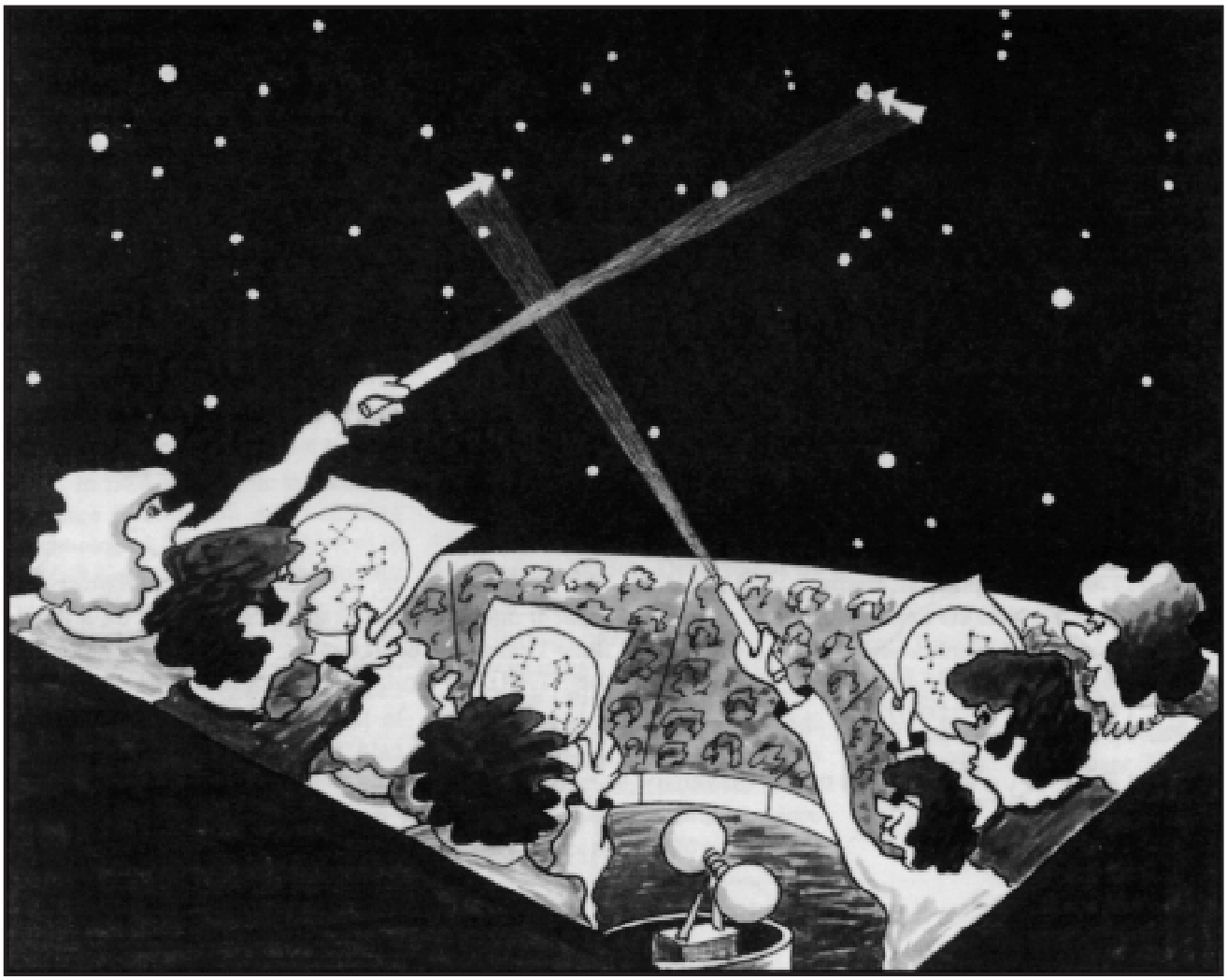
Constellations Tonight

A PROGRAM FROM THE HOLT PLANETARIUM



by Alan J. Friedman
edited by John Erickson, Alan Gould, and Gregory Steerman

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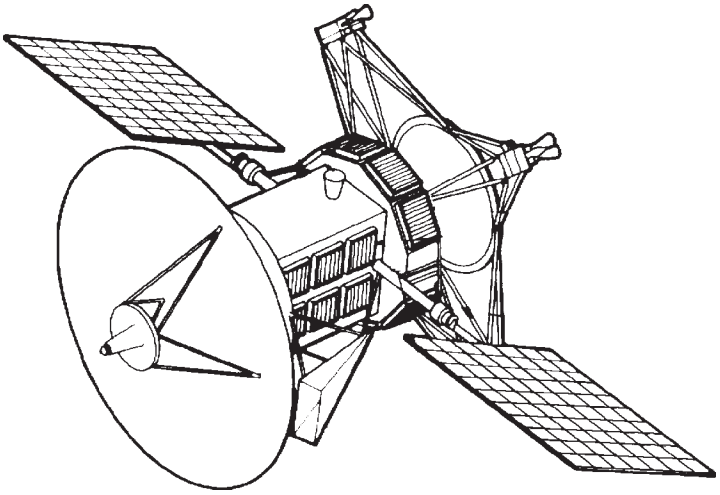

Magellan

Venus Radar Mapping Mission

May, 1989 to April, 1991 (and beyond)

(NASA drawing)

Cover photo of the Pleiades star cluster, courtesy Lick Observatory.

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The first printing of the *Planetarium Activities for Student Success* series was made possible by a grant from Learning Technologies, Inc., manufacturers of the STARLAB Portable Planetarium.

For latest information, valuable links, and resources relating to the PASS series, visit:

http://www.lhs.berkeley.edu/pass

Additional copies of the *PASS* Volumes may be purchased from:

Learning Technologies, Inc.
40 Cameron Avenue
Somerville, MA 02144
800-537-8703

Lawrence Hall of Science website:
http://www.lhs.berkeley.edu/

Acknowledgements

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In 1988, grants from the National Science Foundation and Learning Technologies, Inc. have enabled us to publish *Constellations Tonight* as part of the *Planetarium Activities for Student Success (PASS)* series. Project Co-Directors were Cary Sneider, Director of Astronomy & Physics Education at the Lawrence Hall of Science in Berkeley, CA, and Alan Friedman, Director of the New York Hall of Science, in Corona, New York. Staff members of the Lawrence Hall of Science who contributed to the series included Lisa Dettloff, John Erickson, Alan Gould, JohnMichael Seltzer, and Michelle Wolfson. Staff members of the New York Hall of Science who contributed to the series included Terry Boykie and Steven Tomecek. Special thanks are due to our Program Officers at the National Science Foundation, Florence Fasanelli and Wayne Sukow.

We wish to acknowledge the assistance provided by our Advisory Board, who helped to plan this series, and commented on early drafts: Gerald Mallon, Methacton School District Planetarium, Norristown, PA; Edna DeVore, Independence Planetarium, East Side Union High School District, San Jose, CA; Philip Sadler, Project STAR, Harvard Smithsonian Astrophysical Observatory, Cambridge, MA; Sheldon Schafer, Lakeview Museum of Arts and Sciences Planetarium, Peoria, IL; Robert Riddle, Project Starwalk, Lakeview Museum of Arts and Sciences Planetarium, Peoria, IL; David Cudaback, Astronomy Department, University of California, Berkeley, CA; and Joseph Snider, Department of Physics, Oberlin College, Oberlin, OH.

Perhaps most important are the approximately 100 individuals from around the nation who attended leadership workshops in 1978, and an additional 200 educational leaders who attended three-week institutes in astronomy and space science at Lawrence Hall of Science during the summers of 1989, 1990, 1992 and 1993. These educational leaders were the first to receive the Planetarium Educator's Workshop Guide, and other volumes in the *PASS* series, and provided valuable feedback for their final revision. Their names and addresses are listed in the Appendix to *PASS* Volume 1.

We would like to thank the staff of the 1989, 1990, 1992 and 1993 Astronomy and Space Science Summer Institutes: Joseph Snider, Terry Boykie, John Radzilowicz, John Hammer, Robert Jesberg, Jacqueline Hall, Dayle Brown, Alan Gould, Cary Sneider, Michelle Wolfson, JohnMichael Seltzer, John Erickson, Lisa Dettloff, Kevin Cuff, Debra Sutter, Chris Harper, Kevin Charles Yum, John Hewitt, Edna DeVore, Precious Perry, Gregory Steerman, Debra Sutter, Chris Harper, and David Cudaback.

The particular versions of the Dipper mentioned on pages 15-18 come from the following sources (referenced fully on page 20): Greek myth and "Bear and the Oak Tree" myth from Staal's *Patterns in the Sky*. "Five Wolf Brothers" myth from Clark's *Indian Legends of the Pacific Northwest*. The myths in the "More Mythology" chapter (pp. 41-52) are adapted from sources listed on page 20.

Special editors of the 1993 edition are John Erickson and Gregory Steerman.

PASS Volume 5 Illustrations

p.ii, NASA, CRAF spacecraft (drawing); p.3, Alan Gould, Light pointer (drawing); p.10a, Budd Wentz, Big Dipper (drawing); p.10b, Budd Wentz , Big Bear (drawing); p.11, Budd Wentz, Plow (drawing); p.12, Budd Wentz, Wolf Brothers & Bears (drawing); p.17-20, Alan Gould, Seasonal Star Maps (drawing); p.21, Alan Gould, Queen Cassiopeia (drawing); p.23, 25, 27, Alan Gould, Misc. drawings; p.29, Budd Wentz, Using Star Maps (drawing); p.32, 34, Budd Wentz, Treasure Map (drawing); p.36, Alan Gould, Star Map (Sheet #2); p.37, Alan Gould, Sky Windows; p.39, Alan Gould, Quiz Leo; p.40a, Alan Gould, Quiz Star Map; p.40b, Alan Gould, Quiz star windows; pp. 41-52, Gregory Steerman, constellation illustrations.

Planetarium Activities for Student Success (PASS)

Series Editors: Cary Sneider, Alan Friedman, and Alan Gould

If you have access to a planetarium for teaching about astronomy, space science, and other subjects, this series of books is for you. Designed for both experienced planetarium professionals and teachers who will be using a planetarium for the first time, these volumes provide a wealth of field-tested strategies and practical suggestions for presenting entertaining and educationally effective programs for students.

The first four books provide a general orientation to astronomy and space science education with applications for both the planetarium and classroom settings. Each of the remaining volumes presents a complete planetarium program and related classroom activities. We hope you will find the materials useful in your work with students and teachers, as well as springboards for your imagination and creativity.

Volume 1: Planetarium Educator's Workshop Guide

Participatory planetarium programs involve students actively in the planetarium environment. The most effective programs are both entertaining **and** educational. This guide introduces the theory and practice of developing effective planetarium programs through a series of thought-provoking activities and discussions.

Volume 2: Planetarium Activities for Schools

This volume provides a wealth of effective planetarium activities for elementary and middle school students, as well as ideas for developing new activities for students of any age.

Volume 3: Resources for Teaching Astronomy & Space Science

There is a wide spectrum of resources for teaching astronomy and space science in elementary and middle schools. This annotated resource guide has the best resources that we have found, including school curricula, books, periodicals, films, videos, slides, professional organizations, planetariums, and telescopes.

Volume 4: A Manual for Using Portable Planetariums

Primarily a "how-to" manual for setting up and using a portable planetarium, this guide has many suggestions useful for teaching school programs in **any** planetarium.

Volume 5: Constellations Tonight

In this participatory version of a classic night sky planetarium program, students receive star maps and have an opportunity to use them to find constellations in the planetarium sky. Classroom activities include creating constellations and using star maps.

Volume 6: Red Planet Mars

Students discover Mars three different ways during this planetarium program. They find the red planet by observing it over a period of several nights as it moves against the background stars. Then they view it through a telescope and try to draw a map of its surface. Finally they see Mars via space probes. Classroom activities involve students in modeling the solar system, and creating creatures that might survive under different planetary conditions.

Volume 7: Moons of the Solar System

This program begins with observations of the Earth's Moon and a modeling activity that shows why the Moon goes through phases and eclipses. Then the students look at Jupiter's four major moons on a series of nights and figure out how long it takes each one to circle Jupiter. Finally, the students journey through the Solar System to see many moons through the "eyes" of modern spacecraft. Classroom activities involve students in performing experiments in crater formation, using moon maps, and designing lunar settlements.

Volume 8: Colors From Space

What can we learn about the stars and planets from their colors? Answering this question requires a fundamental understanding of why we see color. During this program, students deepen their understanding through a series of activities in which they "travel" to an imaginary planet circling a red sun, and experiment with color filters and diffraction gratings. Related classroom activities include making secret messages that can only be decoded with color filters, and then using the same filters to view nebulae and planets.

Volume 9: How Big Is the Universe?

Based partly on ideas from the short film *Powers of Ten*, this program surveys distances and sizes of things in the universe. Starting with ordinary things on Earth that students are familiar with, they move to progressively more distant astronomical objects: the Moon, the Sun, the Solar System, nearby stars, the Milky Way galaxy, and clusters of galaxies. Students use various methods to determine distance: parallax, "radar," and comparing brightness of objects. Classroom activities include students writing their complete galactic address, making a parallax distance finder, finding the distance to the "Moon," and activities about the expanding universe.

Volume 10: Who "Discovered" America?

Students ponder the meaning of the word *discover* in this program. Can one "discover" a land where people are already living? Students learn the reasons and methods by which Columbus navigated to the "New World," and some of the impacts of his voyages on Native Americans. They also find that certain myths about Columbus are untrue. He was not, for example, alone in believing that the Earth is round. Students also learn about other explorers who "discovered" America long before Columbus's time. Classroom activities include determining the shape and size of the Earth, using quadrants to determine latitude, and modeling lunar eclipses.

Volume 11: Astronomy of the Americas

There are hundreds of Native American cultures, each with distinctive views of the heavens. There are also common threads in many of those cultures. In this program students visit five cultures: the Hupa people of Northern California, plains and mountain tribes that have used Medicine Wheel in Northern Wyoming, the Anasazi of Chaco Canyon in New Mexico, the Mayan people in Mexico and Central America, and the Incan people in Peru. Students observe moon cycles and changes in the sunrise and sunset positions on the horizon and learn how solar observations help Native Americans stay in harmony with nature. Classroom activities include the Mayan and Aztec number systems, observing changes in real sunset positions, and learning how Venus can appear as either the "Morning Star" or "Evening Star."

Volume 12: Stonehenge

In this program, students learn what Stonehenge is and how it could have been used by its builders as a gigantic astronomical calendar. They also learn how astronomer Gerald Hawkins discovered one of Stonehenge's probable functions, by actively formulating and testing their own hypotheses in the planetarium. Along the way, they learn a lot about apparent solar motion, and the creation of the research field of "archaeoastronomy." Classroom activities include constructing a special Solar Motion Demonstrator to represent the entire yearly cycle of solar motion.

Constellations Tonight

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PLANETARIUM PROGRAM

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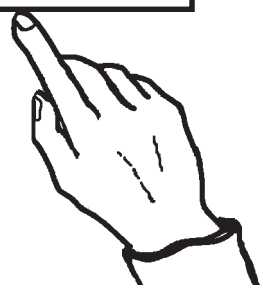


Constellations Tonight

Planetarium Program

Preface

Constellations Tonight was designed for public audiences and for school children in grades four and above. With simpler star maps and other slight modifications, it could be presented to somewhat younger audiences as well.

The program begins by inviting the students to locate a familiar constellation, the Big Dipper. Then, a brief discussion brings out the many possible functions of constellations for the people who invented them. An optional activity for younger school groups helps the children understand the origin of constellation figures by creating their own.

The major activity teaches the students how to use a star map for finding specific constellations in the planetarium sky. Students then take turns pointing out their constellations to the entire audience. As each constellation is identified, the instructor may project artists' conceptions of the constellation outlines, tell a short version of the relevant star myth, and/or show telescope views of star clusters, nebulae, or galaxies that can be found in the constellation.

A student who uses the star map under the true night sky might wonder, "How come the brightest star in that constellation is not on my map?" It's probably a planet. Since planets move around, they cannot be assigned to a the same season each year. Check astronomical a current issue of *Astronomy* or *Sky and Telescope* magazine for current planet positions. Planetary motion is covered in more detail in PASS Volume 6, *Red Planet Mars*.

We would be very grateful to hear from you about how you used this program, what modifications you made, what worked well and what didn't work well.

Objectives

After attending this planetarium program, the students will be able to:

1. Explain that constellation figures are created by people in many societies. Although there are many different possible constellation figures for a given pattern of stars, everyone in a given culture generally agrees on a single figure for each star pattern that is thought to be important;
2. Describe at least two functions that constellations serve for the people who share them;
3. Use a star map to find constellations in the planetarium sky, and ultimately in the real night sky; and
4. Realize that they can use the star map they take home, and feel that it is fun and satisfying to find constellations in the sky.

