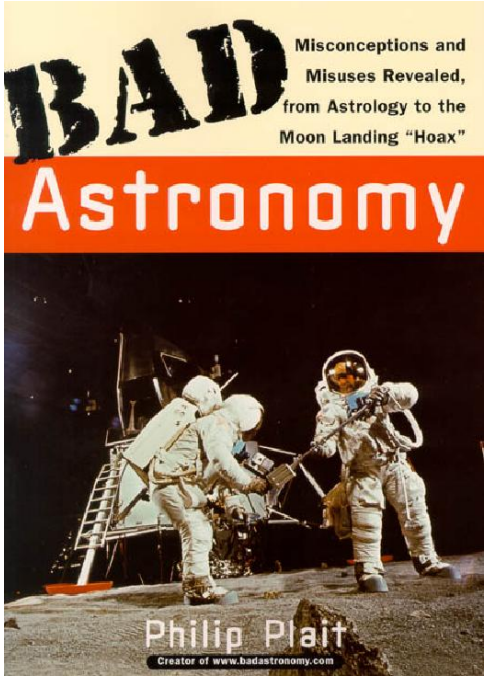
A Teacher's Guide to

BAD ASTRONOMY:
MYTHS AND MISCONCEPTIONS



Presented by the
Cernan Earth and Space Center
Triton College
River Grove, Illinois

Welcome to the
Cernan Earth and Space Center

Introduction

Please take a few minutes to read through this Teacher's Guide before you and your group visit the Cernan Earth and Space Center. It contains important tips and guidelines about your field trip, describes the program that you selected and includes some teacher resources to help you better integrate your Cernan Center visit with your own classroom activities.

The Cernan Earth and Space Center

The Cernan Earth and Space Center of Triton College is a unique and exciting place for persons of all ages. The Cernan Center houses a 100-seat dome theater, a Space Hall with exhibits on space exploration and astronomy and the Star Store gift shop.

The Cernan Earth and Space Center is named for astronaut Eugene A. Cernan, who flew aboard the Gemini 9, Apollo 10 and Apollo 17 space missions. In December of 1972, as the commander of Apollo 17, Captain Cernan became the last human to leave his footprints on the moon. Cernan was born and raised in suburban Bellwood, not far from where the Triton College campus and the Cernan Center now stand. The original Cernan Center building opened in 1974, and in 1984, it re-opened in a new and larger facility.

The Cernan Earth and Space Center's 44-foot diameter dome theater is equipped with a planetarium star projector, a special C-360 motion picture projector, a sophisticated laser projection system, a large format video projection system, a powerful stereo sound system and scores of slide and special effects projectors. Using this equipment, the Cernan Center presents a wide range of educational programs that discuss such diverse subjects as the current night sky, the planets of our solar system, the weather and climate of earth, the space shuttle and the age of dinosaurs. For pure entertainment, the Cernan Center also presents laser light shows that choreograph laser images and planetarium effects to rock music.

The Cernan Earth and Space Center's Space Hall contains a variety of exhibits related to astronomy, space science and earth science. Included are Captain Cernan's Apollo 10 spacesuit and coverall garment, Apollo 17 moon gloves, an Apollo lunar landing diorama, a moon phase exhibit, a weather radar station, a 1/15th scale space shuttle model, a life-size dinosaur footprint model, an Illinois fossil exhibit, a telescope exhibit, an exhibit on recent space discoveries and a variety of other Apollo artifacts. Outdoor exhibits include an Apollo practice capsule and a Nike Tomahawk missile.

The Cernan Earth and Space Center's Star Store gift shop offers an assortment of unique gifts, many related to the popular themes of astronomy, space exploration and the study of our own planet earth. Books, t-shirts, sweatshirts, binoculars, science discovery kits, coffee mugs, posters and unique toys are just a few of the many items for sale. Some items are even $1.00 or less, so even younger patrons can buy a souvenir or two during their visit.

