EDUCATOR'S GUIDE

Pseudoscience: Looking for Evidence and Proof

Disney Presents

For six seasons, millions of students came to understand, appreciate and enjoy the exploration of science through the series, *Bill Nye the Science Guy*. Bill returns with *The Eyes of Nye*, a more in-depth look at science subjects making news, changing lives, and impacting policy. From the future of alternate fuel sources and genetic engineering to population growth trends and issues of race, Bill and his expert cohorts bring science to life right in your classroom, helping you **Motivate** investigation; **Assess** available information; and **Propose** lines of argumentation.

This Educator's Guide includes:

- An **Introduction** that clearly defines the subject and offers an overview of the issue objectives of the guide; how it relates to science from both a social and personal perspective; as well as pertinent questions and insights regarding the topic.
- A listing of all **National Science Education Standards Addressed**.
- Detailed procedures highlighted in the MAP Framework (**Motivate, Assess, Propose**).
- Illustrative **Video Clips** from *The Eyes Of Nye* DVDs with pinpoint chapter cues.
- **Web Site Resources** to help students further investigate and locate research, charts, data as well as experts featured in the program material.
- Easily downloadable **Support Materials** that include articles, transparencies, charts, and much more.

Introduction:

"Pseudoscience" refers to *false science*, or a human penchant for ascribing scientific characteristics to something that bears no resemblance to real science. *The Eyes of Nye – Pseudoscience: Looking for Evidence and Proof* explores certain paranormal phenomena in which many people believe, the actual science beneath these phenomena or the lack thereof, and the potential effects of these beliefs on people and on our society.

For ages we have entertained claims of the supernatural and paranormal. The difficulty—the danger and the real issue involved—is that our society and our students are also repeatedly subjected to claims these beliefs are scientific. To determine the scientific value in such claims, and to mitigate the dangers posed, students should understand more fully the

*Check the **MAP Teaching and Learning Framework** to explore the phases (motivate, assess, and propose) used in this guide.*

distinctions between science, beliefs, and show. To better grasp these distinctions, students should, as with any issue, explore the claims and assess them for adherence to accepted norms of science such as consistency, validity, and precision.

National Science Education Standards Addressed

Science As Inquiry

- Abilities necessary to do scientific inquiry

  Identify questions and concepts that guide scientific investigations.

  Recognize and analyze alternative explanations and models.

  Communicate and defend a scientific argument.

- Understanding about scientific inquiry

Physical Science

- Conservation of energy and the increase in disorder

Earth and Space Science

- The origin and evolution of the earth system

Science in Personal and Social Perspectives

- Science and technology in local, national, and global challenges

History and Nature of Science

- Science as a human endeavor
- Nature of scientific knowledge
- Historical perspectives

On the DVD:

Pseudoscience: Looking for Evidence and Proof – Chapters

Chapter 1: *Pseudoscience Preview*
Beginning through 1:41
Ends with title screen.

Chapter 2: *Extraordinary Claims and Skepticism*
2:03—8:00
Starts with Bill asking, "Do you guys believe in extra sensory perception?"

Chapter 3: *Pseudoscience in its Stride*
8:01—14:24
Starts with Bill asking, "Do you believe in ghosts?"

Chapter 4: *Mind Control or Science?*
14:25—15:15
Starts with fire and Bill saying, "We're going to let this burn down…"

Chapter 5: *Let the Consumer Beware*
15:17—20:12
Starts with Dr. Suzanne Steen intro…

Chapter 6: *Get Some Science!*
20:13 through end of program
Starts with fire and Anthony "Ace" Choice saying, "In the Kalahari desert…"

Pseudoscience: Looking for Evidence and Proof – Activity Clips

People Believe
2:03—2:34
(referenced in Educator's Guide step 3)
Starts with Bill asking, "Do you guys believe in extra sensory perception?"
Ends with interviewee saying "…I definitely believe in paranormal."

The Case of the Extraordinary Claim
3:03—4:41
(referenced in Educator's Guide step 6)
Starts with the screen sign with the above title, then Bill saying, "There's a saying—'Extraordinary claims require extraordinary proof.'" Ends with Bill saying "…going in circles."