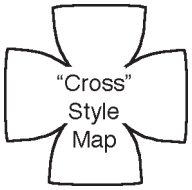
Classroom Activities

The classroom activities, *Using Star Maps* and *Creating Constellations*, are designed for use before or after the planetarium program. The purpose of these activities is to extend and reinforce the concepts presented in *Constellations Tonight.*

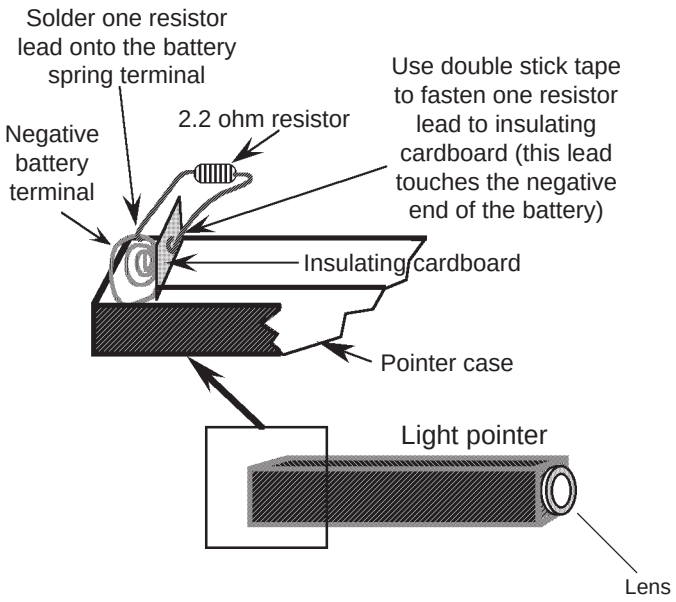
Materials

The following special materials are required to present this program in your planetarium:

1. A one-page star map for the current season for each participant to use and to take home. You may copy the maps on pages 4-9 for use with your students. The short bibliography on page 14 can be copied onto the back of the star map. Gerald Mallon, of the Methacton School District Planetarium in Norristown, Pennsylvania, suggests using an overhead transparency of the map to explain how to use it. Sheldon Schafer of the Lakeview Museum Planetarium of Peoria, Illinois, suggests using the "cross" style map, developed by R.K. Marshall.



2. Battery-operated light pointers. These are available from photographic stores. Have at least two light pointers (one bright and one dim) or a single light pointer with variable brightness. Pointers that use two batteries can be made dimmer by replacing one battery with a "dummy" battery. Some electronics stores (such as Radio Shack) carry dummy batteries. Alternatively, a battery powered light pointer can be made dim by wiring a 2.2 ohm, 1/2 watt resistor to the negative (spring) terminal in the battery com–partment. A cardboard insulator is needed to prevent direct contact of the negative end of the battery to the negative battery terminal (see diagram at right). If a slightly brighter light arrow is desired, use a 1 ohm resistor instead. The addition of either resistor will not only allow you and your students to point out faint objects easily, but will also prolong the lifetime of the pointer bulb as well as the batteries. We highly recommend using rechargeable NICAD batteries in your battery powered light pointers.



Many battery operated pointers have shiny interiors which produce a bright reflected ring of light or a hazy glow around the image of the arrow on the dome. To eliminate the ring or glow, disassemble the pointer, remove the lamp, and paint the interior of the tube between the lamp socket and the front lens. Use flat black paint and take care not to get paint on the lens or lamp socket. Alternatively, line the interior of the tube with dull black paper. This is also a good time to put in a color filter if you wish to color code your pointers.

3. Reading lights for the students. In our permanent planetarium, we have 7-watt night-light orange bulbs under the cove, with shades so they shine down on the audience. This is very convenient, because visitors can examine their star charts and look up at the sky freely. The program can also be done by turning up the daylight for people to study their charts, and then turning daylight down for sky examination. For a portable STARLAB planetarium, good reading light systems are described in PASS Volume 4, pp. 21-22.

4. Constellation outline projectors. For Learning Technologies' Star Lab portable planetarium, there are constellation outline cylinders available. In the permanent planetarium, we use inexpensive "brute force" units each consisting of a small filament light bulb mounted in a tube with simple a simple lens and constellation outline mask at the other end. The length of tube and positioning of the mask depend on the focal length of the lens. Slides of constellation outlines are another simple alternative. Illustrations on pages 9 and 11 can be used as artwork to produce outlines of the various versions of Ursa Major—a dipper, a bear, a plow, and a group of figures from a Native American legend.

5. Slides of interesting objects (nebulae, galaxies, planets) in the current sky. Select three or four appropriate slides from an astronomical slide set such as the Hale Observatories' series (available from Hansen Planetarium in Salt Lake City), Astronomical Society of the Pacific sets, or the Hansen Planetarium set by Charles Capen (15 South State Street, Salt Lake City, Utah 84111). The latter more closely approximate the view in small telescopes. For more info on where to get slides, see the section on slides in PASS Volume 3, *Resources for Teaching Astronomy and Space Science.*

Complete slide sets may be purchased from:

Eureka!
Lawrence Hall of Science
University of California
Berkeley, CA 94720-5200
510-642-1016

or

Learning Technologies, Inc.
59 Walden St.
Cambridge, MA 02140
800-537-8703.

Slides for Constellations Tonight

(celestial objects for particular seasons; also include any major planets that are currently visible)

1. The Great Galaxy in Andromeda (M31)
2. Double Cluster in Perseus
3. Pleiades
4. Orion's Belt and Sword Region
5. The Great Nebula in Orion (M42)
6. Horsehead Nebula in Orion
7. Whirlpool Galaxy in Canes Venatici (NGC5194)
8. The Great Globular Cluster in Hercules (M13)
9. The Ring Nebula in Lyra (M57)
10. The Lagoon Nebula in Sagittarius (M8)

January - February: the Great Galaxy in Andromeda (M31), Double Cluster in Perseus, the Pleiades, Orion's Belt and Sword region, the Great Nebula in Orion (M42), Horsehead Nebula.

March - April: the Pleiades, Orion's Belt and Sword region, the Great Nebula in Orion (M42), Horsehead Nebula, Whirlpool Galaxy.

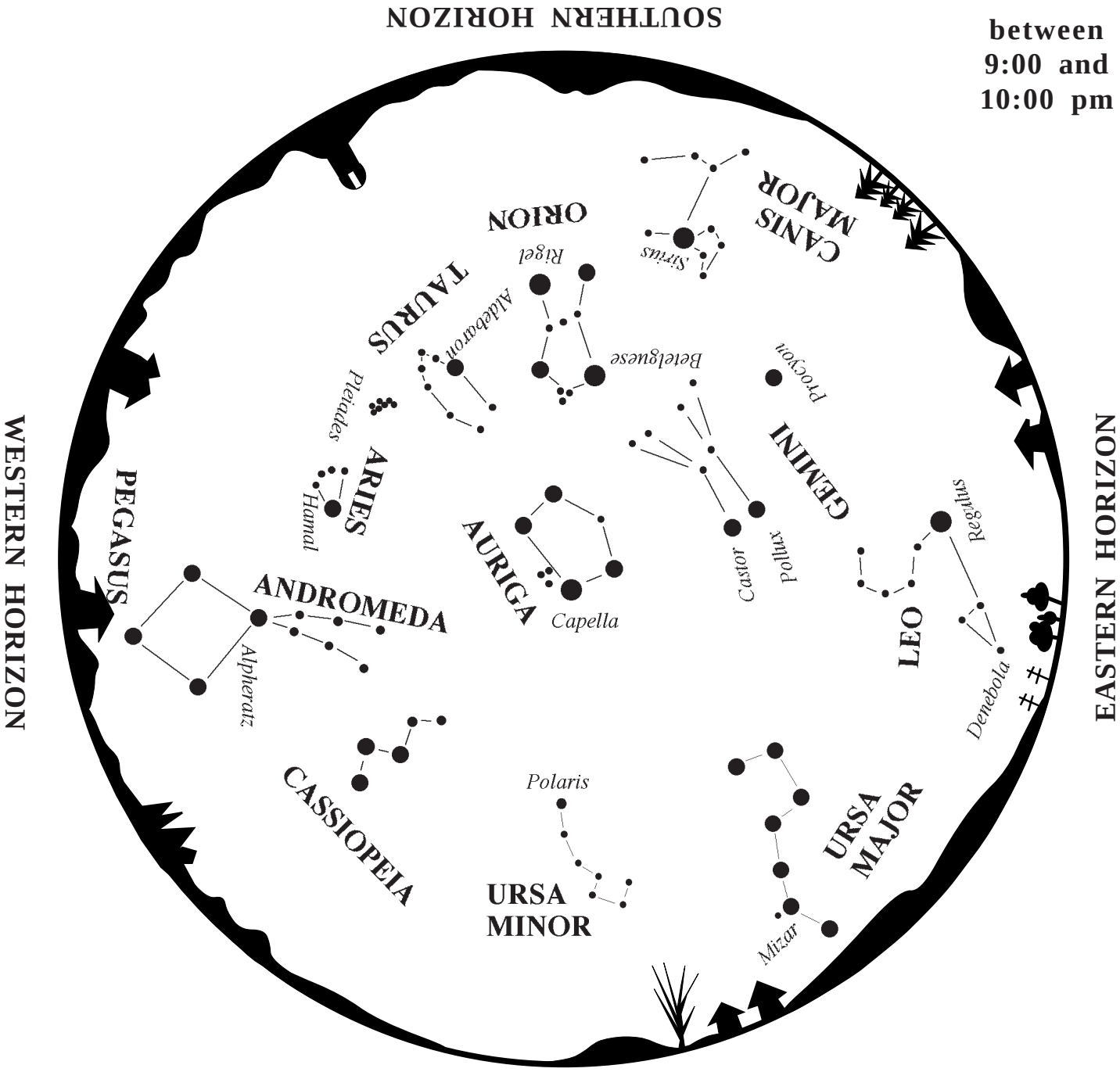
May - June: Whirlpool Galaxy, the Great Globular Cluster in Hercules (M13), the Ring Nebula in Lyra.

July - August: the Great Globular Cluster in Hercules (M13), the Ring Nebula in Lyra, the Great Galaxy in Andromeda (M31), the Lagoon Nebula in Sagittarius.

September - October: the Great Globular Cluster in Hercules (M13), the Ring Nebula in Lyra, the Great Galaxy in Andromeda (M31), the Lagoon Nebula in Sagittarius.

November - December: the Great Galaxy in Andromeda (M31), the Double Cluster in Perseus, the Pleiades, Orion's Belt and Sword region, the Great Nebula in Orion (M42), Horsehead Nebula.

Evening Star Map for January - February



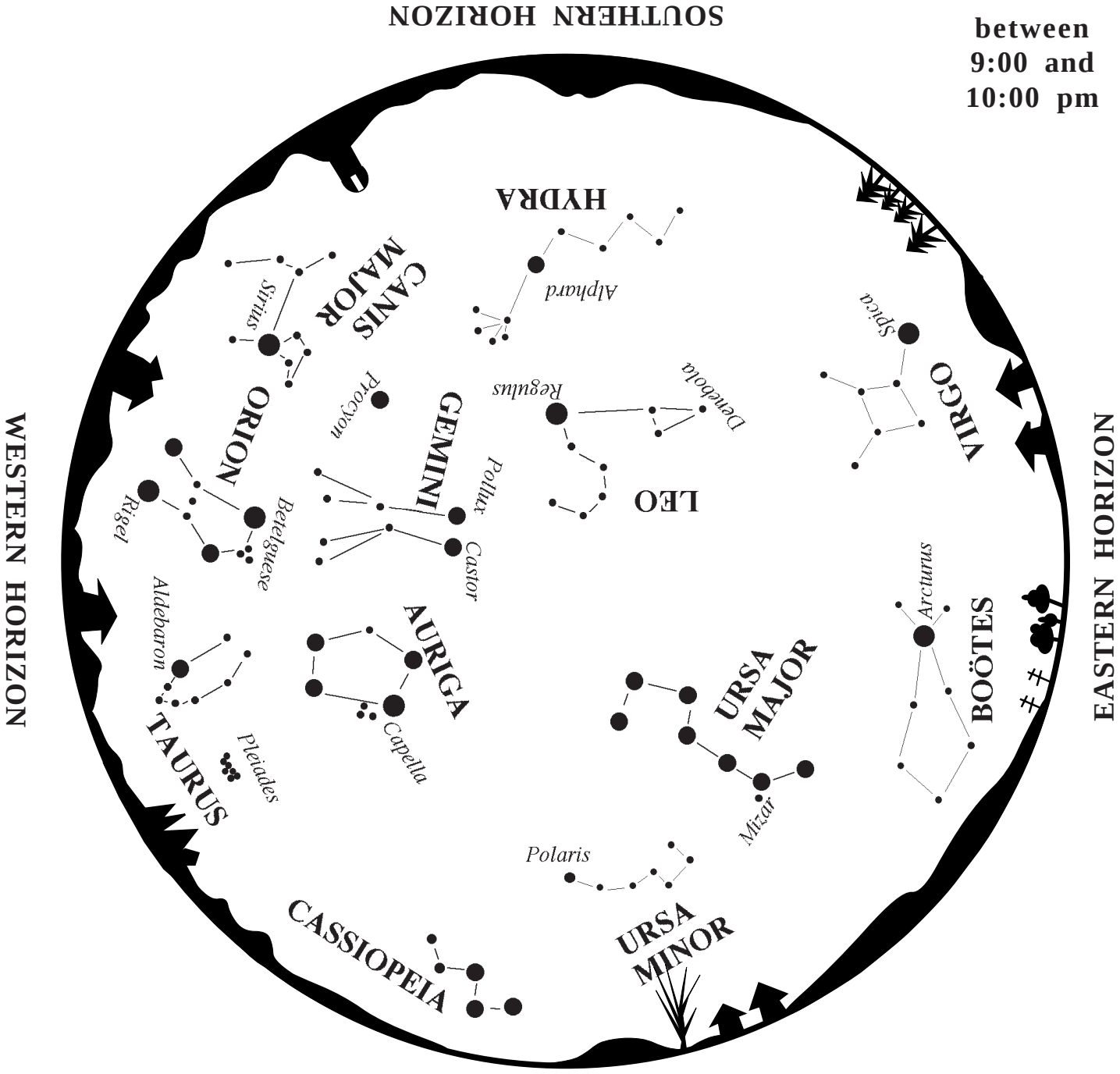
To use map:

Turn the map so the direction you are facing is on the bottom.

The constellations in the sky will match the contstellations on the map.

Holt Planetarium, Lawrence Hall of Science, University of California, Berkeley, CA 94720

Evening Star Map for March - April



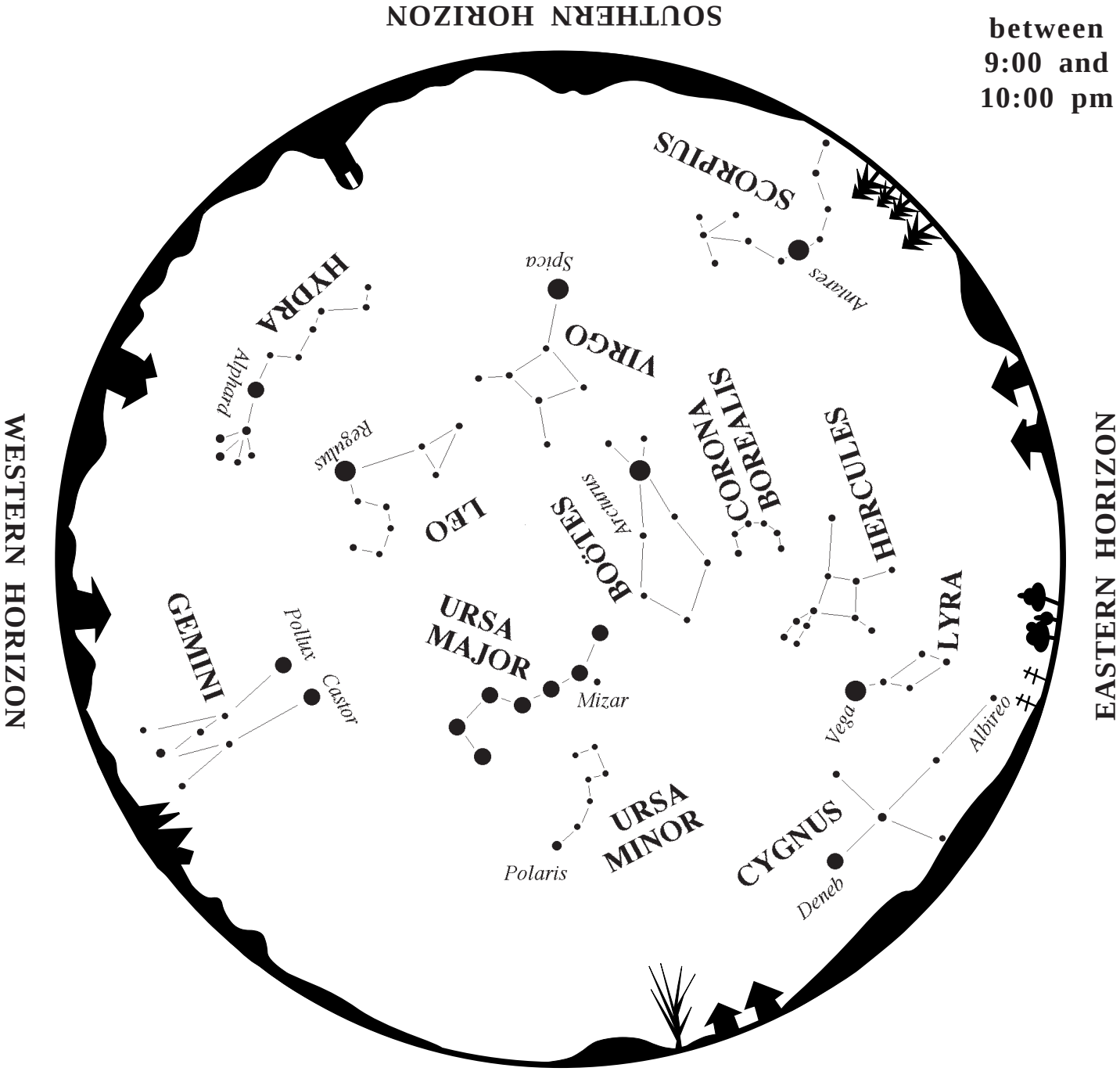
To use map:

Turn the map so the direction you are facing is on the bottom.