Important Field Trip Information

Listed below are a few tips to help make your trip to the Cernan Earth and Space Center run smoothly and stay on schedule:

1. BEFORE YOU ARRIVE. If for any reason you need to reschedule or cancel your reservation, please call the Cernan Center and let us know as soon as possible. Doing so allows us to better accommodate other groups that may prefer your original time slot and may prevent your group from being charged a cancellation fee.

2. ARRIVAL. Plan to arrive at the Cernan Center at least 15 minutes before your scheduled show. This will give you time to check in your group, use the restrooms if necessary and instruct your group to line up at the entrance to the dome theater. If you are planning to eat lunch or visit the Star Store before your show, you should arrive even earlier. Buses and vans should park along the curb directly in front of the Cernan Center and should remain there for the duration of your visit. Automobiles should park in the North Parking Lot just north of the Cernan Center building after dropping off their passengers.

3. CHECKING IN. When you arrive at the Cernan Center, the group leader should check in at the Star Store. Remember to bring the confirmation card that you received in the mail. Please make a note of the number of students and chaperons that you will be paying for. Remember that you must pay in bulk, so please collect the students' money beforehand or have a check made payable to Triton College. In special circumstances, you can make arrangements in advance to have us bill your school or institution after your visit.

4. ENTERING THE THEATER. Your group should be lined up at the dome theater entrance five minutes before your scheduled show time. Please remind your group that they are on a college campus and must remain quiet because of classes in session nearby.

5. SEATING IN THE THEATER. A Cernan Center staff member will let your group into the theater and instruct you on the best place to sit. Since more than one group is often scheduled at the same time, your group should sit together. No food, drink, candy or gum is allowed in the theater.

6. BEHAVIOR IN THE THEATER. Teachers and chaperons are responsible for the behavior of their group. Since the show operator is seated at the top of the room, he or she is often unable to hear or see minor incidents of disruptive behavior. Although the show operator will certainly stop the show for a disruption in the audience, we would prefer that the group leaders control the behavior of their own group.

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7. VISITING THE STAR STORE. If your group plans to visit the Star Store gift shop, please do not allow everyone into the store at once. If you have over 20 students, allow only 10 or 15 students in the store at a time. We also ask that only children with spending money be allowed into the store. This lessens the handling of the merchandise and prevents it from becoming soiled or damaged. We would also appreciate that one teacher or chaperon remain in the gift shop to help maintain order with their group.

8. HAVING LUNCH. With prior notification, the Cernan Center can usually arrange to have Triton College set aside tables on which your group can eat their own bag lunches. Groups can also pre-arrange with the Triton College cafeteria to purchase lunch packages. If your group has reserved this lunch area, we recommend that your group keep the lunches together in boxes or large bags rather than having the students carry them individually. As long as your lunches are in some sort of container, we will be able to provide an area for them to be stored while you are in the dome theater. A staff member will provide you with a campus map to direct your group to the Triton College cafeteria, which is a five-minute walk from the Cernan Center.

9. ANY QUESTIONS? We pride ourselves in offering friendly, personalized service, so if you have any questions pertaining to your trip to the Cernan Center, just give us a call at **(708) 456-0300, Ext. 3372** and we'll be happy to answer them. You can also contact one of our staff astronomers if you have a question related to astronomy, space science or earth science.

WE LOOK FORWARD TO SEEING YOUR GROUP AT THE CERNAN EARTH AND SPACE CENTER!

VISIT THE CERNAN CENTER ONLINE!

Visit the Cernan Center online at: **www.triton.edu/cernan**. To shop our Yahoo! Store online, please visit: **http://store.cernanstore.com/**. You can also e-mail one of our staff astronomers if you have a question related to astronomy, space science or earth science at: **cernan@triton.edu**.

For more information about the Cernan Center, its programs, field trips or events, please call (708) 456-0300, Ext. 3372. For public program information, please call our Program Line at (708) 583-3100.