Reading the Signs
9:04—10:44
(referenced in Educator's Guide step 7)

Starts with the screen sign The Astrological Reading, then Dr. Shermer saying, "I'm getting something about a scar on your knee…" Ends with lady saying "…maybe talk to her a little bit more."

Their Answers, Their Money
10:44—11:55
(referenced in Educator's Guide step 7)
Starts with Bill saying, "So Michael… you've never done this before." Ends with Dr. Shermer saying "…but they gave it to the psychic."

Science for a Change
13:17—14:24
(referenced in Educator's Guide step 8)
Starts with Bill saying, "You probably know your sign." Ends with Bill saying "…a sexy Scorpio?"

Preparing for the Walk
14:24—15:15
(referenced in Educator's Guide step 10)
Starts with fire and Bill saying, "We're going to let this burn down…" Ends with Bill saying "…and then we're going to re-evaluate."

The Science Down Under
20:34—22:55
(referenced in Educator's Guide step 10)
Starts with fire and Bill saying, "So Tony, you hold your hands like this…" Ends with Bill saying "…and walking on fire is a result of natural laws."

Procedure: Motivate Phase

1) Ask students if they know anyone who believes there is a science to palm reading, UFOs, or interpreting a person's personality traits based on their birth date. Most will know someone who believes there is. Ask them to define "pseudo"—a word meaning *false*—and "science." The last will be difficult for most students. Tell them part of the lesson will address this, and we will return to it numerous times as we move forward.

2) Ask students why they think people ascribe science to such beliefs. Pause as students voice a variety of opinions. Ask them to volunteer a series of paranormal claims people have said are scientific. Record each in a visible location, and in each case ask students if they have ever seen any verifiable scientific data (or even direct observation by a credible source) that substantiates the claim, or if the "instance" cited has ever been repeated or replicated. For those that have been supposedly observed more than once, ask if students know of any direct experimental results that have been or can be used to substantiate the claims. Suggest that regardless—students are correct—many people believe the claims are scientific (an important distinction).

3) Play ***"People Believe,"*** in which numerous people express their belief in paranormal experiences. Follow by describing data regarding people's beliefs (below), and ask students why they think this is the case. Possibilities range from people's lack of understanding of science, to insecurities, to a simple desire to hear things that make them feel better. Pose the broad question, "Pseudoscience: Is there anything to it?" Ask students how we might determine the answer to that question.

What will we believe? Data shows:

- *60% believe in ESP (Extra Sensory Perception)*
- *40% believe in Astrology*
- *42% believe in Communication with dead*

- National Science Foundation -

- *Americans spend $6.5 billion a year on dietary supplements. That is twice the GNP of Costa Rica.*

- Food and Drug Administration -

4) Record students' suggestions and categorize them according to whether they address scientific distinctions or whether they deal with potential results or repercussions of ascribing scientific merit to beliefs in paranormal phenomena. Help students combine suggestions and select two scientific and one social question we can directly investigate.

Potential scientific questions

a) What are the differences between pseudoscience and what we commonly accept as real science?

b) Is there any scientific merit or danger in believing in pseudoscience?

Potential social question

c) Why do some people find personal satisfaction in promoting pseudoscience and what, if anything, should be done about it?

Procedure: Assess Phase

5) Recall the number of people who said they knew someone who believed in some type of paranormal experience. Play ***"Chapter 1: Pseudoscience Preview"*** (end at title frame), and though asked in jest, repeat the question Bill asked at the close of the segment, "How *did* he know?" Ask students to consider if there is scientific evidence—facts that lend validity, consistency between findings or with external theory, or even precise or numerical data—to support the beliefs of the people interviewed earlier regarding ESP, the Roswell UFO/alien claim, or astrology and palm reading. Suggest it is curious we continue to believe in it.

6) Explain to students that "pseudoscience" goes a step further—it suggests there is scientific merit to support such beliefs—a broad and distinctive leap from simple belief. Reiterate Bill's suggestion the scientific method can help us tell the difference between

"false" (pseudo) and credible scientific claims. Play ***"The Case of the Extraordinary Claim,"*** in which Bill demonstrates the application of scientific principles to a simple physics problem—a balloon inside of a car moving forward when the car accelerates. Discuss the scientific method and reliance on scientific norms when we claim evidence supports observations.