The constellations in the sky will match the contstellations on the map.

Holt Planetarium, Lawrence Hall of Science, University of California, Berkeley, CA 94720

Evening Star Map for May - June



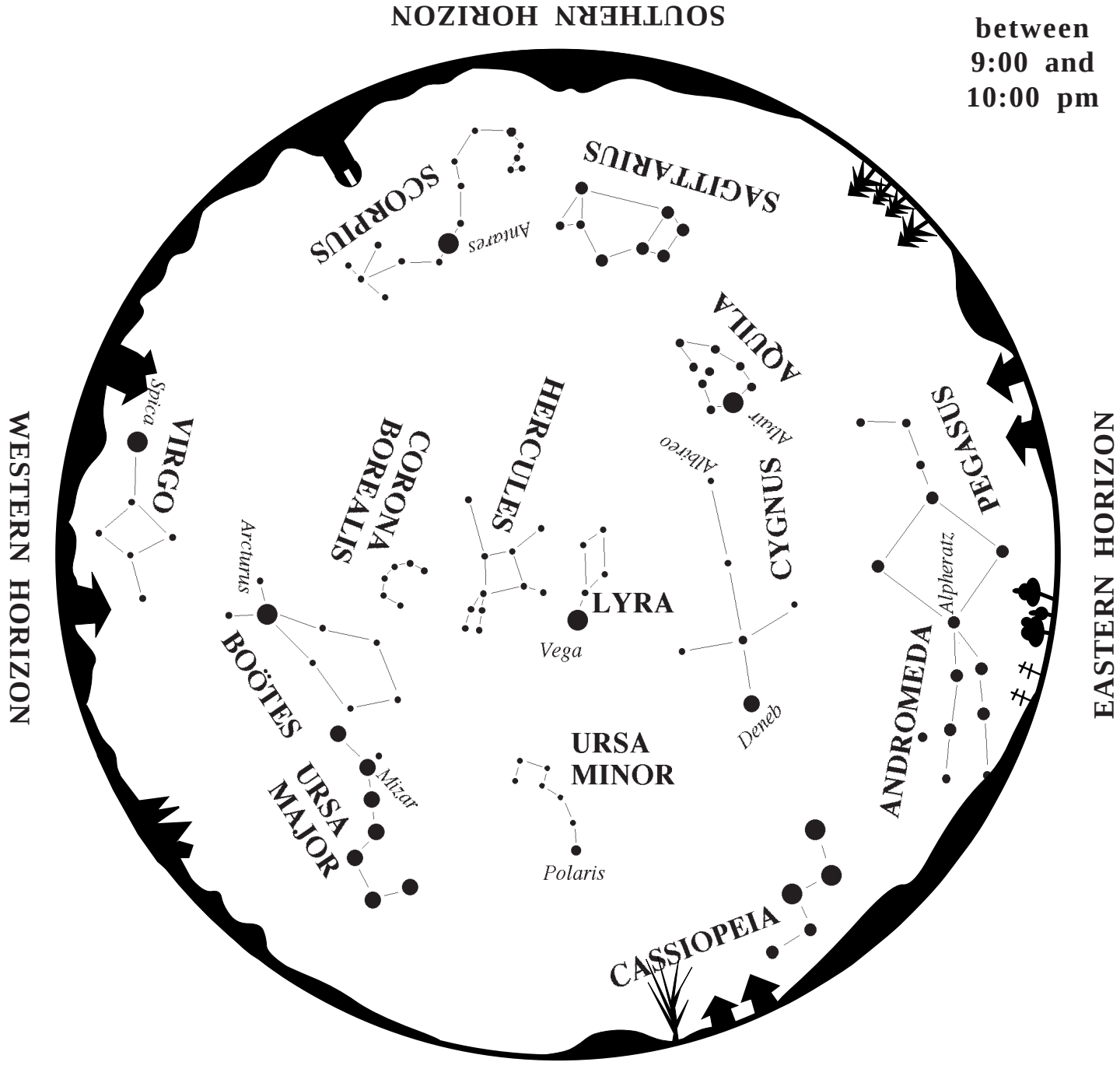
To use map:

Turn the map so the direction you are facing is on the bottom.

The constellations in the sky will match the contstellations on the map.

Holt Planetarium, Lawrence Hall of Science, University of California, Berkeley, CA 94720

Evening Star Map for July - August



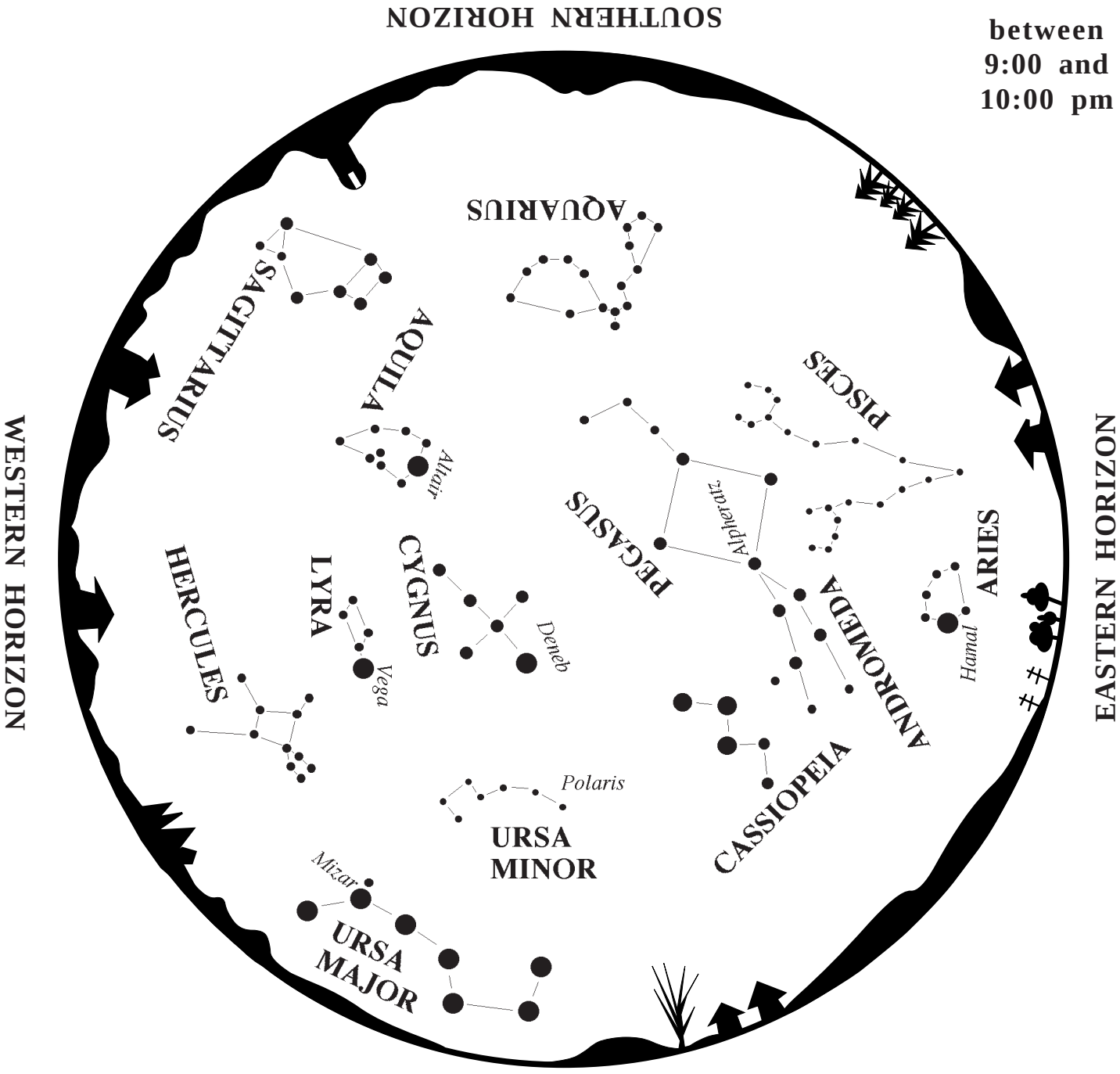
To use map:

Turn the map so the direction you are facing is on the bottom.

The constellations in the sky will match the contstellations on the map.

Holt Planetarium, Lawrence Hall of Science, University of California, Berkeley, CA 94720

Evening Star Map for September - October



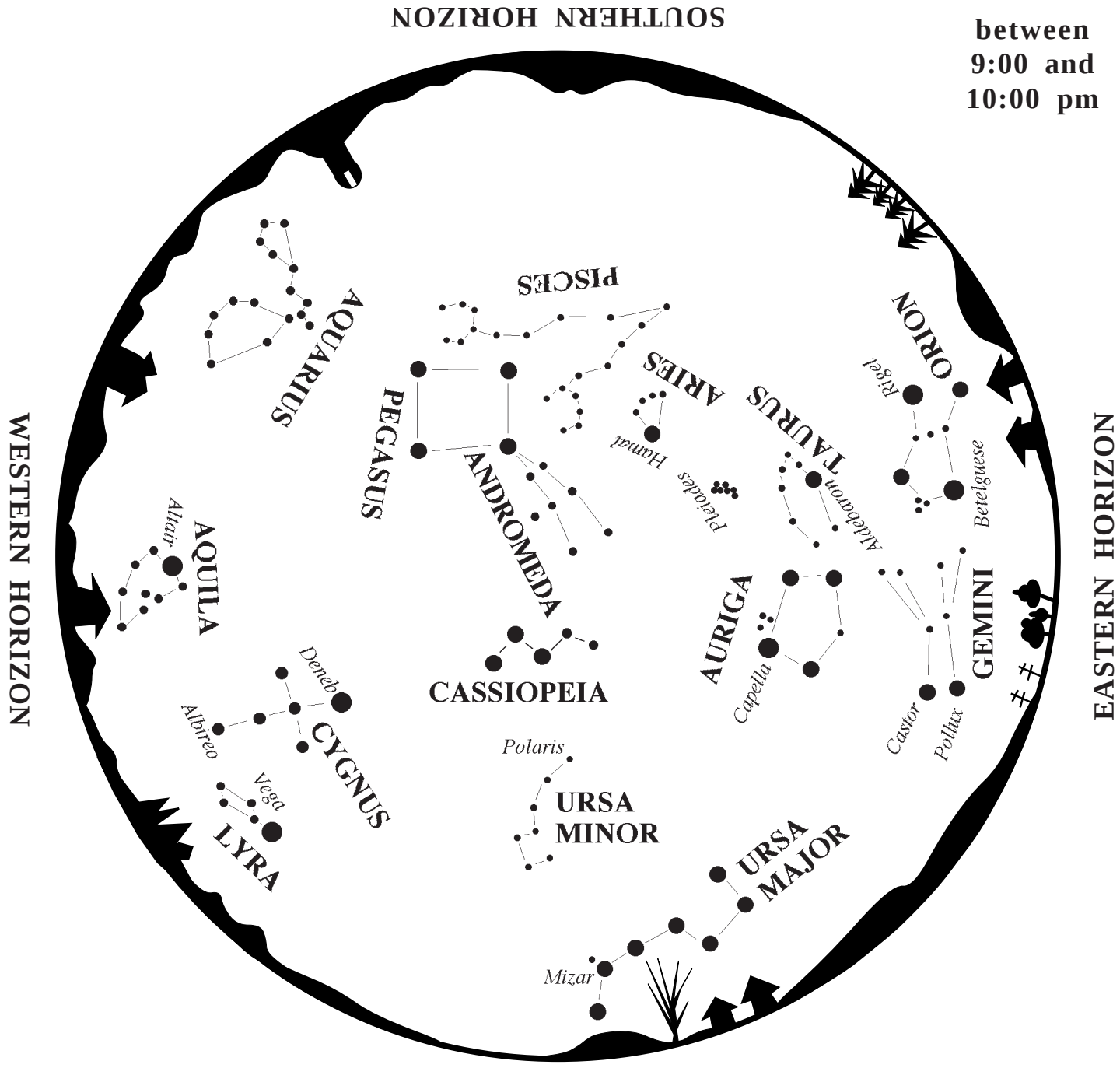
To use map:

Turn the map so the direction you are facing is on the bottom.

The constellations in the sky will match the contstellations on the map.

Holt Planetarium, Lawrence Hall of Science, University of California, Berkeley, CA 94720

Evening Star Map for November - December



To use map:

Turn the map so the direction you are facing is on the bottom.

The constellations in the sky will match the contstellations on the map.

Holt Planetarium, Lawrence Hall of Science, University of California, Berkeley, CA 94720

Set-Up

1. Latitude: Home.
2. Precession: Current.
3. Set sun and sky for today's date.
4. Time: About 9:00 p.m.
5. Turn off sun, moon, planets, NEWS lights.
6. Check constellation outline alignments. For STARLAB, have cylinder ready.
7. Set slide projector on first slide.
8. Be sure to have a current star map on hand for each member of the audience.
9. Check operation of battery-operated light pointer(s).

Recommendations for Using the Script

We don't expect the script which follows to be memorized (as an actor might memorize a part) but to be used as a guide in learning, rehearsing, and improving presentations. We recommend that you read the script once or twice, then work with it in the planetarium, practicing the projector controls, slides, special effects, and music. You should be able to imagine yourself presenting information, asking questions, and responding to participants. For your first few presentations, you can have the script on hand, using major headings as reminders of what to do next.

The script is organized in blocks or sections. The purpose of these separations is only to help you learn and remember what comes next. Once you have begun a section, the slides or special effects and your own train of thought will keep you on track. When beginning a new section, make the transition logically and smoothly.

Directions for the instructor are printed in *italics*, the instructor's narrative is printed in regular type, and directions and questions to which the audience is expected to respond are printed in ***bold italics***. There is no point in memorizing narration word-for-word since what you need to say will depend upon the participants. The language you use and the number and kinds of questions you ask will depend on how old the participants are, how willing they are to respond, and how easily they seem to understand what is going on.

We believe that the most important elements of the program are the questions and the activities since these involve the audience in active learning. If you must shorten your presentation, we recommend that you borrow time from the narration.

Introduction

Gradually turn down daylight while turning on stars.

Welcome. My name is _____ and I would like to welcome you to the _____ Planetarium. Today, you can learn how to use a star map to find the constellations and some of the brightest stars.

The stars which you see now are just as they will appear tonight from our area around nine or ten p.m., if the sky is clear. Let's see if you can find one constellation without any help from me. ***Look around the planetarium sky and see if you can find a group of stars that looks like a big dipper. Hold up your hand when you find it.***

Wait until most of the participants indicate that they have found it, then give one person the pointer to show everyone else the location. Ask him or her to slowly point out the "handle" of the Big Dipper and the "part that holds the soup." If your person found "another" dipper shape, be positive. Note that there are many dipper-like shapes, all good, but we want the most familiar one. Then ask for another dipper shape to be found.

Every civilization, all over the earth, has names and stories about the stars. Usually, these stories are about a group or "constellation" of stars that seem to form a pattern or shape in the sky. People who lived at different times, in different places, often chose the same groups of stars as constellations, but imagined them to look like the particular animals or gods that were important in their own culture. What we call the Big Dipper, for instance, was called Ursa Major, or the Big Bear, by the ancient Romans. (*Point out parts of bear*.) ***Why do you think that people like the Romans, who lived thousands of years ago, made up names and stories about the stars?***

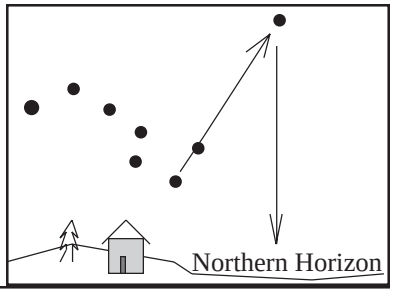
Accept all answers, then list the participants' ideas before going on.

One of the reasons for identifying constellations is still important today—finding directions. Sailors, flyers, and even astronauts tell directions by the stars. If you are lost in the woods, but you know that there is a city to the South, you can use the Big Dipper to find Polaris, the North Star. Since Polaris is always directly North, we can use it as a compass at night. ***Does anyone know a good way to find Polaris?***

Usually someone does. In any event, use your pointer to show how to use the pointer stars and Polaris to locate the northern horizon and the other directions. Have the audience identify South, East, and West.