Earth and Space Exhibits

The Cernan Earth and Space Center has a number of earth and space exhibits in its main lobby, as follows:

APOLLO / MARS LANDSCAPE DIORAMA

This large exhibit, covered by a plastic dome, is a two part exhibit. One half of the exhibit commemorates the successful Apollo missions to the moon, while the other half celebrates the present and future exploration of Mars. The Apollo side of the diorama contains models of the lunar module (the Apollo spacecraft that brought two astronauts to the lunar surface each mission) and the lunar rover, which astronauts used in the final three Apollo missions (15, 16 and 17) to extend the range of their lunar explorations. The Mars side of the diorama re-creates the rocky and sandy Martian landscape, complete with scale model of the Sojourner probe.

APOLLO 10 SPACE SUIT

This was the space suit worn by astronaut Gene Cernan on the Apollo 10 mission. This space suit was never worn on the moon, since the Apollo 10 mission was not designed to land astronauts on the surface. Instead, this mission served as the final “dress rehearsal” before the first lunar landing mission of Apollo 11 two months later.

OTHER APOLLO ARTIFACTS

This case contains other Apollo artifacts, including a coverall garment worn by Gene Cernan en route to the moon and several pieces of Apollo spacecraft navigation equipment.

EARTH VIEW EXHIBIT

This computer generated video exhibit, which updates every five minutes, displays a world map that shows the current day and night hemispheres, along with the locations on earth that have the sun directly overhead and the moon directly overhead.

DOPPLER WEATHER RADAR

On days when there is rain or snow in the Midwest, the Doppler Weather Radar exhibit displays the intensity and movement of this precipitation.

“MOON SHADOWS” EXHIBIT

This interactive exhibit uses a model of the earth-moon system to assist viewers in understanding the phases of the moon. By looking through an eyepiece built into the exhibit, viewers can observe how the moon phase changes as they manipulate the position of the moon along its orbit.

TELESCOPE EXHIBIT

This exhibit shows cutaway models of the major types of telescopes and describes a few of the many celestial objects that can be seen with small telescopes.

DINOSAUR FOOTPRINT

This is a full-scale model of a footprint and lower leg bone of a Brachiosaurus that illustrates the size of these great prehistoric animals. This is not a real footprint, nor was this the footprint from a dinosaur found locally. No dinosaur bones have ever been found in northern Illinois due to the fact that glaciers from the last Ice Age "scoured away" any dinosaur fossils that may have once existed.

FOSSIL EXHIBIT

This exhibit displays a wide variety of Illinois fossils including our state fossil, the "Tully Monster."

SPACE EXPLORATION EXHIBIT

This exhibit displays information about the Hubble Space Telescope and other unmanned spacecraft and some of the recent astronomical discoveries that they have made.

CURRENT EVENTS BULLETIN BOARD

This bulletin board contains a current sky map; the latest astronomical images from the Hubble Space Telescope; and news stories featuring recent scientific discoveries, often obtained the same day from Internet sources.

OUTDOOR EXHIBITS

The Nike Tomahawk missile was used to collect weather information in the earth's upper atmosphere. The Apollo Practice Capsule never flew in space, but was used by the U.S. Navy to practice ocean recoveries.

The Cernan Earth and Space Center also offers an **Exhibit Hunt handout** that can be distributed to each student before or after their scheduled program(s). To complete the Exhibit Hunt, students must find answers to the questions among the artifacts and text panels throughout the Cernan Center's lobby exhibit area. The activity takes approximately 20 to 30 minutes to complete.

If you'd like to arrange an Exhibit Hunt for your students, please let the Cernan Center know before your scheduled visit.

The Cernan Center's exhibits are subject to change. Any changes to the exhibit area will be posted to the Cernan Earth and Space Center Online, which can be found at: **www.triton.edu/cernan**. Click on "Exhibits" to access this information.

