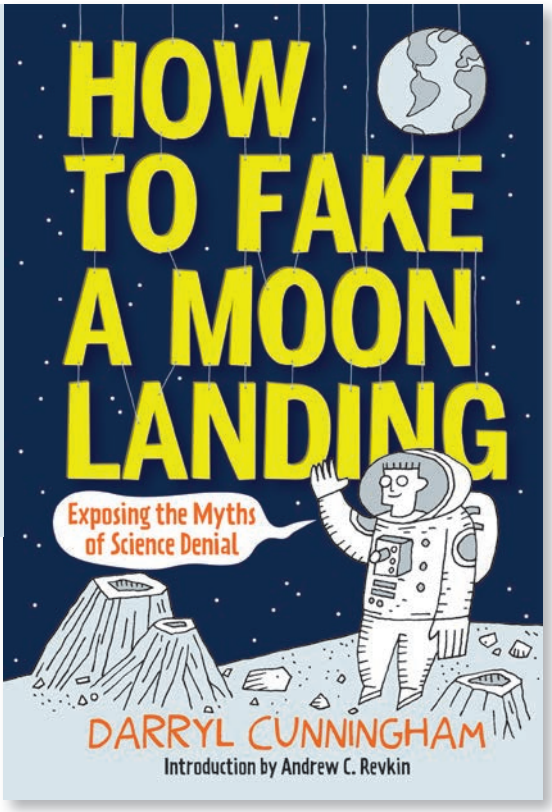


CURRICULAR BENEFITS

A rigorous and yet eminently accessible text of graphic nonfiction, *How to Fake a Moon Landing* provides an engaging way to address the Common Core's emphasis on reading across the disciplines. Indeed, its consistent attention to the way that science intersects human affairs demonstrates how educators might additionally connect its content powerfully to the social studies curriculum (see **pp. 129–34** and **144–52** for key political and/or economic issues). Moreover, instead of representing a departure from science as a discipline, such connections actually strengthen its relevancy by vividly illustrating how topics such as climate change and fracking might impact the lives of students. Whether or not they always agree with the author's positions, the clarity of his arguments and the extent of his research should prompt the critical thinking that is the book's ultimate goal. In short, it's about thinking like a scientist even as it focuses on those who don't.

ALIGNMENT WITH NEXT GENERATION SCIENCE STANDARDS

The draft version of the NGSS available in early 2013 consistently correlates to the content of *How to Fake a Moon Landing* at Grades 6–12. The "assessable component" text presented below, organized by coded performance expectation, is intended as a sampling of this alignment. For more specific correlations, please visit **http://www.nextgenscience.org/** to download the current version of the standards, and search it for the kinds of items included in the Teaching Index below.

Middle School

MS-ESS2-n. Use models of Earth's atmosphere and surface to support the explanation of the greenhouse effect.

MS-ESS2-p. Ask questions from evidence found in the geologic record to determine relationships between the evolution and proliferation of living things and changes in the geosphere, atmosphere, and hydrosphere over geologic time.

MS-LS1-d. Design and conduct an investigation to gather evidence to support explanations that the body is a system of interacting subsystems composed of groups of cells working to form tissues and organs specialized for particular body functions, and that scientific advances in understanding of those systems have led to improvements in nutrition, health, and medicine.

MS-LS3-b. Apply scientific knowledge to support the explanation that changes (mutations) to genes located on chromosomes affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.

High School

HS-LS3-a. Ask questions to obtain information about the role of DNA and chromosomes in coding the instructions for forming the characteristic traits of species passed from parents to offspring.

HS-ESS3-b. Analyze and revise solutions for developing, managing, and utilizing resources that would increase economic, social, environmental, and/or cost: benefit ratios.

HS-ESS3-f. Analyze data regarding the effects of human activities on natural systems to make valid scientific claims for how engineering solutions are designed and implemented to help limit environmental impacts.

HS-ESS3-h. Apply scientific reasoning, theory, and models to construct explanations for how humans may predict and modify their impacts on future global-climate systems.

TEACHING INDEX

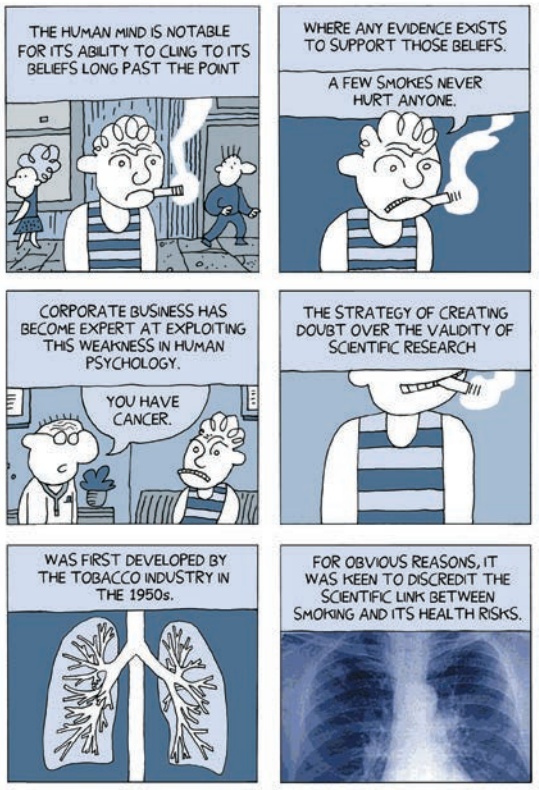
DURING AND AFTER READING: THINK/TALK/SHARE