In fact, Polaris indicates North with more accuracy than a simple magnetic compass. (*Turn on NESW lights*.)

Astronomers today use constellations as convenient direction markers to help name and locate interesting objects, like "the galaxy in Andromeda." We shall use constellations this way in today's program.



Sky Map Activity

Turn up orange seat lights (or daylight). Pass out one map to each participant. In some planetariums, it may be more convenient to hand out maps as people enter. Introduce the activity as follows:

These are maps of the sky which we will use to identify some of the major constellations that can easily be seen this month. After you have some experience using these maps right here in the planetarium, your map will be yours to take home so that you can identify constellations from your own backyard.

These maps represent the sky for _____ and _____ months around nine and ten p.m. The whole sky is compressed on these charts to fit within a circle. The dots on the map represent stars—the bigger the dot, the brighter the star will be. Only the brightest 50 or so stars are marked on the map.

What do you think the edge of the big circle on the map represents? The edge of the circle on the map is intended to represent the "horizon"—where the sky seems to meet the earth, and what you see when you look straight out horizontally. (*Point out, indicating the planetarium horizon.*) If a star on the map is near the words "Northern Horizon," it will be in the northern part of the real sky. (*Point out.*) If the star on the map is near the words "Eastern Horizon," it will be in the eastern part of the sky. (*Point out.*)

The closer to the center of the map a star is, the higher in the sky it will be. ***Where would the very center of our map be in our sky? Point to the place in the sky that the center of your map represents.*** *(Everyone should point to the top of the planetarium dome.)* A star at the very center of the map would be directly overhead in the sky. The point directly overhead is called the "**zenith.**"

One key to using this star map is in how you hold it. If the star or constellation you are looking for is closest to the northern horizon, you must hold the map so that "Northern Horizon" is at the bottom. That way the stars in that part of the sky will be right side up on your map. If you are looking for stars in the southern part of the sky, **turn the map** so that "Southern Horizon" is at the bottom and the stars in the south will look right side up on your map.

As an example, let's use the map to find the Little Dipper, called by its Roman name, Ursa Minor. ***When you find Ursa Minor on your map, raise your hand.*** If you have trouble, ask your neighbor for help.

When the students indicate they have found it, go on.

What direction should you face to find it? *"North" (or a little east or west of North, depending on the time of year.)*

Is Ursa Minor near the horizon or high up in the sky? Make sure that everyone agrees before going on.

Now watch me as I use the map to find Ursa Minor in the sky. On the map, Ursa Minor is closest to the "Northern Horizon," so I know I should face North and hold this map so the words "Northern Horizon" are at the bottom. When I look at the sky, about this high, I should see the same pattern of stars that appears on the map, and there it is! (*Point it out or have a student point it out.*) If I were looking for a constellation in the South, I would face South, and turn the map so that the words "Southern Horizon" at the bottom. (*Demonstrate*.)

Keep in mind a 4-step recipe for finding constellations:

1) First locate the constellation on the map; describe the pattern to yourself and note which stars are the brightest.

2) Determine what direction you must face; turn your map so that direction is at the bottom.

3) Decide if your constellation is high in the sky or near the horizon.

4) Compare your map with the stars you see in the sky.

It will be easier to locate the brightest stars in your constellation first. Once you have found a constellation, use it as a reference for finding other constellations nearby.

Assign groups to locate constellations. Be certain each group can see its constellation from their own position in the planetarium. Encourage the group members to help each other, to move around if they need to, and to use the hand pointers to help discuss which stars are which.

Leave reading lights on continuously. Fully dark skies have too many stars to easily pick out constellations. All the constellations on these maps can be found most easily in a "light-polluted" planetarium sky.

Offer to help individual groups one at a time, but don't rush them. Don't point out stars for anyone, but talk through the procedure for using the star map step-by-step for their constellations until they are looking in the correct direction. If some groups finish quickly, ask them to find neighboring constellations in the sky. Check to see that all groups have found their constellations before going on.

Is everybody ready? Let me pass around a flashlight-pointer so that one member of each group can show us which stars in the sky you think make up your constellation. Let's begin with the constellation_____ (appropriate constellation for the season).

Have one person in each group name the constellation his or her group has been assigned, and then ask everyone to find that one on their maps, and to approximate what part of the sky it should be in. Then have the person in the group point out where they decided the constellation was, star by star. If they mis-identify it, be positive and encouraging, pointing out how close the resemblance is, and ask them (or others) to try again.

Optional

As each constellation is identified, you may wish to add further information such as:

1) Show an outline of the mythological figure, and tell a brief version of the myth.

2) Show a slide of an interesting object (nebula, cluster, double star, galaxy, etc.) that appears in the constellation. If possible, show a slide of the binocular appearance, as well as one of the appearance in a large telescope.

3) Point out the location of the interesting object in the constellation, and invite the visitors to mark that position on their maps, and look for the object themselves, using binoculars, the next time they are out under dark skies. Mention that these objects are not physically "in" the constellations, but may be very far beyond the stars we can see (like the Andromeda galaxy). The stars of the constellations provide convenient direction markers, or frames.

Constellation outlines are a useful way to introduce a brief narrative on the mythological origin of each constellation.

Motion of the Stars

In Spring and Summer, when the Dipper is already overhead, advance diurnal motion only until the Dipper is aligned with the constellation outlines you have prepared, then go directly to "Versions of the Big Dipper." Next return to this section, followed by the "Conclusion." In Winter and Fall, follow the normal order: "Motion of the Stars," followed by "Versions of the Big Dipper," followed by the "Conclusion." If you present the Dipper first, make appropriate minor changes in the following paragraphs.

We have found each of the major constellations in tonight's sky. ***If we kept watching tonight, would the stars remain like this? What would happen? Why?***

Accept ideas from the audience.

Let's find out by going through the entire night, speeded up so that we will come to tomorrow morning in just three minutes. Please keep track of your constellation to see what happens to it during the course of the night. ***Also, please watch this star, which we said was Polaris. What is special about its behavior?***

Fade in music, gradually dim orange lights (or daylight), and begin diurnal motion. In Fall and Winter, stop when the "Dipper" is aligned with your constellation outline for the following section (if used).

It is now about two a.m. ***Can you still see your constellation? What has happened to it?***

What has happened to the Big Dipper?

What has happened to Polaris, the North Star?

Allow time for responses and discussion after each question. Encourage general observations such as "stars seem to rise and set like the sun," or "the North Star always stays still."

We have observed that the stars seem to rise in the East and set in the West. Stars in the North turn sround Polaris which appears to stand still. Even though it looks like the sky turns around the Earth, we have good evidence that the motion is caused by the Earth turning on its axis. Polaris does not appear to move because the Earth's axis points towards it.

Optional: Making Up Constellations

This activity is especially good for elementary school children.

Take a look around the sky and see if you can find a group of stars that looks like some kind of animal, person, or thing. Raise your hand if you have an idea that you want to tell us about.

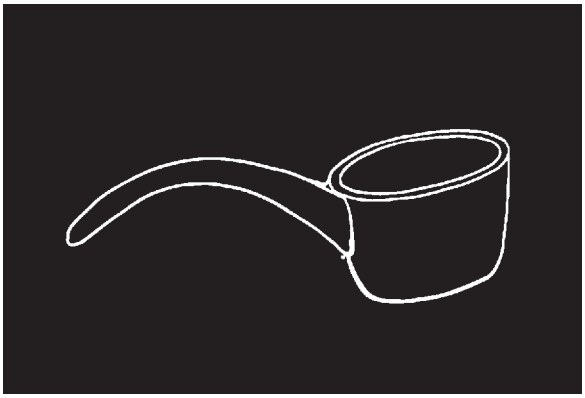
Allow three or four students to point out their constellations and describe them to the group—try to help everyone see what the inventor of the constellation sees.

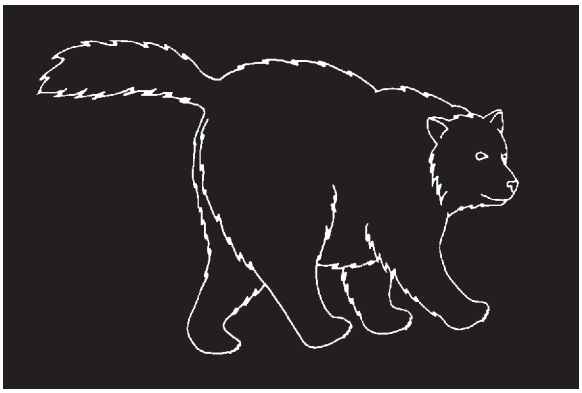
In ancient times—pretelevision times, people enjoyed making up constellations like this, just as most of us spend time watching TV today.

Versions of the Big Dipper (optional)

It is easy to see the Big Dipper as just that, a big dipper; and indeed, to some people in southern France, this group of stars was the Casserole, or sauce pan.

1. CASSEROLE OUTLINE





But to the Romans, the Dipper was just part of a larger constellation, Ursa Major, which means "the great bear." ***Try to imagine a bear. Where is his nose? Where are his legs?*** (*etc*.)

2. BEAR OUTLINE

Many of you have seen bears in the zoo. ***What is wrong with this picture of the bear?*** (Accept ideas from audience.) We can see that what's wrong with this bear is its long tail.

Roman mythology stories explain the long tail.

Very short version: Once the king of the gods, Jupiter, fell in love with Callisto, a beautiful young girl. But Juno, the queen of the gods, was very jealous, so she turned poor Callisto into a bear. Jupiter felt sorry for Callisto, so to protect her from hunters, he placed her up in the sky where we can see her every night if we look. To get her into the sky, he grabbed her by the tail and whirled her around and around and flung her up to the sky. That's why the tail is so long!

Long version: Jupiter, the King of the gods, often fell in love with mortal women of earth, so his wife Juno was often jealous. When Juno found out that Jupiter was favoring a young maiden named Callisto, Juno got so furious that she changed Callisto into a big shaggy bear. Years later, Callisto's son Arcas was hunting in the forest when his mother, now in the form of a bear, saw him. She got so excited, she forgot she was a bear and she rushed forward to embrace him. Of course, Arcas did not recognize his mother and he leveled an arrow in his bow to kill her. In the last instant, Jupiter intervened by changing Arcas into a bear as well, and then grasping both Callisto and Arcas by their tails, flung them into the sky (stretching out the tails)—where Callisto is now the Great Bear and Arcas the Little Bear.

Juno, still not satisfied with her revenge, persuaded Poseidon to forbid the two bears from cooling their feet in the waters of the oceans. This is why Ursa Major and Ursa Minor never sink below the horizon.

To many Native American tribes, the Dipper is also a bear. It is remarkable that many cultures, so very far apart, came up with the same unlikely image for these stars. But the Native Americans did not draw their bear exactly this same way.

If you have lots of time, take another minute or two to tell the following Native American story:

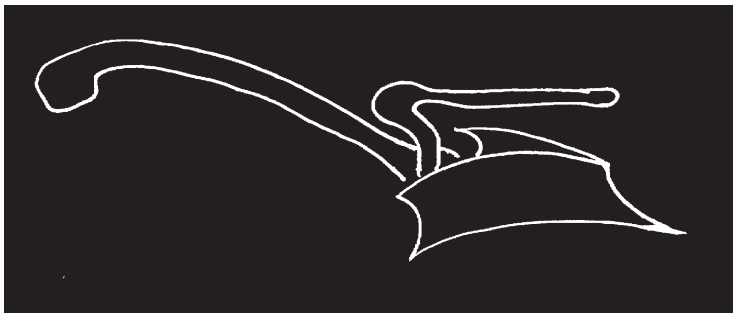
The Bear in the Oak Tree Forest

Long ago there was a great oak forest that was enchanted and magical, because every night at midnight the trees in this forest would move around and visit each other. One day a bear wandered into this forest and got so lost, he couldn't find his way out. He became frightened, and when midnight came, he was terrified to find the trees moving about. The poor bear started racing madly all over and bumping into trees right and left. The trees did not appreciate this intruder at all and one tree was so upset that it started chasing the bear. Because bears generally are faster than trees, this chase lasted almost till dawn. The tree knew that he and all the other trees had to go back to their original places by dawn or the sun would notice that they had moved. So the tree, just at twilight, made one last grasp at the bear with its longest branch and just barely caught the bear by the tail. Then the tree swung the bear up into the sky where we see him now. That is why his tail is so long.

To the early people in England, the Dipper was neither a dipper nor a bear, but was a plough, drawn by oxen. ***Why do you think that they thought of this constellation, which is high in the sky like this in the springtime, as a plough?***

Responses might include "it is time to plant," "it goes round and round like a farmer ploughing his field," etc. Accept all answers.

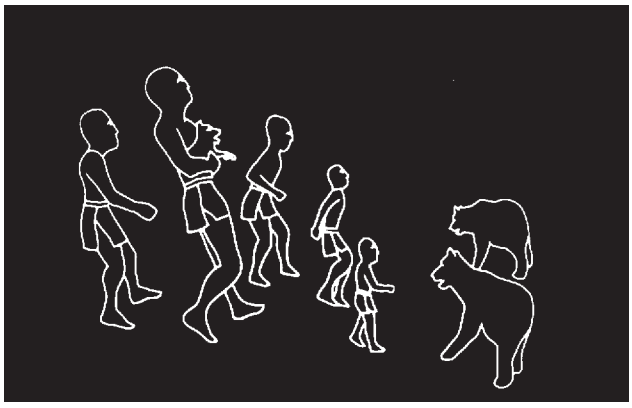
3. PLOUGH OUTLINE



Finally, I'd like to tell you one last story that is a favorite of mine. It is a Native American story, one from the Wasco Indians of the Pacific Northwest, the area we call Oregon and Washington.

Tell the following story of the five wolf brothers or, better still use a story from Native American culture of your own planetarium's region.

4. WOLF BROTHERS AND BEAR OUTLINE



Wasco Indian Version: The Five Wolf Brothers

Once upon a time there were five brothers named the Wolf brothers who made their living by hunting deer. Every night they would make a camp fire, cook some meat and eat together. They shared their food with another man named Coyote (a mythical god-like character). After eating, the brothers would relax and gaze into the sky in a certain area and look puzzled. One night Coyote asked the oldest brother, "What are you looking at?" The oldest brother said, "I won't tell you—you would think I was foolish." But on later nights Coyote questioned the other brothers until one night they answered, "We can see two animals moving in the sky but they are so high up we cannot tell what kind of animals they are." Coyote replied, "Wouldn't you like to get a closer look at them to see what they are?" To which the brothers replied, "Oh, yes, but none can travel into the sky." Said Coyote, "Nonsense, it is easy," and proceeded to collect three quivers full of arrows. Then he took an arrow and shot it straight towards the place in the sky where the brothers said they saw the two animals. The arrow went all the way to the sky and stuck there. Then Coyote shot a second arrow so that its tip stuck into the end of the first arrow. By the time Coyote finished shooting all the arrows, which took all night, there was a string of arrows reaching all the way from the sky to the earth. At dawn the five brothers and Coyote began climbing the arrow ladder. The youngest brothers went first, and Coyote and the oldest brother, carrying their little dog, went last.

After climbing almost all day, they reached the sky and found that the two animals were grizzly bears. The oldest brother shouted, "Stay away! They might tear you to pieces." But the younger brothers, who didn't want to appear afraid, crept closer and closer to the bears. The other brothers followed behind. Finally, the grizzly bears looked up and noticed the five Wolf brothers, but the bears did not attack, for they had never seen people before, and were curious. The bears just stood there looking at the brothers and the brothers stood very still looking back at the bears.

Coyote thought, "What a funny picture these bears and the Wolf brothers make just staring at one another. I would like for everyone to be able to see this," and he proceeded to climb down the arrow ladder, taking out the arrows as he went, leaving the picture in the sky for everyone to see.

The phrase "follow the drinking gourd" was remembered by freed or escaped slaves making their way north to safety via the "underground railroad." Whether the "gourd" was the Big Dipper or the Little Dipper, the general direction (north) was correct for the desired purpose.

For any constellation, there is no "best" or "correct" story. Each of you can make up your own story about the Big Dipper and the other constellations. Stars belong to no one, so your own imagination is just as valid as the ancient Romans' or anyone else's.

Conclusion

Let's speed up the motion of the earth again. As we go to early morning, a whole new set of constellations swing into view.

Fade in music, turn on sun, and begin diurnal motion. Gradually turn on red sunrise. As sun disk appears on horizon, slowly turn on daylight and fade out music.

Good morning! Please use your star map to find constellations in the real sky on the next clear night. Thanks visiting us. Happy star hunting!

Discover More About Constellations

STAR MAPS

Norton's Star Atlas, Arthur P. Norton, Sky Publishing Company, Cambridge, Massachusetts. A set of detailed star charts and good lists of interesting objects for telescope observing (star clusters, nebulae, galaxies, double stars, etc.)

A Popular Star Atlas, R.M.S. Inglis, Gall and Inglis, London, 1972. A much shorter and less expensive version of Norton's atlas.