Bad Astronomy

This is the Cernan Center program that you made a reservation to see. Below is some basic information about the show that should help you prepare your class for their upcoming visit.

Show title: *Bad Astronomy: Myths and Misconceptions*
Grade Level: 5th grade and up
Length: 40 minutes

Summary of show:

Based on the popular book and website of the same name, *Bad Astronomy* offers an enjoyable and informative approach to learning about the cosmos. Viewers will join author and astronomer Philip Plait as he takes a critical look at several astronomy-related myths and misconceptions to show audiences how science can be used to evaluate questionable claims. Utilizing the Cernan Center's new three-screen video projection system, star projector, and panorama projectors, *Bad Astronomy* is divided into several "chapters" that each describes a different myth or misconception, as follows:

Unidentified Flying Objects (UFOs)
This section of *Bad Astronomy* describes the history of UFOs, which Phil Plait prefers to call "Misidentified Flying Objects." Since most people rarely look up at the night sky, many UFO reports can be traced to the misidentification of astronomical objects or other natural phenomenon. The program describes a few famous UFO sightings that were discovered to be hoaxes, while a few others remain unexplained. However, the presence of such unexplained phenomena does not "prove" that extraterrestrials have visited Earth. The author explains that the incredibly large distances between star systems make such alien visitation unlikely, even if an advanced civilization could somehow fly in spacecraft approaching the speed of light.

Moon Landing Hoax
Several books, articles, and television programs have suggested that NASA faked the Apollo Moon landings, which began in 1969 with Apollo 11 and ended in 1972 with Apollo 17. This section of *Bad Astronomy* describes some of the "evidence" that some researchers have used to support the "anti Moon landing" point of view, including the lack of stars in Apollo photographs, the unnatural appearance of shadows in some Apollo photographs, the waving of the American flag on the airless Moon, and the impossibility of navigating to the Moon using the primitive technology of the 1960s. Each of these pieces of evidence is described and debunked by the author, and the validity of the Apollo missions is upheld.

In the Movies
From *Star Wars* and *Star Trek* to *Armageddon* and *Independence Day*, there have been many Hollywood movies set in space. This section of *Bad Astronomy* shows a typical "space battle" movie segment and asks the viewer to find whatever scientific inaccuracies they can. From the sights and sounds of space weaponry . . . to the design of future spacecraft are how they are "flown" . . . and to the density and appearance of asteroid belts, the author describes how movies are written and produced for maximum drama, often at the expense of scientific accuracy. He also explains what Earthlings should really do if an asteroid was on a collision course with Earth, and his answer bears no resemblance to Bruce Willis' actions in *Armageddon*.

What's Your Sign?

For most of human history, people have held the belief that the position of the heavenly bodies influences our lives on Earth. This section of *Bad Astronomy* describes how astronomy and astrology differ and the unlikelihood that celestial objects as far away as the planets could somehow exert a force large enough to affect our lives. The author performs an experiment using the birthdays of U.S. presidents and reads his own horoscope to further demonstrate that astrology is merely a set of beliefs without scientific validity. Finally, the author reminds us that science has brought forth new medical miracles, developed consumer electronics (e.g. personal computers, microwave ovens, television, and cell phones), and opened up a universe of discovery to those who choose to follow it. He concludes by saying, "Welcome to science . . . you're going to like it here!"

Bad Astronomy was written and produced by the Detroit Science Center and the Cranbrook Institute of Science in Bloomfield Hills, Michigan.

Pre-visit Preparation:

Like all the dome theater shows presented at the Cernan Center, no preparations are needed for students to enjoy and learn from their visit. If, however, you would like to conduct some pre-visit class discussions, you can start by using information contained in the "Summary of Show" and/or the "Post-visit Activities" sections of this Teacher's Guide.

Post-visit Activities:

After your visit to the Cernan Center, you may wish to discuss one or more of the following topics with your class, or perhaps have your students research the topics themselves and prepare a report or oral presentation.