THINK/TALK/SHARE

There are several options for using this section. If you wish to assess learning in terms of pure content, you can assign the reproducible student page opposite for independent in-class or take-home completion. Or you can use it more informally, as a way for students to revisit information as a prelude to the higher-order questions below—or as a diagnostic to suggest topics that may require reteaching prior to more in-depth discussion. Alternately, the "discussion" prompted by these questions can take the form of an organized debate or the composition of persuasive essays.

CRITICAL THINKING DISCUSSION QUESTIONS

1. Given that the moon landing took place in 1969 and that so many of the issues explored in the book have present-day health and environmental implications, why do you think Darryl Cunningham includes it? If so few people (comparatively) believe that the moon landing was faked, why not simply ignore such claims?
2. Based upon the examples provided in the book (e.g., chiropractic, Tom Corbet's backing of "sound science" on **p. 131**), in what ways might it make sense to conceptualize a third category between the scientific approach and "science denial"? Is there more value or risk in acknowledging "pseudo-science" as a distinct position in that its proponents at least ostensibly, or occasionally, recognize scientific data and methods? Do you think the author would agree with such a distinction or maintain that followers/advocates of pseudo-science are the same as science deniers? Why or why not?
3. A recurring theme concerns how the profit motives of individuals and corporations can foster both pseudo-science and outright science denial. Examples include Jacques Benveniste **(p. 31),** B. J. Palmer **(pp. 50–51)**, Andrew Wakefield **(pp. 73–75)**, Koch Industries **(pp. 147–49)**, and tobacco companies **(pp. 159–60)**. However, using your background knowledge of fields such as pharmacology, energy, and agriculture, how do commercial interests also drive innovation in science and technology? Is it possible, then, to sum up the relationship between science and industry, and what factors make such a generalization problematic?
4. A related question concerns the role of governmental leadership and regulation, a topic that's addressed explicitly on **pp. 129–31** and implicitly throughout the final three chapters. From the examination of such topical subjects, how do you think the relationship between the public policy sphere and the scientific community might be reset to the benefit of a common good that recognizes environmental and safety concerns but does not stifle economic development? Specifically, drawing on the book's presentation of the scientific method (**pp. 164–71** and throughout), what steps could be introduced into the legislative or enforcement process that would honor current consensus among scientists?
5. Cunningham convincingly makes the case that public debate (and the resulting policy) is often shaped by media coverage that can disproportionately **(pp. 81–82, 151–52, 161–63, 169)** favor non-scientific data and theory. Given that both negative (sensationalism) and positive, if misguided, motives (fairness vis-à-vis presenting "both sides") are at play, what can be done about this situation? Or is it inevitable, given the nature of freedom of speech, mass media, and the fact that, after all, the audience for it is overwhelming lay people who expect/are accustomed to/need science presented in sound bites?



6. Sharpen critical thinking skills by taking on the role of "devil's advocate." For example, how might one oppose the anecdotal evidence about chiropractic's safety by citing in comparison the staggering malpractice statistics and legal settlements involving mainstream medicine (while also acknowledging the author's potential counter to this on the bottom of **p. 62**)? Moreover, practice these skills by adopting a stance contrary to what the author believes *even if you agree with him*.
7. Similarly, apply understanding of the scientific method by outlining how one might go about designing experiments or making predictions (as in the chapter on evolution) in order to validate any of the non-scientific or pseudo-scientific claims and theories presented in the book . . . or any others that you may know from such fields as ufology and cryptozoology. If you believed in the value of scientifically studying these subjects, how would you accommodate demands such as data collection, peer review, and replication?

Answer Key for Knowledge Inventory

1. c
2. b
3. d
4. peer review
5. There is no need to doubt the veracity of the NASA footage of the moon walk.
6. Possible answers include: shale deposits are often well below drinking water sources; steel and concrete enclose the well bore; several wells can be drilled from a single pad; chemicals make up only about .5% of the total fluid used; produced water can be processed into sludge at sewage plants
7. Evolution
8. Climate Change
9. The MMR Vaccination Scandal
10. Homeopathy

WORKSHEET

KNOWLEDGE INVENTORY FOR *HOW TO FAKE A MOON LANDING*

Name _____ Date _____

CIRCLE THE BEST ANSWER FOR EACH QUESTION.