Sky Challenger, a unique set of six interchangeable star wheels, provides many activities in star gazing, including "Binocular Treasure Hunt," "Native American Constellations," and "Test Your Eyes/Test Your Skies." Discovery Corner, Lawrence Hall of Science, Berkeley, California.

Star Maps for Beginners, I. M. Levitt & Roy K. Marshall, New York: Simon and Schuster, 1987. Grade Level: 5-up. Monthly sky maps in the shape of two crossed ellipses show the position of the stars viewed from every direction. With the history and development of constellation lore.

Star Paths—Star and Planet Chart, Edmund Scientific Company, Barrington, New Jersey. An inexpensive adjustable star wheel that can be set to show how the sky appears at any time.

The Star Book, R. Burnham, Astromedia Press, 1983. Cambridge University Press, 1984. Grade Level: 3-6. This book uses cardboard star maps to instruct beginners in stargazing. It has 8 color charts of the Northern Hemisphere.

The Stars: A New Way to See Them, 3rd edition, H. A. Rey, illus., Boston, MA: Houghton Mifflin Co., 1976. Grade level: 3-6. A simple non-mathematical guide to stars and starwatching for the amateur astronomer. Simple ways to find stars and information about them. The Astronomical Society of the Pacific calls it "a classic guide to the constellations that introduced a simplified way to keep track of them."

Whitney's Star Finder, 4th edition, Charles A. Whitney, New York: Knopf, 1985. Grade Level: 7-up. A clear, a primer on sky phenomena and constellations by Harvard astronomer. Good for Junior high and middle school students.

CURRENT PHENOMENA

Sky and Telescope Magazine, Sky Publishing Company, Cambridge, Massachusetts

Astronomy Magazine, AstroMedia Corporation, Milwaukee, Wisconsin.

Both magazines contain monthly star charts, current positions of the planets, and special events such as eclipses, comets, novae, and such. *Sky and Telescope* is slightly more technical than *Astronomy* Magazine.

Sky Calendar, by Robert C. Victor, Abrams Planetarium, Michigan State University, E. Lansing, Michigan 48823. This monthly calendar gives a day-to-day guide to interesting events in the sky.

Discover More About Mythology

American Indian Mythology, Alice Marriott and Carol L. Rachlin, 1968, Thomas Y. Crowell Company.

Humanities and the Stars (planetarium programs) Eileen Starr, Eastern Washington University.

Indian Legends from the Pacific Northwest; Ella Clark, 1953, University of California Press. American Indian stories about the star patterns that we call Orion, Cassiopeia, the Seven Sisters, the Big Dipper, and others.

In the Beginning: Creation Stories from Around the World. Virginia Hamilton, Illustrated by Barry Moser, Harcourt Brace, 1988. ISBN 0-15-238740-4. These stories of the creation of Earth and its people are gathered from cultures all over the world and throughout history, including familiar biblical tales, Greek and Roman myths, legends of the Australian aborigines and Native Americans.

Lakota Star Knowledge, Studies in Lakota Stellar Theology, Ronald Goodman, 1990, Sinte Gleska College.

Mythology; Edith Hamilton, 1971, New American Library.

The New Patterns in the Sky; Julius D.W. Staal, 1988, Blacksburg VA: The McDonald and Woodward Publishing Co. An excellent compilation of the Greek and Roman myths, with a scattering of other cultures as well.

Popul Vuh, The Maya Book of the Dawn of Life, Dennis Tedlock, 1985, Simon & Schuster, NY.

Star Names, Their Lore and Meaning; Richard H. Allen, 1963, Dover. This book has the origin of star names and constellations from various cultures.

Stars of Jade, Astronomy and Star Lore of Ancient China, Julius D. Staal, 1984, Writ Press, Decateur, GA.

Star Tales, North American Indian Stories About the Stars Gretchen Will Mayo, Walker and Company, NY.

They Dance in the Sky, Native American Star Myths, Jean Guard Monroe and Ray A. Williamson, Houghton Mifflin Company, Boston.

Look in library card catalogues and you will find many titles that start out Myths and Legends of... on almost every culture.

See also,

Planetarium Activities for Student Success (PASS) Volume 3, Resources for Teaching Astronomy and Space Science, sections on "Star Mythology Books" and "Stargazing," Eureka!, Lawrence Hall of Science, University of California, Berkeley.

William K Holt Planetarium, Lawrence Hall of Science
University of California, Berkeley, California 94720

Constellations Tonight

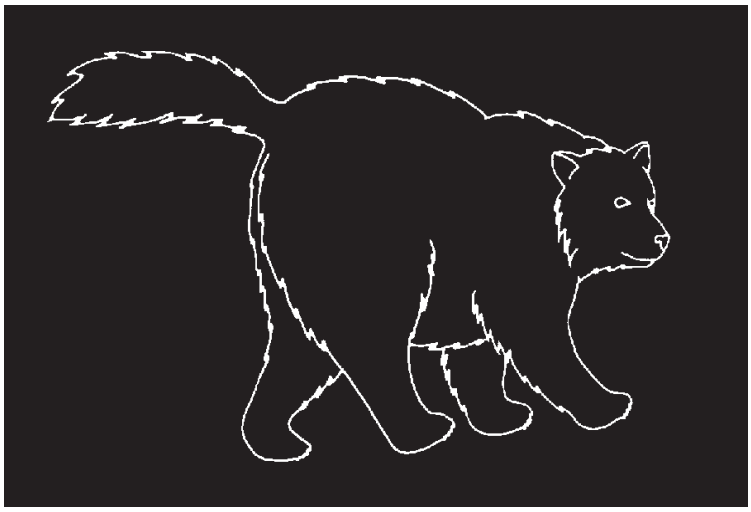
Classroom Activities

Creating Constellations

This science activity is designed for students in grades three through eight. It can be presented by teachers with no special preparation in science. Creating Constellations is keyed to concepts in the planetarium program, *Constellations Tonight*, so it will probably be most effective if presented just before or just after visiting the planetarium. Each teacher may wish to adapt the language and pace of the activity to his or her particular class.

Objectives

This activity involves the stage of scientific thinking in which many different ideas, or hypotheses, are generated. It focuses on the type of problems that have many equally good solutions (like naming a new animal) in contrast to problems that have only one right answer (like finding the North Star). After the lesson, the students will be able to:



1. Recognize that several different ideas may be equally good solutions to the same problem.

2. Recognize when they need to "break set"—that is, to find a new approach to the problem. (Set breaking can be thought of as "getting out of a mental rut.")

3. Recognize that the constellations which they invent can be just as useful as the ancient Greek and Roman constellations.

Before Class

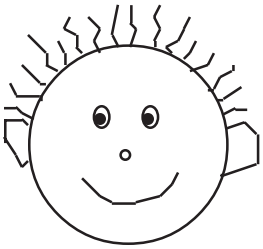
1. Duplicate one copy of the Circle Puzzle, Dots Puzzle, and Create a Constellation for each student (masters on pp. 23, 25, and 27 respectively). Prepare large sheets of paper and crayons.

2. Have board space and tape ready to display the students' work.

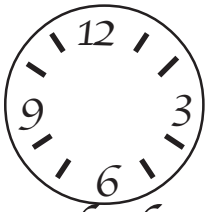
3. On a different section of the blackboard draw three or four circles, about 18-20 inches in diameter.

CIRCLE PUZZLE

Make each circle into a picture of something and write a name for what you draw underneath. The first two circles are completed as examples. Notice that each one is DIFFERENT and each one has a name.



Boy



clock

Part A. Circle Puzzle

Here is a puzzle that has many equally good answers. Make each circle into a **different** picture, and **name** what each picture shows.

Hand out the Circle Puzzle. Read the directions with the students if necessary. Then allow about ten minutes for them to work.

Who would like to come to the board to show one of their ideas?

Three or four students draw in the prepared circles on the blackboard.

Share your papers with your neighbors to see how many different ideas you can count. ***How many did you find? How many different possibilities do you think there are?***

How many of you thought of a few different ideas for the circles, and then just couldn't think of any more? What are some different things you could try at that point, to think of a different idea?

Let the students share strategies for generating new ideas that THEY find useful. Examples of strategies are: look around the room for round objects, imagine my room at home, share ideas with someone else, and so on.

Part B. Dots Puzzle*

Directions for this puzzle are very similar to the Circles Puzzle, only you create figures out of dots instead of circles.

Hand out one copy of Dots to each student. Give them about five minutes to work.

Now compare your drawings with your neighbors' drawings. ***Did any of you have the same idea? How many different ideas can you count?***

Let the students discuss their ideas with their neighbors for a minute or two. Then, hand out the last sheet, entitled "Create A Constellation."

On this sheet you will probably recognize the same pattern of dots that you saw in the Dots Puzzle. This is actually a pattern of stars visible in the sky. Ancient Greek astronomers, who lived about 2000 years ago, saw the Queen of Ethiopia, called Cassiopeia (pronounce: Kasio-**pee**-ah) in this pattern of stars.

Cassiopeia is an especially easy constellation to find just about any time of the year.

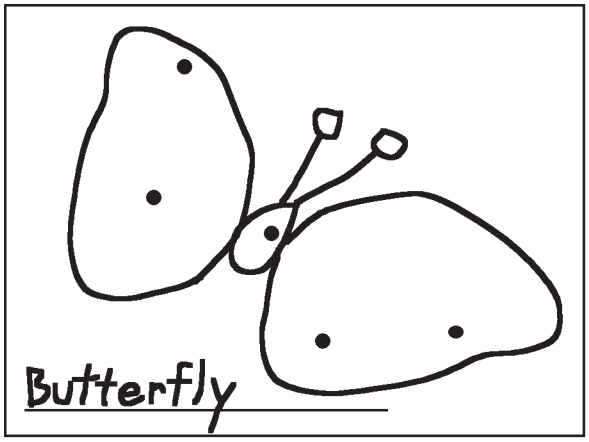
* The activities described in Part B have been adapted from "An Introduction to Constellation Study (or Isn't That Big Bird in the Sky?)" by Gerald Mallon. Published in Science and Children, November/December, 1976, Vol. 14, No. 3, pp. 22-25.

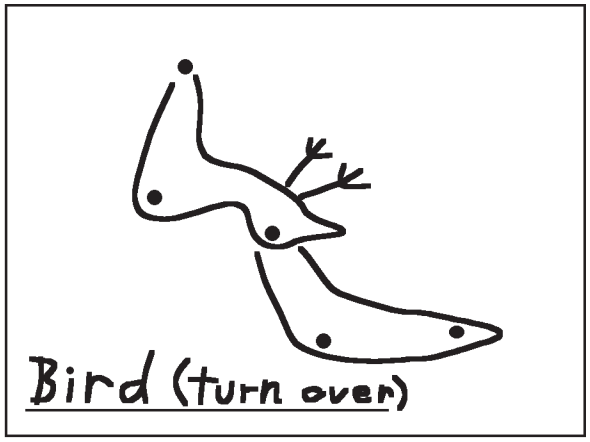
DOTS PUZZLE

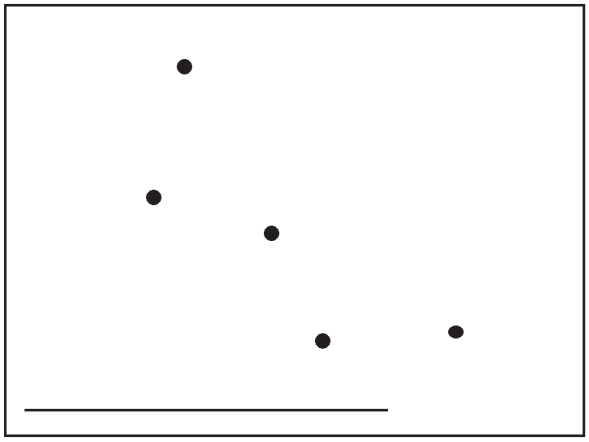
These six pictures all show the same pattern of dots. In the first two pictures, people have drawn something which the dots make them think of. They labeled their pictures with a name that tells what the drawing is supposed to be.

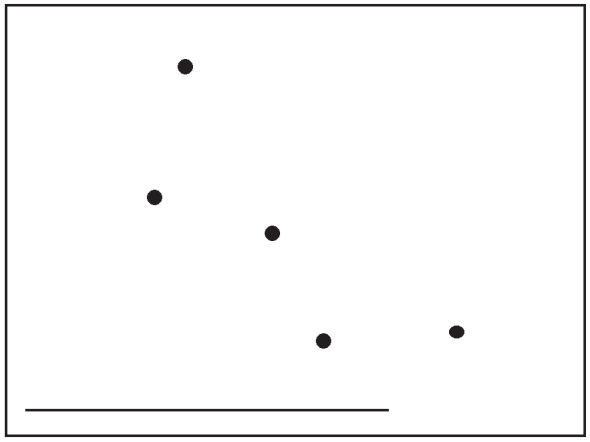
INVENT FOUR COMPLETELY DIFFERENT THINGS BASED ON THE SAME PATTERN OF DOTS.

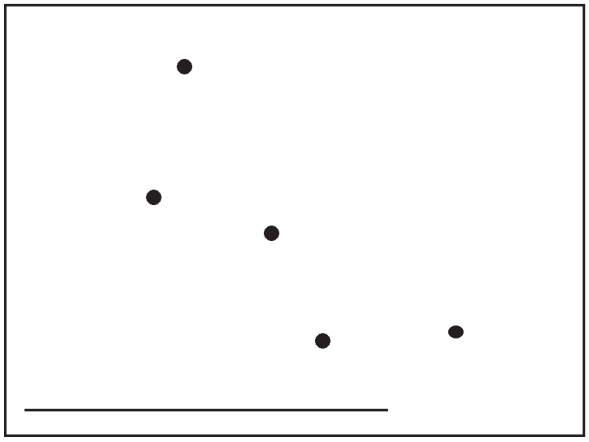
Draw your ideas in the last four boxes and label each one to tell what it is supposed to be a picture of.

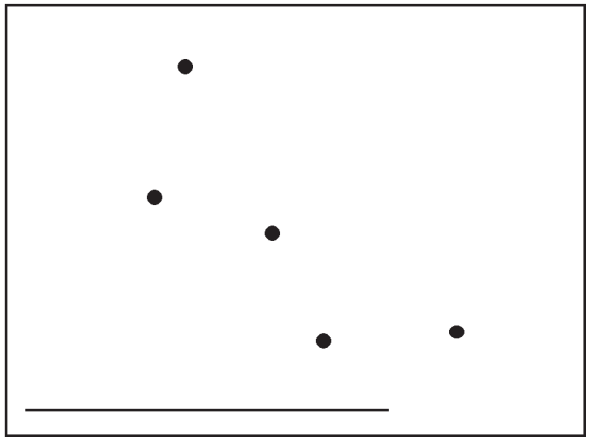












A picture and name that **anyone** imagines when he or she looks at a pattern of stars is called a "constellation." In the box at the bottom of the page, draw the idea which YOU like best and name it. This is **your own constellation** which you can find in the night sky. When you are working by yourself, your own constellation invention is just as useful, perhaps even better, than the "classic" ones.

Would it sometimes be better for us all to agree on a single constellation for everybody to use? How would that be useful?

Possible answers to this question might be: "To tell someone else where to find certain stars, or directions in the sky."

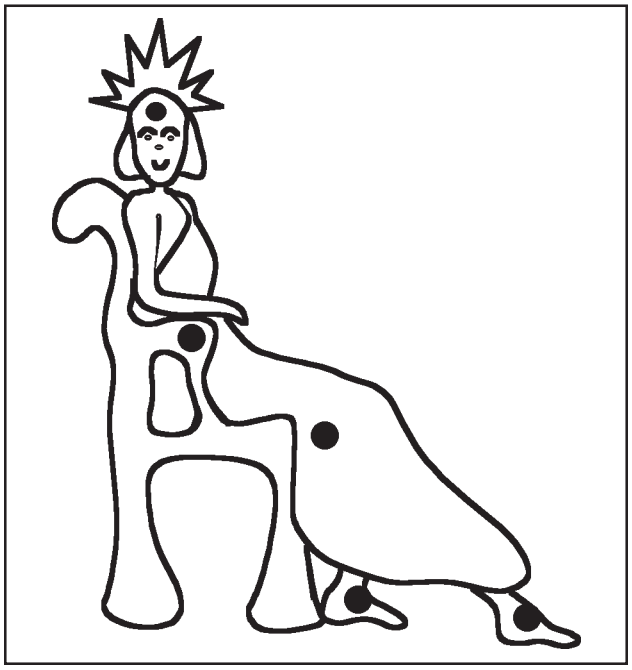
For astronomers, the word "constellation" has a more specific meaning that refers to a particular region of the sky. To make it easy to refer to areas of the sky, the whole celestial sphere is divided into the 88 classic constellations.

Any arbitrary group of stars that form a picture other than those 88 constellations is referred to as an "asterism."

For example, Ursa Major is a constellation, but the Big Dipper is an asterism within the constellation Ursa Major.

In colloquial usage, the word *constellation* is often used to mean the same thing as an asterism. In the following activity, we are not actually making up constellations in the narrow (astronomical) sense of the term. Astronomers all over the world will not recognize "made up" constellations!