- Research the Apollo missions. How many missions were there? How many landed on the Moon? Discuss the many steps (and missions) that were needed to achieve the goal of landing men on the moon and returning them safely to earth. An outstanding book is A Man on the Moon by Andrew Chaikin.
- Research additional details of the life of our namesake, astronaut Eugene Cernan. Where was Gene Cernan born? Where did he attend school? What did he do before he became an astronaut? What space missions did he fly on? What has he done since retiring from NASA? The definitive book is The Last Man on the Moon by Eugene Cernan and Don Davis.
- Obtain a map of the moon and identify the landing sites of the six successful lunar landing missions. Speculate on why each site was chosen. If you were selecting Apollo landing sites, where would you choose to land and why?
- Ask your class to watch the movie Apollo 13, starring Tom Hanks. Use the movie to "launch" a discussion on the Apollo missions to the moon and whether the Apollo 13 mission was a success, a failure, or both.
- Ask your students to write a report or create illustrations that describe what future missions to the moon may be like. A good start would be NASA's Constellation program and Ares V rocket, which was cancelled in 2010. Describe what you think such a mission would be

like. Where else in the solar system might people visit in the future?

- Ask your students to research the topic of UFOs, specifically a UFO report that has never been satisfactorily explained. Pretending to be investigators, students would discuss how they would collect evidence in hopes of finding a good explanation for the UFO.
- Plan a return visit to the Cernan Center to see *The Xtra Terrestrial Files*, a planetarium show that explores UFOs and the likelihood that extraterrestrial beings traveling in alien spacecraft have visited the Earth.
- Have one or more students research their own astrological sign with regard to either their personality traits or their daily horoscopes over a period of time. Ask the student(s) to report on their findings and explain whether their research supports or cast doubt on astrology.
- Please refer to the enclosed document "The Astronomical Zodiac," which lists the 13 (rather than 12) constellations through which the Sun passes each year, the approximate dates that the Sun spends within the official boundaries of each constellation, and the number of days that this represents. Use this document as a starting point to research and discuss the many differences between astrology and astronomy.
- Obtain a copy of Phil Plait's <u>Bad Astronomy</u> book, which includes the topics described in the *Bad Astronomy* planetarium show, as well as many more.

Bad Astronomy: Misconceptions and Misuses Revealed
Philip C. Plait
John Wiley & Sons, New York, 2002
ISBN: 0-471-40976-6

The book's 24 chapters discuss 24 different myths or misconceptions, of which only four were addressed in the planetarium show. Those four subjects are <u>underlined</u>. The subjects described in his book are as follows:

1. Egg Balancing on the Equinox
2. The Coriolis Effect and the Water in your Bathroom
3. Bad Astronomy in Everyday Language
4. Why the Sky is Blue
5. Why Summer Turns to Fall
6. The Moon's Changing Face
7. The Moon and the Tides
8. The Big Moon Illusion
9. Why Stars Appear to Twinkle
10. Stars of Many Colors
11. Daylight Star Sighting from a deep well
12. Is the North Star the brightest star?
13. The Dangers of Solar Eclipses
14. The Great Planetary Alignment of 2000
15. Protecting Earth from Asteroid Impacts
16. Understanding the Nature of the Universe
17. <u>The Apollo Moon Landing Hoax</u>
18. Worlds in Collision
19. Creationism and Astronomy

20. UFOs
21. Why Astrology Doesn't Work
22. Hubble Space Telescope Misconceptions
23. The Star Naming Business
24. Bad Astronomy in Major Motion Pictures

Select one or more chapters for your classroom to discuss.