1. Which does author Darryl Cunningham NOT cite as a contributor to science denial?

   a) politicians b) the news media

   c) environmental groups d) the oil and gas industries

2. Who originated the idea of removing blockages to "the body's innate intelligence"?

   a) Andrew Wakefield b) Daniel David Palmer

   c) Jacques Benveniste d) Dr. Peter Dingle

3. The author offers the migration of the testes in humans to support the idea that

   a) evolutionary change proceeds according to the need to survive.

   b) the intelligence of DNA is obvious in the body's structures.

   c) the theory of the body's "innate intelligence" can be disproved.

   d) no creator would intentionally want such a dangerous design.

ANSWER THE QUESTIONS IN THE SPACE PROVIDED.

4. What is it called when experts assess the quality of research before it's published?

5. What did the *MythBusters* TV show demonstrate?

6. What are some factors that may make fracking seem environmentally safe?

MATCH THE PANEL FROM THE BOOK TO THE CORRECT TOPIC.

7. 

8. 

9. 

10. 

THE MOON HOAX **THE MMR VACCINATION SCANDAL** **EVOLUTION**

CLIMATE CHANGE **FRACKING** **CHIROPRACTIC**

HOMEOPATHY

EXTENSION AND ENRICHMENT

The "Media Construction" of Science. Follow up on one of the book's key themes by viewing, either in full or in select clips, a science fiction movie, a documentary such as *An Inconvenient Truth*, or TV news coverage of a science-related story. Then evaluate the content by asking how it respects, does not respect, or pretends to respect the scientific method.

Making Mini-Comics. Use Cunningham's graphic nonfiction approach as a model for creating, either in teams or individually, a comic of a few pages that depicts an important incident of science denial. Topics could include infamous trials such as Galileo's in 1633 or schoolteacher John T. Scopes's in 1925.

Research Analysis. Divide students into chapter-specific groups to produce an annotated version of the Sources section in the back matter. Which sources should be replaced because newer research has been conducted? Which is the most valuable in terms of each subject area?

DIFFERENTIATED INSTRUCTION

FOR ENGLISH LANGUAGE LEARNERS . . .

Clarify cultural references that may be unfamiliar and that are not explicitly addressed by the print text (e.g., **p. 23**, panels 1 and 2; **p. 146**, panels 4 and 5).

Encourage oral language development by having students provide made-up text verbally for, or explain the meaning of, panels that rely on cartooning conventions or other visuals to express ideas (e.g., **p. 32**, panel 6 and the succeeding panel).

Guide students to use both print and graphic context clues to determine the meanings of word parts that are common not only in the domain of science, but also in English vocabulary generally; these include *micro-gravity* **(p. 18–19)**, *homeopathy* **(p. 24–43)**, and *mesosphere* **(p. 142)**.

BELOW-LEVEL READERS

Boost comprehension by drawing attention to graphical text features that are used to convey information; examples include pie charts **(p. 112)** and cross-sectional diagrams **(pp. 99, 109)**.

Help students navigate the views and informational purposes of the outside "voices" that regularly engage the narrator in dialogue, especially as these can vary in presentation from chapter to chapter **(pp. 11–17, 119, 140–153)**.

Point out that the artwork often requires readers to make inferences to grasp its relationship to the print text; these inferences can range in difficulty from the straightforward (**p. 13**, panel 1; **p. 26**, panels 1–2) to those that demand the activation of more specific schema/background knowledge (**pp. 68**, panel 6; and **146**, panel 6).

ADVANCED STUDENTS

Encourage students to engage in meta-level or global thinking about the book's content by having them classify the non-scientific claims it covers into broad categories. These might include misinterpreting or ignoring data, over-generalizing, poor mathematical skills, faulty logic, hidden agendas, failure to consider alternative hypotheses, and of course the overlapping of these. What patterns in science denial, if any, emerge from such an analysis of its causes and traits?

Challenge students to extend the author's emphasis on critical and rational thinking by approaching the book itself as a media document that uses persuasive techniques that can be more emotional than factual; for example, contrast how the artwork represents those of whom the text is supportive **(pp. 76–77)** with those of whom it is not **(pp. 78, 80)**.

Inspire more in-depth exploration of the topics by having students conduct research into the arguments that Cunningham debunks. How have these been updated or modified by supporters since the publication of his book? What current distortions of science are circulating in the media? Students can summarize their findings in a report to the class or via a blog post that hyperlinks to relevant online sources.

Teacher's Guide conceived and by Peter Gutiérrez, a spokesperson on comics and graphic novels for the National Council of Teachers of English (NCTE), and a frequent contributor to *School Library Journal* and *Booklist*. He can be reached at fiifgutierrez@gmail.com.

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