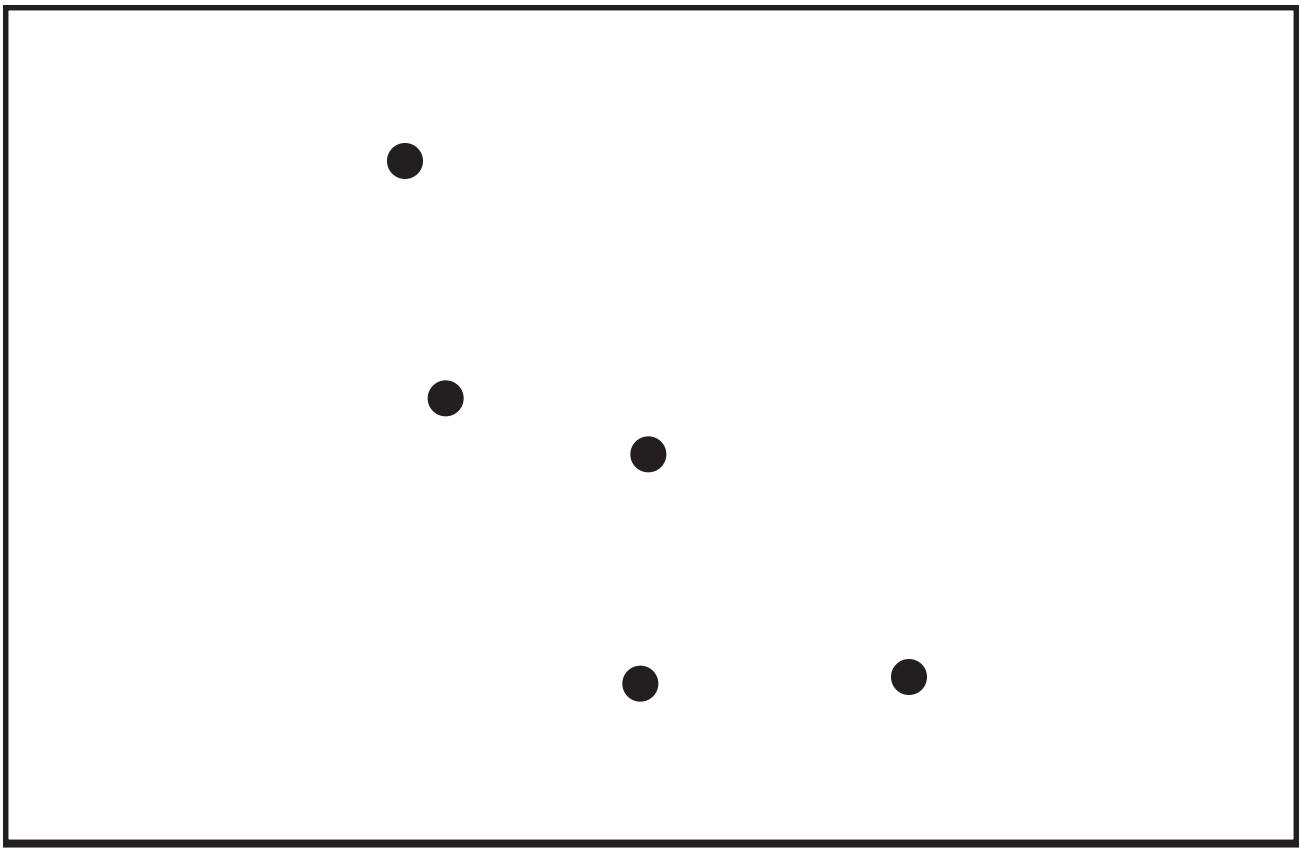
CREATE A CONSTELLATION



The Queen Cassiopeia Sitting On Her Throne

The pattern of dots from the "Dots Puzzle" is really a pattern of stars that you can find in the sky. The Ancient Greeks saw this pattern as a beautiful queen, Cassiopeia, sitting on a throne.

In the box below, create your own constellation for the same pattern of stars.



Follow-Up Activities

1. Have the students invent myths which tell the story of their constellations. This activity might be preceded by having them read ancient Greek, Roman, or Native American star myths which appear in many anthologies for children.

2. Have the students draw or paint more detailed pictures of the constellation figures they have created to illustrate their stories. Instruct them to show where the stars appear in the pictures.

3. The quiz on page 37 may be used as a pre-test and/or post-test to find out how well your students understand the concepts in this program. Please note that some questions refer to "Creating Constellations," while others refer to "Using a Star Map" or CONSTELLATIONS TONIGHT. You should revise this test as needed to fit your particular classroom situation.

4. Sheldon Schafer of the Lakeview Museum in Peoria, Illinois recommends the following activity, best done just after the circle puzzle, to demonstrate the value of using constellation figures.

a. Draw a random assortment of dots on the board.

b. Ask the students to memorize the arrangement. Allow a minute or two. No notes should be taken.

c. Erase the dots COMPLETELY.

d. Ask for a volunteer to recreate the pattern on the board or have all students do so on a piece of paper.

e. Compare the results with the original.

f. Draw a new pattern of dots on the board, this time connected into some kind of figure.

g. Repeat steps b-f.

h. Compare the results of the first trial with those of the second. Usually there will be an easily noticeable difference between the two.

Make a Constellation

Edna DeVore from Independence Planetarium in San Jose, CA contributes this activity in which individuals or teams of students make constellation projectors:

Materials (for each student or team):

For Projection Constellation
- overhead projector
- square of aluminum foil (25x25cm)
- star map for the season
- paper clip or sharp pencil
- rubber band

For Viewer Constellation
- soup cans without ends or similar sized tubes
- square of aluminum foil (10x10cm)
- star map for the season
- paper clip or sharp pencil

In Class

1. Students select (or are assigned) a constellation from a star map.
2. Using a pencil or straightened paper clip, students transfer the star pattern to the aluminum foil. For the Viewer type, the pattern must be smaller than the can diameter.
3. To project: place aluminum squares on overhead projector, turn on light and ask students to identify with their star maps.

   To view: place aluminum foil over the end of the can and secure it with a rubber band. View by looking toward a bright light. Identify the pattern by using star maps. Be careful to place the pattern "right-side-up" or "right-side-out" so that the images are seen correctly, not a mirror image.

Using Star Maps

This science activity is designed for students in grades five through eight. It can be presented by teachers with no special preparation in science. *Using Star Maps* is keyed to concepts in the planetarium program, "Constellations Tonight," so it will probably be most effective if presented just before or after the planetarium visit. Each teacher may wish to adapt the language and pace of the activity to his or her particular class.

Objectives

The primary objective of this activity is to improve the students' ability to use maps. Following the lesson, the students will be able to:

1. Use "direction" and "distance" to find locations in the classroom.

2. Draw a map of the classroom.

3. Use a star map to locate the positions of constellations in the sky by noting the direction and distance from the zenith (point overhead).

4. Use a star map to visualize the orientation of constellations in the sky.

Before Class

1. Gather the following materials for each student: a pencil, and one copy each of "Map of My Classroom" and "Sky Windows." (Master for photocopy on pages 34-35; if necessary, make a new version of sheet #1 to match the shape of your room.) Also make a copy of the star map from the current month (from pages 4-9) for each student.

2. Label the four walls of your classroom with paper signs marked with the four primary compass directions. These need not correspond to the actual compass directions. However, a person facing "North" should be able to see "East" to the right, "West" to the left, and "South" to the rear.

3. To illustrate how to draw a map of the classroom, draw a rectangle on the blackboard, and label the four directions (as on Worksheet #1). Draw in the teacher's desk or some other prominent object so the students can see how to procede.

4. Optional: make an overhead projector transparency of the current season's star map. Create a cardboard "Star Window" of appropriate inside dimensions which will, when placed on the star map transparency, frame views that will illustrate those on Worksheet #2.

Part A. The Directions Game

We will begin today's lesson about Star Maps by playing the Directions Game. Notice the four signs on the walls that indicate the primary compass directions: North, South, East, and West. ***What direction would I look to see Northeast? Southeast?***

Point to the four direction markers. Question the students to see if they understand the system of compass directions.

Now we are ready to play. ***Who will be our first volunteer?*** Okay, Jennifer, please stand in the center of the classroom and face AWAY from the blackboard. I will write the name of some object in our classroom so that everyone but Jennifer will know what I have in mind.

Write the name of an object that is within Jennifer's line of sight—say "George's Desk"—on the blackboard. Let everyone read it, then erase it.

Now I would like someone to give directions to Jennifer so she can find the object, just by looking around. Do this by giving the DIRECTION she should turn, and HOW FAR she must look. For example, you might say, "Look Northeast, about half-way to the wall." ***Who wants to give Jennifer directions first?***

If Jennifer fails to find the object on the first try, encourage the students to give clues, but not to name the object. Let the students use whatever strategies they can think of (like giving the size, shape, or color of the object.)

Good! Now that Jennifer has found the object, who would like to try the next one?

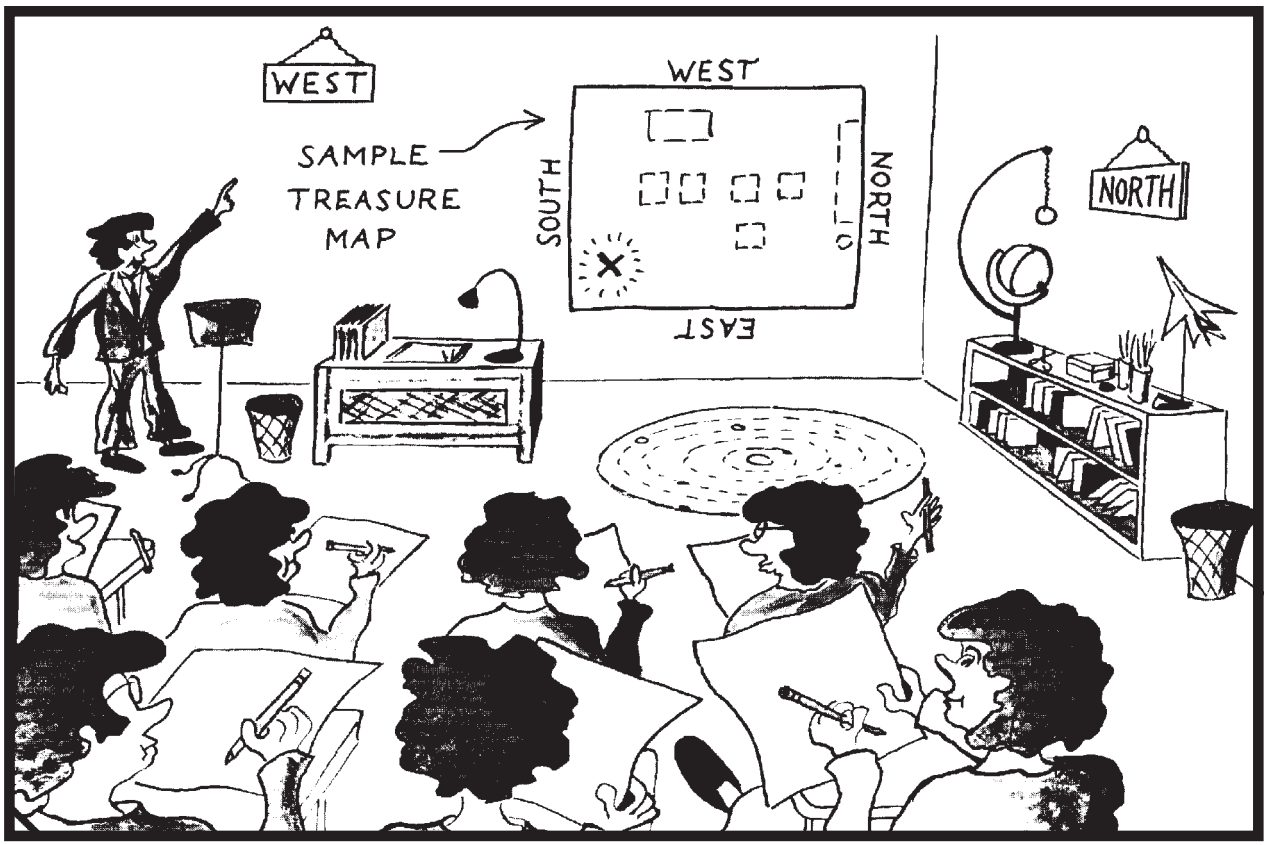
Part B. Map of the Classroom

On the blackboard I have started to draw a map of our classroom. Notice that I have labeled the four primary directions and I have drawn the location of my desk. *Point to the example on the blackboard.*

If a stranger who has never before been to our classroom saw this map, how would he or she use it to find my desk?

If the students are not able to transfer learning from the "Directions Game," help them by drawing an arrow from the center of the map to the location of the desk, and ask what the stranger would do if he or she stood in the center of the room.

Now that you understand how to use direction and distance to locate things on a map, I want you to complete the map of our classroom. On this paper, show all of the things that rest on the floor—chairs, tables, desks, and anything else you think is important. Make sure the directions on your maps correspond to the directions in the classroom, and that the distances are about right.



Hand out Sheet #1. Help students as they request it. Allow them to look at each others' papers to get ideas and to criticize.

When you are finished, compare papers with one other person. ***How are your papers similar? How are they different?*** Improve your map if necessary to make it more useful to someone who has never seen our classroom before.

Now plant a "treasure" somewhere in the room and mark the spot with an "X" on your map. Exchange treasure maps with one other person and see if you can find each others' treasures.

The same excercise can be done with older students using the entire schoolground rather than just the classroom.

Part C. Reading Star Maps

Hand out a star map for the current season to each student. Optional: in addition, display transparency of star map on overhead projector.

This star map shows how the stars will appear tonight at about 9 or 10 o'clock. The center of the circle shows the point directly overhead, called the "Zenith." The rim of the circle shows the "horizon," which

is what we call the line where the sky meets the earth. I would like another volunteer to stand in the center of the room. *Sam volunteers and takes his position.*

Pretend the walls and ceiling of our classroom are the sky. ***Where would you look, Sam, to see the zenith? How about the Northern Horizon? The Southwestern Horizon?***

If Sam has difficulty, other students can help. Thank Sam and ask him to be seated. Select a constellation near the horizon. For example, on the March-April map, Orion is near the Western horizon.

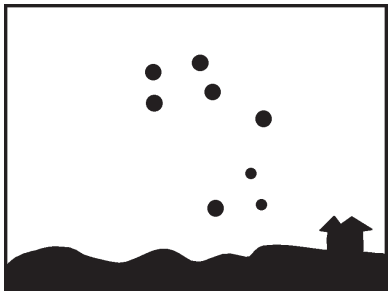
To use the star map to locate a constellation, we must hold the star map so that the constellation we wish to find appears right-side up on the map. Let's try to find [Orion] *(use constellation you have selected for your star map)*. ***First locate [Orion] on your maps. Which horizon is [Orion] closest to? How far between the zenith and the horizon is [Orion]? Who would like to point to where [Orion] would appear in the sky?***

Do this with several constellations, having students answer by indicating where on the walls or ceiling the constellation would appear. Then, hand out Sheet #2.

When you use these maps to find constellations in the real sky, remember to turn your map around until the direction you wish to look is at the BOTTOM.

Now I would like you to take Sheet #2 and draw the stars you would see in each "Sky Window."

Illustrate the first box on the chalkboard. Optional: use overhead transparency map and cardboard window frame to help in illustrating. Illustration at left shows sample view for Sept-Oct star map.



Any questions?

While the students are working, draw boxes on the chalkboard labeled like the rest of the boxes on Sheet #2.

Who would like to come to the board and draw the stars as they are on your paper for the Eastern horizon? Call on a volunteer to draw.