7) Introduce the age-old practices of palm and tarot card reading and play ***"Reading the Signs,"*** in which "psychic" Dr. Michael Shermer describes for various people what he "sees." Review the subjects' opinions—that he was right and could not have known these things without psychic powers. Ask students if they think there may be something plausible here. Pause for a moment, and then ask if maybe these individuals simply listened to the wrong person. Play ***"Their Answers, Their Money,"*** in which Shermer's true method and true identity—editor of *Skeptic Magazine*—is revealed.

How far does your skepticism go? Allow students to explore "experts" who pose claims.
For more on exploring claims and claimants, go to eyesofnye.org

8) Point out to students that astrology is often used to predict people's fortunes or futures, much like the above, except it is supposedly based on the alignment of celestial bodies. Ask how many students know people who read their horoscope. For some people it may be great fun, but recall from the earlier discussion that 40% of people believe it works. Ask students to read about Astrology in the issue support provided (right). Briefly discuss, and then play ***"Science for a Change,"*** in which Bill describes changes in the alignment of stars since ancient Babylonians invented the notion of astrology.

9) Point out specifically the earlier mention of "the alien thing" and the incident in Roswell, New Mexico. Most students have heard of it, but don't know the details, or what is or is not credible regarding the story. Distribute and ask students to read the handout, "Roswell." Review the claims regarding the incident, the facts we have available, and the statements made by various credible sources. Relate the latter to points made regarding the norms of science yet to be met. Discuss as well that many people have actually gone to great lengths over the years to find, or rather produce, scientific evidence that supports the claim. Encourage them to explore those some time, put a scientific magnifying glass to each, and ask why the claim is being made to begin with. Explain that the adventure is probably the most believed and persistent pseudoscience ever repeated in the United States.

10) Tell students that most of them have heard of the ancient tradition of fire walking. Play ***"Preparing for the Walk,"*** and then explain that we are going to, as Bill said, "re-evaluate." As we do so, ask students to pay close attention to the description of mind over matter provided by Anthony "Ace" Choice, and the follow-up demonstration provided by Bill. Play ***"The Science Down Under."*** Explain to students that far too often, actual science is misused to encourage people to believe in questionable causes. Ask students why people might want to do this; suggestions will range from control to money. Tell them we will take a closer look at the latter.

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Explore the notion of astrology.
See ***The Eyes of Nye*** *Issue Support* ***Astrology***

The greatest story ever told?
See ***The Eyes of Nye*** *Issue Support* ***Roswell***

11) Play ***"Chapter 5: Let the Consumer Beware!"*** (end at close of interview) in which Dr. Suzanne Steen describes the dangers and risks associated with certain natural dietary aids. Point out in particular the information provided—and not provided—on the labels of these products. Distribute or use an overhead to illustrate a few of these labels in "What We Don't Notice." Note to students these are right off the shelves. Ask if there are always negatives associated with these types of products (not necessarily), but if, scientifically, it is a good idea to look more closely at what we do in our everyday affairs and how we do it.

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See **The Eyes of Nye** Issue Support **What We Don't Notice**

Procedure: Propose Phase

12) Ask students to recall the final investigative question constructed early in the lesson, "Why do some people find personal satisfaction in promoting pseudoscience and what, if anything, should be done about it?" Tell them they have explored the distinctions between science and pseudoscience, some potential scientific merits or dangers, and even certain social implications of people's beliefs. Explain to students that *I-Values* are personal beliefs or feelings we either consciously or subconsciously hold very dear. We don't always admit them, yet they influence our perceptions and beliefs, even when scientific evidence indicates those beliefs are false. Note as mentioned, ascribing *scientific* reasons to these beliefs is the real crux of the pseudoscience issue. Explain sometimes, as with the promotions of certain dietary supplements, questions about scientific credibility can be all too real, to ourselves and our families as well as society.