A. As the teacher, read the chapter first so you fully understand the nature of the myth or misconception.
B. Introduce the subject to your students and ask them what they already know about it. You may discover that they know very little about it. Or, they may have heard the incorrect explanation (i.e. the myth or misconception) associated with that subject. List the major points that are raised in this discussion; this list will be referred to later in the exercise.
C. Distribute copies of that chapter to your students and give them a reading assignment.
D. Discuss the same subject again, this time concentrating on what students learned differently about the subject after reading the appropriate chapter. Some open-ended questions may include:

    i. Where do you think the incorrect notion comes from?
    ii. What scientific process or experimentation was used to establish our current scientific understanding of this subject?
    iii. Did your reading this chapter change your view? If so, how? If not, why not?

- Phil Plait maintains a *Bad Astronomy* website that contains information related to his book and this planetarium show. Its URL is www.badastronomy.com/index.html .

- Use the Bad Astronomy book and planetarium show as a springboard to discuss the foundation on which it is based – the Scientific Method. Please refer to the two enclosed documents – "Steps of the Scientific Method" and "What Science is Not" – as guidelines and starting points for such discussions.

Steps of the Scientific Method

1. **Ask a Question**: The scientific method starts when you ask a question about something that you observe: How, What, When, Who, Which, Why, or Where? And, in order for the scientific method to answer the question it must be about something that you can measure, preferably with a number.

2. **Do Background Research**: Rather than starting from scratch in putting together a plan for answering your question, you want to be a savvy scientist using library and Internet research to help you find the best way to do things and insure that you don't repeat mistakes from the past.

3. **Construct a Hypothesis**: A hypothesis is an educated guess about how things work: "If _____[I do this] _____, then _____[this]_____ will happen." You must state your hypothesis in a way that you can easily measure, and of course, your hypothesis should be constructed in a way to help you answer your original question.

4. **Test Your Hypothesis by Doing an Experiment**: Your experiment tests whether your hypothesis is true or false. It is important for your experiment to be a fair test. You conduct a fair test by making sure that you change only one factor at a time while keeping all other conditions the same. You should also repeat your experiments several times to make sure that the first results weren't just an accident.

5. **Analyze Your Data and Draw a Conclusion**: Once your experiment is complete, you collect your measurements and analyze them to see if your hypothesis is true or false. Scientists often find that their hypothesis was false, and in such cases they will construct a new hypothesis starting the entire process of the scientific method over again. Even if they find that their hypothesis was true, they may want to test it again in a new way.

6. **Communicate Your Results**: To complete your science fair project you will communicate your results to others in a final report and/or a display board. Professional scientists do almost exactly the same thing by publishing their final report in a scientific journal or by presenting their results on a poster at a scientific meeting.

Source:
Steps of the Scientific Method
http://www.sciencebuddies.org/science-fair-projects/project_scientific_method.shtml

What Science is NOT

1. Science is not a process that can solve all kinds of problems and questions. The realm of science is limited strictly to solving problems about the natural world. Science is not properly equipped to handle the supernatural realm (as such), nor the realm of values and ethics.
2. It's not a process that can ignore rules. Science must follow certain rules; otherwise, it's not science (just as soccer is not soccer if its rules are not followed).
3. It's not a process that seeks the truth or facts. The goal of science is to come as close as we can to understanding the cause-effect realities of the natural world. It's never "truth" or "facts." "Truth" and "facts" can mean different things to different people.
4. It's not a process that attempts to prove things. The process of science, when properly applied, actually attempts to disprove ideas (tentative explanations)... a process called "testing," or "challenging." If the idea survives testing, then it is stronger, and more likely an accurate explanation.
5. It's not a process that can produce any kind of explanation. Scientific explanations must be potentially disprovable. Therefore, supernatural explanations cannot be used, since they can never be disproved (supernatural forces, by definition, do not predictably follow the laws of nature). Whatever results occur in any test can be attributed to those nebulous forces, effectively ending any further efforts to explain.
6. It's not a process that produces certainties, or absolute facts. Science is a process which can only produce "possible" to "highly probable" explanations for natural phenomena; these are never certainties. With new information, tools, or approaches, earlier findings (theories, or even facts) can be replaced by new findings.
7. It's not a process that can always be relied upon due to its total objectivity and internal self-correction. Science can be done poorly, just like any other human endeavor. We are all fallible, some of us make fewer mistakes than others, some observe better than others, but we are still subjective in the end. Internal self-correction mechanisms in science merely increase the reliability of its product.
8. It's not a process that is always properly used. Unfortunately, science is all too frequently misused. Because it works so well, there are those who apply the name of science to their efforts to "prove" their favorite cause, even if the rules of science were not followed. Such causes are properly labeled "pseudosciences." Also, some scientists have been known to do fraudulent work, in order to support their pet ideas. Such work is usually exposed sooner or later, due to the peer review system, and the work of other scientists.
9. It's not a process that is free from values, opinions or bias. Scientists are people, and although they follow certain rules and try to be as objective as possible, both in their observations and their interpretations, their biases are still there. Unconscious racial bias, gender bias, social status, source of funding, or political leanings can and do influence one's perceptions and interpretations.
10. It's not a process in which the product (understanding) is based on faith or belief. The