Let's compare this answer with the Star Map. ***What do you think? Is this what you would see in the sky if you looked in this direction tonight?***

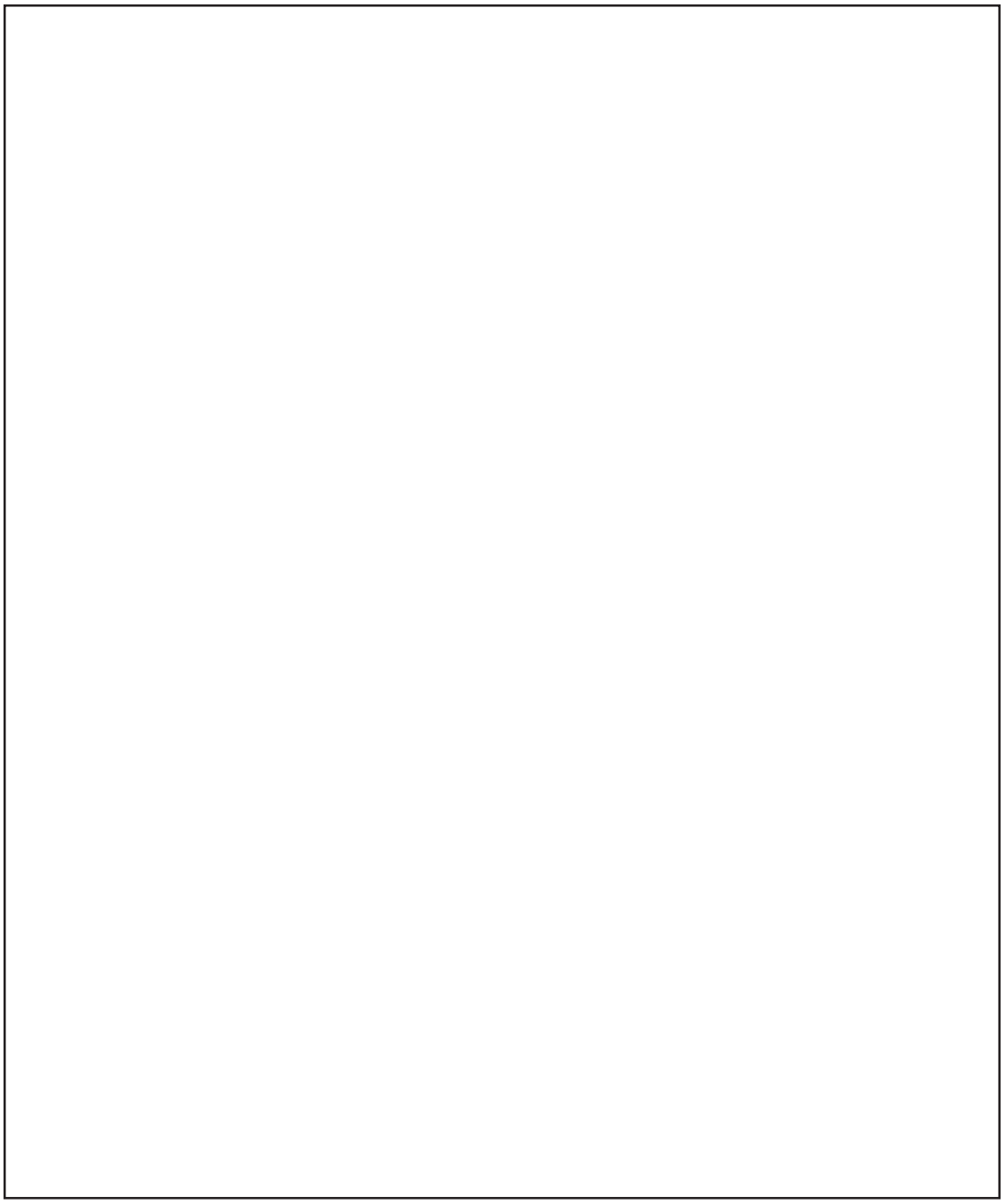
The answer will vary a little depending on how much of the sky the student tried to depict. Discuss each of the boxes the same way. In the box labeled "Zenith," there is the added subtlety of which way the observer's body is facing even though looking straight up. One drawing may be rotated compared with another drawing.

Optional: use the overhead transparency star map and your cardboard window frame to allow the whole class to view sample window frame portions of the sky.

If you understand how the Star Map works, you can go outside tonight and find any of these constellations that you wish. Good Luck!

Map of My Classroom

SOUTH



EAST **WEST**

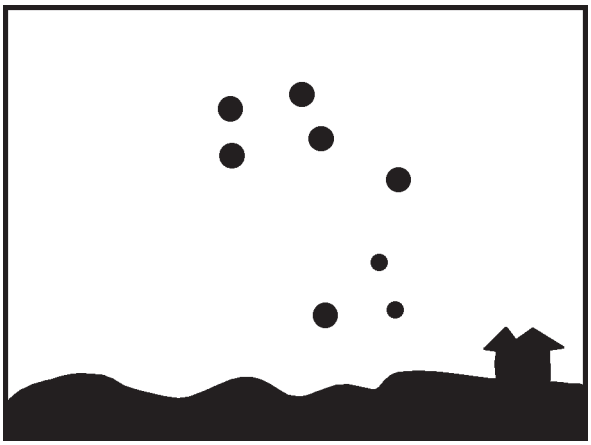
NORTH

In order to get to my own desk from the center of the classroom, in what direction must I go?

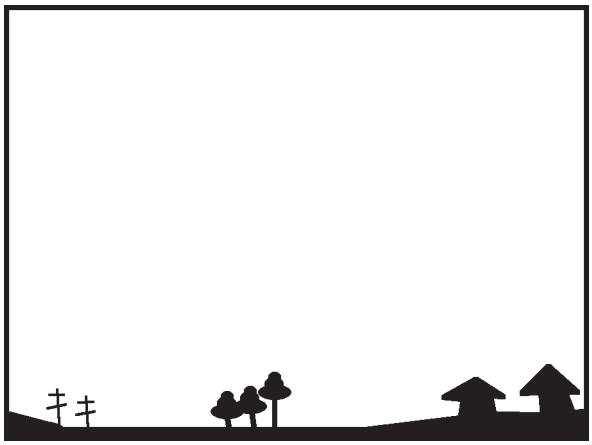
_____

How far towards the wall must I walk? _____

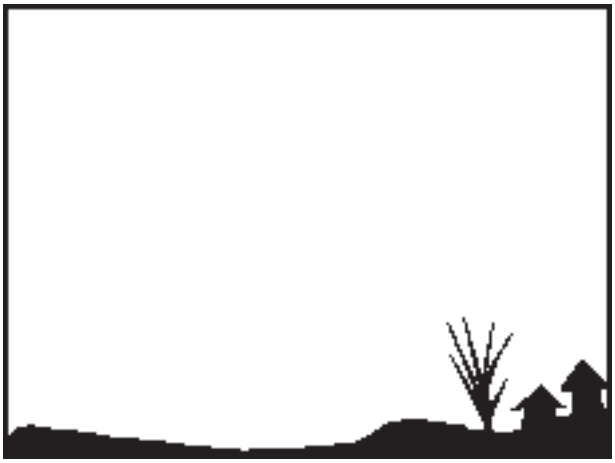
Sky Windows



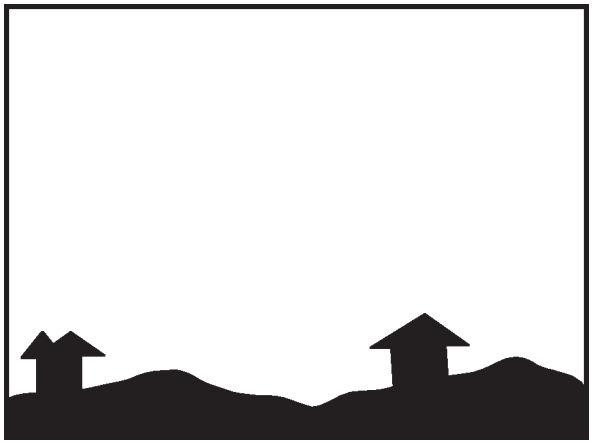
Southwestern Horizon



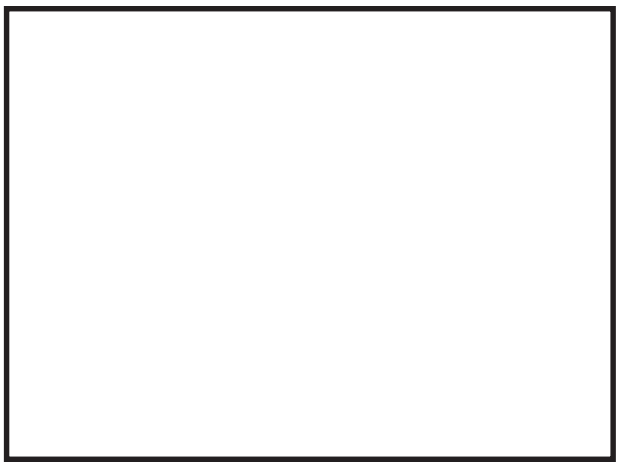
Eastern horizon



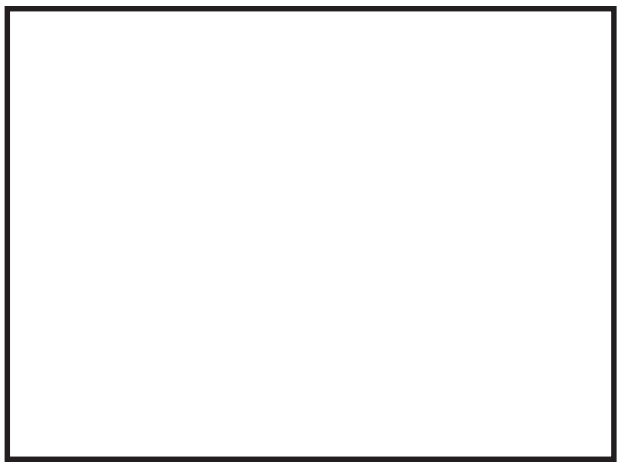
Northern Horizon



Western Horizon



Zenith (overhead)



Half-way between Zenith and Northern Horizon

Follow-Up Activities

1. Have the students locate the constellations in the sky at night and draw in more stars for each constellation they can find.

2. Have the students draw the SHAPE and POSITION of the moon on their star maps each night for a period of two weeks. Instruct them to show where the moon is located in comparison to the stars and constellations. Look on a calendar, in a newspaper, an astronomical magazine, or call your local planetarium to find out when the crescent moon will start to appear so the students can begin their observations.

3. An activity in which students use the constellations to make "Star Clocks" is described in ***Earth, Moon, and Stars***, a teacher's guide in the series, Great Explorations in Math and Science (GEMS). for a brochure and order form write to: GEMS, Lawrence Hall of Science, University of California, Berkeley, CA 94720

4. Try out ***Sky Challengers***, a set of activities for stargazers in the form of interchangeable star "wheels" which can be set for any season at any time of night (like a planisphere). They are available at Discovery Corner, Lawrence Hall of Science, University of California, Berkeley, CA 94720. Edna DeVore of Independence Planetarium in San Jose, CA has made a nice adaptation of Sky Challengers in her "Do It Yourself Star Finder."

5. Use this unit as an introduction to Social Studies activities using maps. The Elementary Science Study (ESS) unit on ***Mapping*** provides a large number of different activities. ESS is out of print, but copies may be in your school library and permission to reproduce may be obtained from Educational Development Center, 55 Chapel St., Newton, MA 02160, (617) 969-7100.

6. Gerald Mallon of the Methacton School District Planetarium recommends further activities in ***Igniting Creative Potential*** by Project Implode, Bella Vista Elementary School, Salt Lake City, Utah.

7. Jeanne Bishop at the Westlake Public Schools Planetarium recommends additional activities in the Science Curriculum Improvement Study (SCIS) unit "Relative Position and Motion," published by Delta Education, Inc., P.O. Box M, Nashua, NH 03061, (800) 258-1302.

8. The quiz which follows may be used as a pre-test and/or post-test tell you something about how well your students understand the concepts in this planetarium program. Please note that some questions refer to "Creating Constellations," while others refer to "Using a Star Map" or CONSTELLATIONS TONIGHT. You should revise this test as needed to fit your particular classroom situation.

Answers to the Astronomy Quiz

CONSTELLATIONS TONIGHT

1-True, 2-True, 3-True, 4-(look for two different constellations that make use of the dots), 5-D, 6-(depends on class discussion, but answers might include time-telling, calendars, navigation, or just because it was fun), 7-(depends on class discussion, but answers might include the same as above, plus space navigation, locating deep-space objects for telescopes, studying the history of stars and ancient cultures), 8-C, 9-(circle touching near the words "EASTERN HORIZON"), 10-(X in the center of the star map circle), 11-(line ending at the horizon circle near the words "NORTHERN HORIZON."

Astronomy Quiz
CONSTELLATIONS

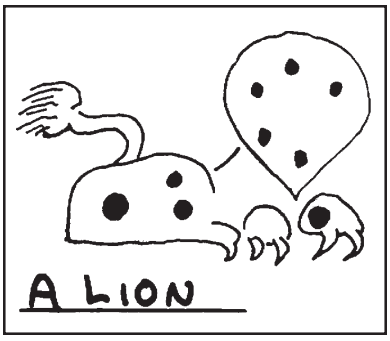
Circle the best answer.

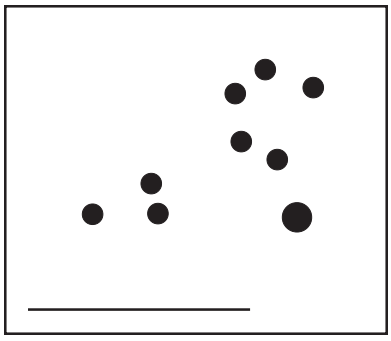
1. Constellations can be used to find directions on Earth. True False Don't Know

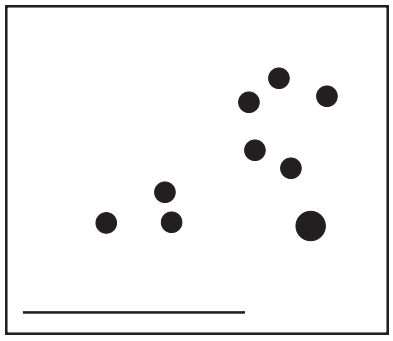
2. If you see a dim star next to a bright star,
   you will always find it next to the same bright star. True False Don't Know

3. A star map is used to find constellations. True False Don't Know

These three pictures show the same pattern of stars.
Picture A shows a constellation that was invented a long time ago.







4. Invent two different constellations and draw them in Pictures B and C. Label each constellation with a name that looks like your drawing.

5. Ancient people in America, Europe, and China saw different constellations in the same set of stars. Why do you think this was so? (Circle the best answer.)

   A) People in different countries saw different stars.

   B) In those days people did not have telescopes.

   C) The atmosphere blurred the view of the sky.

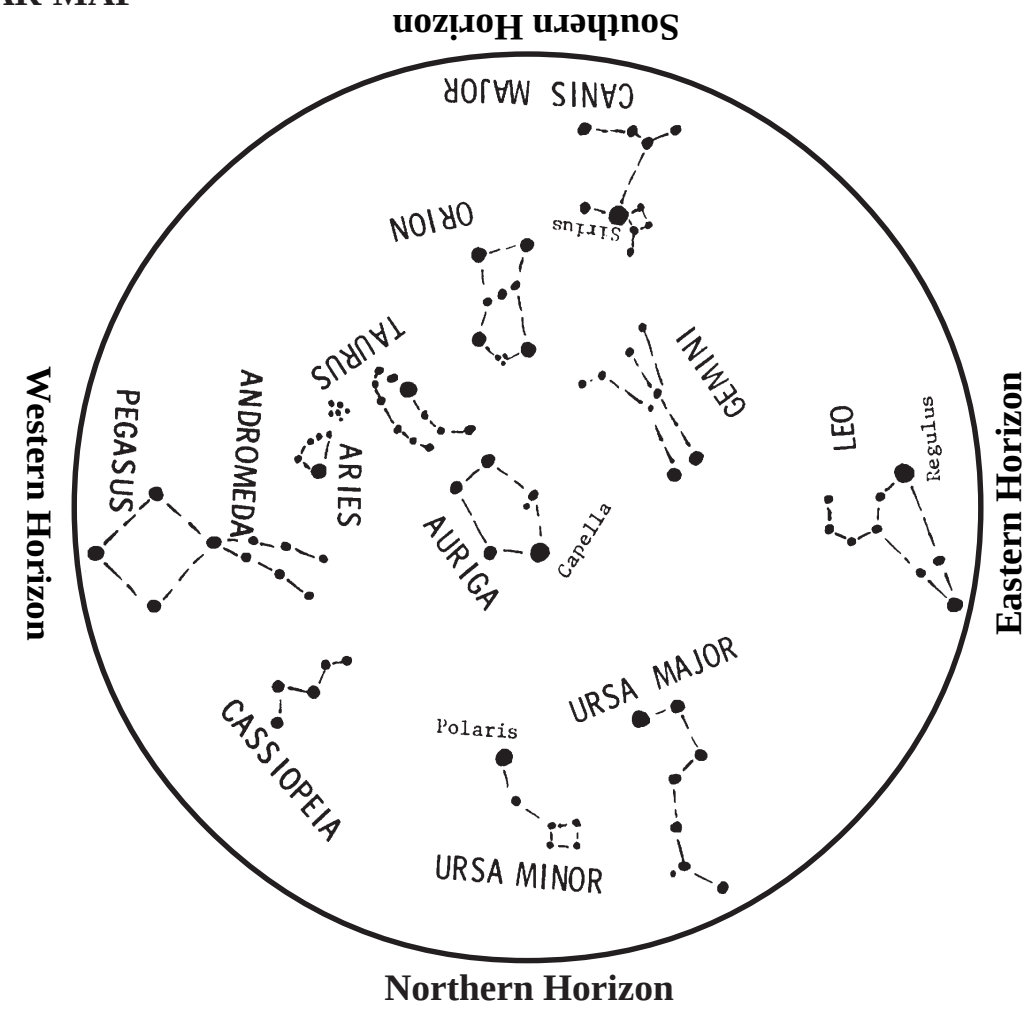
   D) People in different countries saw things important to them.

List as many reasons as you can for questions 6. and 7.