13) Ask students to write a persuasive paper that would convince a reader, such as a local or state legislator, of the scientific merit of a position to require or not require additional testing and/or labeling of dietary supplements. Tell students they may recommend one, both, or neither action. They may also choose another pseudoscience "remedy" to address besides dietary supplements. Regardless of the stance taken, students should discuss social and scientific values or dangers involved, address the influence of personal beliefs (I-Values), and adhere to certain structural guidelines (below).

Persuasive paper format:

- *Introductory paragraph stating view and briefly listing three supporting reasons.*
- *Body consisting of explanation of reasons, preferably in three separate paragraphs.*
- *Conclusion that restates the view as an assertion based on evidence provided.*

Final Teacher Note: *Though the importance of students' understanding of how we know what we know from science cannot be overstated, students at times should realize their own personal beliefs can and do play a tremendous role in what they "believe"—this is neither "unscientific" nor inappropriate. As mentioned in various manners in this guide, the problem and issue with pseudoscience is not that people have beliefs that don't involve science, but they ascribe scientific reasons to these beliefs. If scientific validity is claimed, then claimants should, as a scientist would, deal with it in a scientific manner. It is important from a scientific standpoint that students know which is which, they know when science or rather "false" science, is wrongly applied, and are able to make their decisions about issues based on their own beliefs and not the "false" science that underlies someone else's beliefs.*

For more, go to eyesofnye.org

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Further Research

Investigating the Issue: Pseudoscience

Making decisions or constructing lines of argumentation related to belief in pseudoscience is a unique dilemma. There are important and accepted norms we use to judge—or assess—the scientific credibility of a claim or evidence that purportedly supports a claim. At the same time, there is recognition, as strongly in scientific circles as elsewhere, that our beliefs, even those not founded in science, play a crucial role in our decisions about scientific issues that affect our society. On the surface, the latter can often be mislabeled "pseudoscience," and of course the tendency could be magnified when "pseudoscience" is the principal topic of study in a lesson. In accuracy, the study of pseudoscience is about the issue of falsely ascribing scientific proof to beliefs. If approached properly, the topic can result in students' direct ability to put scientific norms (*constitutive* criteria such as accuracy, precision, and consistency) into action in a way that few issues do—they are directly the concepts being taught and learned, not just used as they are with many other issues. However, teachers must avoid questioning the value of believing in anything that can't be proven scientifically.

In addition to the information and claims presented in *The Eyes of Nye - Pseudoscience*, students may access a variety of informative sources related to various "pseudoscience" practices, including astrology, Extra Sensory Perception, UFOs, and others.

Exploring Pseudoscience Claimants

The principal featured "experts" are listed below, in order of their appearance. Students should be encouraged to explore their potential motives as well as the organizations/goals of the organizations for which they work.

Anthony "Ace" Choice, Life Coach, Firewalker	
Dr. Michael Shermer, editor	Skeptic Magazine
Dr. Suzanne Steen, sports nutritionist	University of Washington

ISSUES SUPPORT MATERIAL

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Astrology

Astrology involves interactions between the stars and planets. It is different than astronomy in that these interactions are attributed with a force or power over the people on our planet. It has been used for many different things, such as attempting to predict when a famine or other disaster—natural or otherwise—will occur or telling a person's future. Astrology predates both astronomy and psychology, making it one of the oldest "sciences."

Astrology has its roots primarily in Babylon, where it was being practiced as early as the 1800s BC. Astrology has ties to several other countries as well. In Egypt, the complex timekeeping and calendar system that is used in astrology was developed. In Greece, a famous scientist named Ptolemy wrote texts on astrology and astronomy. Several of the emperors in Rome wrote laws and counseled citizens based on the stars.

Ptolemy created a model of the universe on which astrology is based. It featured the earth as the center of the universe—a model of geocentricity. It had to be revised repeatedly based on the observed movement of heavenly bodies. Since these models defined circular patterns that celestial bodies followed in their orbit around Earth, these patterns became more and more convoluted. The "science" of astrology was revised as the circular orbits within orbits were revised, but there have been no modern revisions to the powers and forces supposedly exerted by heavenly bodies for thousands of years.