product of science (probable explanations for natural phenomena) is always based on observations carefully analyzed and tested. The high confidence we have in science comes from the many successful applications to real-life problems (e.g. in medicine, space exploration, chemistry and technology).

11. It's not a process in which one solution is as good as another, or is simply a matter of opinion. In science, there is a rigorous analysis and fair-test comparison of alternative explanations, using discriminate criteria, e.g., confirmation by multiple independent lines of evidence, leading to one "best" solution.

12. Scientific Theories are not "tentative ideas" or "hunches." The word "theory" is often used this way in everyday conversation, but a theory in science refers to a highly probable, well-tested comprehensive explanation, usually for a large collection of observations.

Source:
Teaching Units for Biology; Indiana University
http://www.indiana.edu/~ensiweb/lessons/unt.not.html

The Astronomical Zodiac

Listed below are: A) the 13 constellations through which the Sun passes each year, B) the approximate dates that the Sun spends within the official boundaries of each, and C) the number of days that this represents.

Capricornus	Jan 20 - Feb 15	27
Aquarius	Feb 16 - Mar 11	24
Pisces	Mar 12 - Apr 18	38
Aries	Apr 19 - May 13	25
Taurus	May 14 - June 20	38
Gemini	June 21 - July 20	30
Cancer	July 21 - Aug 10	21
Leo	Aug 11 - Sep 16	37
Virgo	Sep 17 - Oct 30	44
Libra	Oct 31 - Nov 22	23
Scorpius	Nov 23 - Nov 29	7
Ophiuchus	Nov 30 - Dec 17	18
Sagittarius	Dec 18 - Jan 19	33

As you can see, this list does <u>not</u> coincide with astrological dates, largely because of precession of the Earth's rotational axis. Also, mainstream astrology does not recognize the constellation of Ophiuchus (the serpent bearer) as one of their zodiacal "signs." Finally, the astronomical community recognizes a slight variation in the names of two other constellations, calling them Capricornus and Scorpius, instead of astrology's "Capricorn" and "Scorpio."

Teacher Resource Pages

Whether your class is studying astronomy, dinosaurs or earth science, the dome theater programs offered by the Cernan Earth and Space Center serve as an excellent supplement to your classroom instruction. However, if you would like to further research your subject area, or are looking for additional information on the topics presented in our shows, please refer to the following list:

ASTRONOMY AND SPACE SCIENCE

A wide variety of online resources can be found at the Cernan Center's Astronomy/Space Links page by visiting www.triton.edu/cernan and clicking on "Space Links."

NASA -- Educational materials including fact sheets, newsletters, slides, and videotapes.

1. NASA Educator Resource Center; Museum of Science and Industry; 57th Street & Lake Shore Drive; Chicago, IL 60637. Phone: (773) 684-9844, Ext. 2426. FAX: (773) 684-5580.
Website: **www.msichicago.org**. It has an extensive NASA video collection. Copies available free of charge if you provide blank tape. Many other resource materials available.

2. NASA Glenn Research Center; NASA Educator Resource Center; 21000 Brookpark Rd., MS 8-1; Cleveland, OH 44135. Phone: (216) 433-2017. FAX: (216) 433-3601.
Website: **www.nasa.gov/centers/glenn/education/**. NASA Teacher Resource Centers are established to provide educators with NASA-related educational materials for use in the classroom. These materials can be references or duplicated at the Center; they include classroom activities, lesson plans, teacher guides, laser disks, slides, audio and video tapes. Most materials and services are also available at Chicago's Museum of Science and Industry.

3. "Report to Educators" Free quarterly periodical about NASA for educational use. Request subscription on school letterhead by writing:

NASA Report to Educators
Education Affairs Division
Code XE
NASA
Washington, D.C. 20546

ASTRONOMICAL SOCIETY OF THE PACIFIC – "The Universe in the Classroom." A quarterly newsletter on teaching astronomy. You may request a free subscription by completing the electronic subscription form at **www.astrosociety.org/education/publications/tnl/tnl.html.**

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PERIODICALS:

1. SKY AND TELESCOPE Magazine. Monthly periodical. For subscription information, please write or call:

Sky Publishing Corporation
49 Bay State Road
Cambridge, MA 02138
(800) 253-0245 Website: **skyandtelescope.com**

2. ASTRONOMY Magazine. Monthly periodical. For subscription information, please write or call:

Kalmbach Publishing Co.
21027 Crossroads Circle
P.O. Box 1612
Waukesha, WI 53187
(800) 533-6644 Website: **www.astronomy.com**

3. ABRAMS SKY CALENDAR. Monthly sky map and astronomy events calendar. For subscription information, please write:

Abrams Sky Calendar
Abrams Planetarium
Michigan State University
East Lansing, Michigan 48824
Website: **www.pa.msu.edu/abrams/SkyCalendar/Index.html**

4. ODYSSEY Magazine. Children's monthly astronomy periodical. For subscription information, please write:

Cobblestone Publishing Company
30 Grove Street, Suite C
Peterborough, NH 03458
(800) 821-0115 Website: **www.odysseymagazine.com**

Please help us keep our information current. If you discover an address, phone number, or Internet address in our Teacher's Resource Pages that has changed, please inform the Cernan Center at **(708) 456-0300, Ext. 3372.** Thank you very much.

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EARTH SCIENCE

A wide variety of online resources can be found at the Cernan Center's Earth Science Links page by visiting www.triton.edu/cernan and clicking on "Earth Links."

DINOSAURS:

The best local resource for educators is the Field Museum of Natural History in Chicago. Call (312) 922-9410 and ask for the Teacher Resource Department. Website: **www.fmnh.org**

GEOLOGY:

U.S. Geological Survey (USGS) Website: **www.usgs.gov**
Boulder, Colorado

WEATHER:

National Climatic Data Center Website: **lwf.ncdc.noaa.gov/oa/ncdc.html**
NOAA Environmental Data Services
Federal Building
Asheville, North Carolina 28801

National Weather Service Website: **www.nws.noaa.gov**
Public Affairs Office
Silver Springs, Maryland
(301) 899-3296

Illinois Emergency Services and Disaster Agency
100 E. Adams
Springfield, Illinois 62706
(217) 782-2700

MISCELLANEOUS:

National Geographic Society Website: **www.nationalgeographic.com**
Educational Services
Department 38
Washington, D.C. 20036
(800) 368-2728

Please help us keep our information current. If you discover an address, phone number, or Internet address in our Teacher's Resource Pages that has changed, please inform the Cernan Center at **(708) 456-0300, Ext. 3372.** Thank you very much.