During the Renaissance, when literacy became widespread, astrological material began being published for the masses. Galileo and Copernicus, along with other famous figures of the time, practiced astrology. However, many dire predictions based on the alignment of stars and planets in 1524 did not come true, and astrology began to lose popularity. Around 1540, Copernicus revised Ptolemy's model of the universe, putting the sun at the center of the universe. This simplified most of the convoluted patterns present in Ptolemy's model, but not all of them. It is important to remember the "science" of astrology was not revised at this time, even though the movements of the planets were better understood. The same power and force were assumed to be present by astrologers.

Astrology and other practices were replaced by astronomy as the Scientific Revolution strengthened. Astrology again found a niche with the birth of Princess Margaret in 1930, when the London Sunday Express ran a profile of the princess based on her astrological sign.

This started the modern horoscope columns.

Astrology is much more mystified in the Eastern world, which makes its roots difficult to trace. It is intertwined with religion and culture. Early Indians developed a complex map of the universe, complete with combinations of lunar and planetary positions. As a result of development separate from the Western world, Eastern astrology took on many distinct features, such as its influence on karma, salvation, and caste structures.

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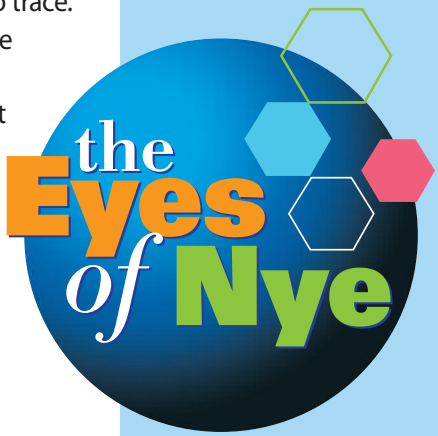

Roswell

It was 1947 and the media leaped on claims from the public of sightings of what they dubbed "flying discs" (which we now know as UFOs or flying saucers). More of these sightings were being reported every day, but nobody ever got a clear view of them…

That is, until a strange wreck appeared on the land of a rancher, Mac Brazel, who lived about 30 miles southeast of Corona, New Mexico. The wreckage was spread over a large area, as if whatever it was had fallen at high speed. It consisted of rubber strips, tinfoil, a strangely durable paper, and sticks. Mac Brazel had never heard of flying discs, so he didn't think too much of the find at first. However, about a month later, he heard of the mysterious appearance of these UFOs all over the planet, and he became concerned. What if the debris he had found was from a crashed flying disc?

The next time he was in town, he went straight to see the sheriff, George Wilcox. He told the sheriff confidentially that he may have found the remains of a flying disc on his ranch. Wilcox immediately got in touch with the Roswell army airfield. Major Jessie A. Marcel and a man in plain clothes, who was not identified, accompanied Mac Brazel to his home, where they picked up the rest of the debris and tried to reconstruct it.

They could find no way to make the pieces fit. After that, Major Marcel brought it to Roswell, and that was the last Mac Brazel heard of it.

For a little while, that is. People began reporting seeing alien bodies on the ground near where the debris was discovered and roaming around nearby. Perhaps the aliens had come back for their lost spacecraft? It created quite a scare, and the army came in yet again. People wondered for a long time what the army had done in Roswell, and some people believe the U.S. government has a treaty with the aliens the army "found."

What the Air Force said

The Air Force reported that the recovered debris was simply the remains of the military's balloon-borne research project code named MOGUL. Records describing the research that was carried out in the MOGUL project were collected, provided to the government, and published in one volume for easy access to the public. The "alien bodies" were reported to actually be test dummies that were made to resemble humans and were carried by high-altitude Air Force balloons for scientific research.

What We Don't Know

And what the labels do and do not tell us…

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Vitamin E is a powerful antioxidant that fights free radicals.* Studies have shown that oxidative stress caused by free radicals may contribute to aging.* Vitamin E also promotes immune function and helps support cardiovascular health.* Our Vitamin E is made with purity in mind - so you are assured of quality supplementation. Vitamin World's Vitamin E is perfect for everyone and comes in a convenient to use softgel.

*These statements have not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure or prevent any disease.

What will influence your choices?