6. Long ago people probably invented constellations because:

7. Today constellations are still useful for:

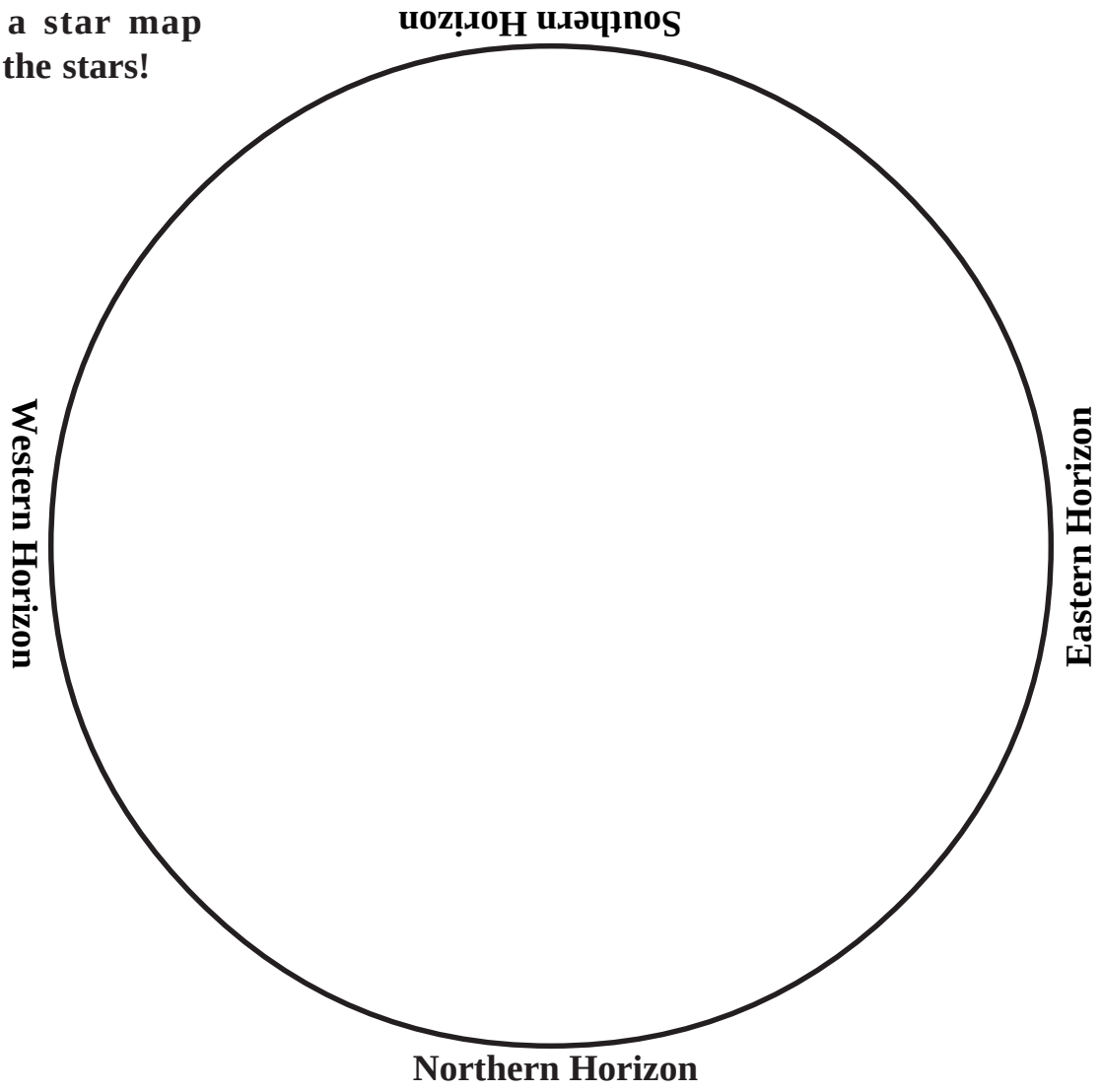
This is a STAR MAP



8. Circle the letter of the picture that shows what you would see if you looked towards the Eastern Horizon tonight, according to the above star map.

A **B** **C**

This is a star map without the stars!



This is a star map, just like on the last page, but without any stars on it. Please mark your answers to the following questions directly on the map.

9. The moon is just rising on the Eastern Horizon. Show the moon on the map as a little circle.

10. Pretend you just saw a UFO (or "flying saucer") directly overhead. Draw an "X" on the map showing where it would appear in the sky.

11. Pretend you saw the UFO fly in a straight line and zoom out of sight over the Northern Horizon. Draw a line showing the path of the UFO.

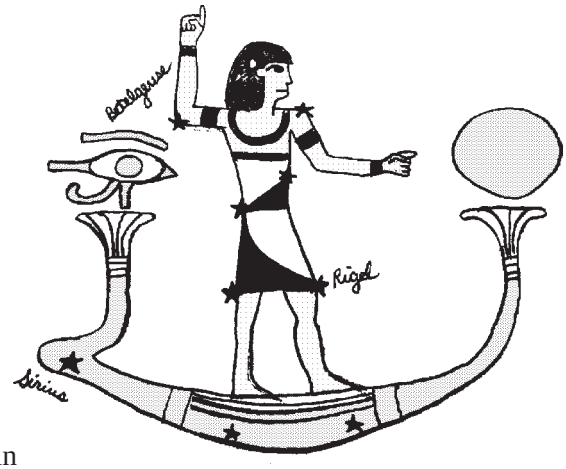
More Mythology

Here are some more constellation stories to add to your repertoire and to enhance your students' appreciation of the rich cultural diversity of skywatchers from all over the world.

In The Winter Sky…

Orion

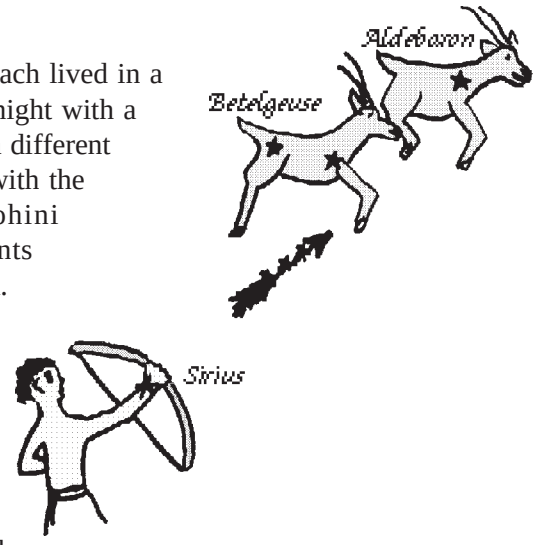
…In Egypt



Osiris, God of Light, ancient king of Egypt brought respect and prosperity upon the land. But his jealous brother Seth, God of Darkness, conspired to destroy him. He tricks Osiris into entering a specially made coffin disguised as a beautiful chest. When Osiris enters the coffin, Seth closes the lid and throws the coffin into the Nile River where it is carried down stream.

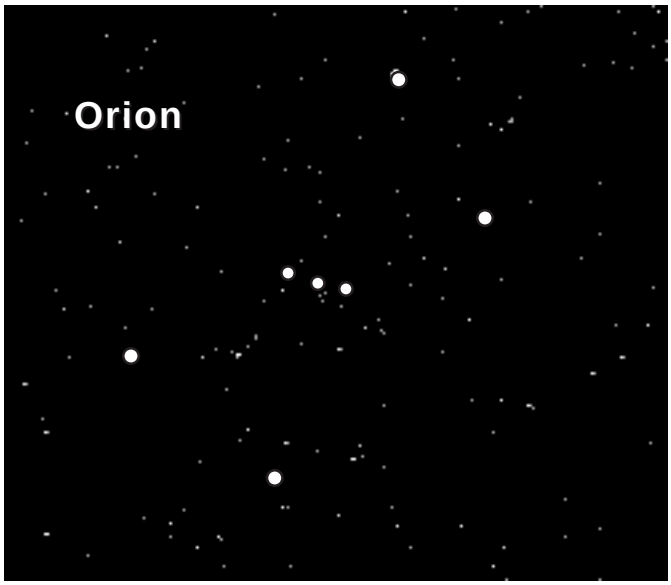
Isis finds the coffin and gives her husband, Osiris a proper burial. But the body is recovered and dismembered by Seth. With the help of Re, the Sun god, Isis painstakingly recovers the pieces and wraps the body in bandages like those of a mummy. Isis' breath enters the nostrils and Osiris' spirit rises to the sky for eternity as overseer of the spirit world and god of the dead. Just as Osiris' death is not eternal, so too will the spirit of human beings who live in a holy manner be reunited with the eternal universe.

…In India



The powerful god Prajapati (Betelgeuse) had 27 daughters. Each lived in a different mansion among the stars. Soma (the Moon) spends each night with a different one of Prajapati's daughters. Usually, Soma will move to a different mansion each night. At one time long ago Soma spent more time with the most beautiful of Prajapati's daughters, the red maiden Rohini (Aldebaran). When Prajapati found out about Soma's movements toward his daughter Rohini, he became enraged and cursed the Moon. Now we see the effect of that curse. Each lunar month Soma wastes away until only a sliver of his body remains.

With Soma out of the way, Prajapati himself becomes enamored with Rohini, who is disguised as an antelope. Prajapati changes himself into a stag and begins to chase her. Rohini is saved by a hunter, Lubdhaka, known as the Deer Slayer (Sirius). Lubdhaka shoots a three jointed arrow which pins Prajapati helplessly to the sky for all eternity.



…In China

This is Tsan, the Supreme Commander. He was elected to lead the local farmers in battle against invaders who come down from the hills in winter to steal food reserves. Tsan is the symbol of a prudent and trustworthy leader, having qualities necessary for a military commander.

Tsan is also called the Market Place. In order to alleviate pressures from the nomadic hunters from the hills, taxes were lifted in the winter so they could more easily trade skins for the food they needed from the farmers instead of having to steal it to avoid starvation.

…In North America (Tewa)

The people trusted Long Sash, a famous warrior, (Betelgeuse) to lead them in defense against their enemies. They begged him to take them to a safe place where they would be free from attack. Long Sash warned the people that the migration would be very difficult. Many hardships: sickness, thirst, hunger await them on the path to the new land. The people pleaded, "Lead us to a place of safety where we can live in peace."

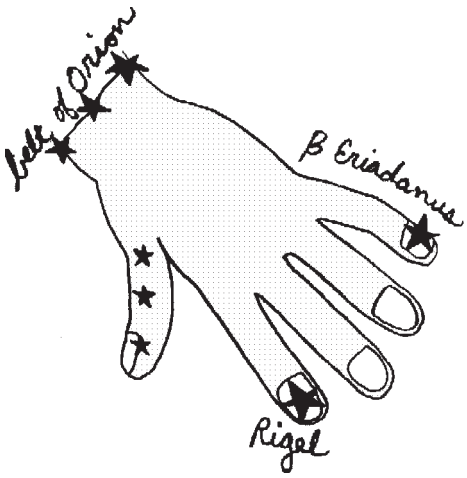
After many generations walking on the Endless Trail that stretches like a white band across the sky, the people began to quarrel and fight with each other. When blows were exchanged and wounds inflicted, Long Sash stopped them and warned, "You hurt yourselves worse than your enemies. You must decide if you will destroy yourselves or if you will follow me in peace and harmony with each other." This place where they stopped is marked by two bright stars (Castor and Pollux.) Known as the Place of Decision, people today pray to these stars for guidance in making the difficult decisions they confront during their lives.

Long Sash grew old and began to hear voices from the ancestors. He instructed the people to pray for help and guidance from the Above Persons, their

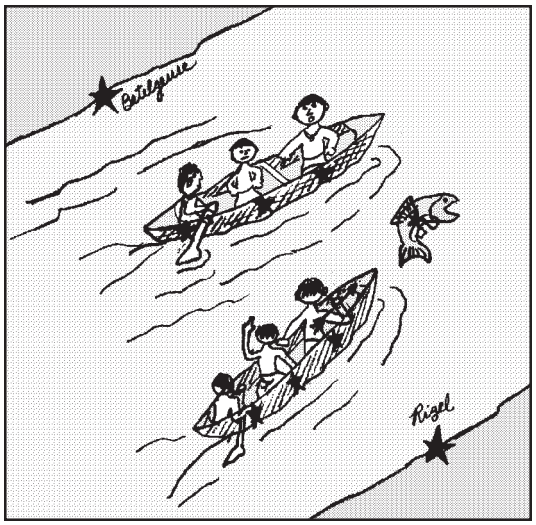
fathers and mothers. To comfort the people he set his headdress down among a faint cluster of stars which can be seen today (in Cancer). Two young men help carry an old woman's load. These three stars (in Leo) remind the people to be helpful and thoughtful of each other. Thus they are called the Stars of Helpfulness. The whole story of the journey and the events which followed is still seen in the sky above and still told on the Earth below.

…In North America (Lakota)

The Hand belongs to the Chief Who Lost his Arm. The arm was stolen by Wakinyans, Thunder Beings, the ones who rob Mother Earth of her fertility in winter. Fallen Star is told by the chief's daughter that he must recover the arm before she will marry him. Using magic powers he gains along the way, Fallen Star traverses Earth and Sky and eventually recovers the arm and marries the chief's daughter. In so doing, Fallen Star symbolically restores fertility to the Earth and contributes to the continuation of the cycle of life.



As Fallen Star, human beings play an important role in restoring fertility to the Earth and helping the cycle of life to continue. The descendents of the first people of the Great Plains enact a ceremony in which blood is shed as from the first of gods—Inyan, the Rock—in creating the Earth. When the Hand is seen in winter the people are assured that their sacrifice helped the creative forces in the universe to continue. Thus the coming of the next spring is ensured, and with it their own survival.



…In North America (Columbia River)

Cold Wind has no respect or honor. He is also very lazy, always waking too late to catch any salmon. So his habit is to steal from the home of Chinook Wind's old grandfather who always wakes early and works hard to catch many salmon as food for the people.

Hiding in his grandfather's home, Chinook Wind waits to trap the thief. But when Cold Wind arrives, he just laughs at the smaller boy. "You'll have to wrestle this fish from me if you think you can get it," he jeers. Thus the battle between Cold Wind and Chinook Wind begins.

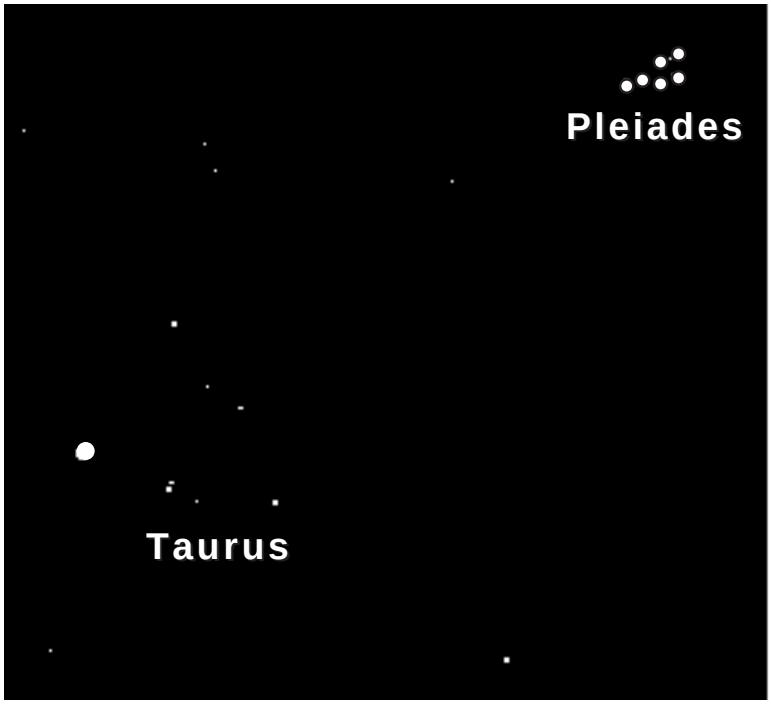
We see two canoes racing for Old Grandfather's salmon. (The canoes are the "belt" and "sword" of Orion.) In one is Cold Wind and his brothers, in the other, Chinook Wind with his. Not just a race, this is a battle between forces of Nature. As winter ends, the winds battle for control of the river valley. From the coast comes the warm chinook wind, named for the people who live there. The chinook wind wrestles the cold wind coming from the high plateau region to the East. The people can see the Chinook brothers are winning the race and thus are confident that warmth will prevail as Spring defeats the cold winds of winter.

What is commonly called Orion (The Giant) is also these things…

…Among the Norse it is Frigg's spinning wheel. Frigg is a goddess and knows of all things. She is also known as the goddess of fertility, destiny, love wisdom, independence, marriage, and children.

…To the native people of Greenland, it is seal hunters who are lost at sea. The three stars of Orion's belt are also known as steps leading to the heavens.

Pleiades



The Pleiades are among the most widely recognized star groups in the world through the ages. This cluster has been a significant part of traditional mythologies for thousands of years. It is also commonly known as the Seven Sisters.

In many stories, they are women, sometimes goddesses or children, who leave the Earth and enter the sky world. In some cultures they are known as seeds and are associated with agriculture. In Spring when they are last seen near the horizon after sunset, they signify the sowing of the seeds. Later in the year, when they are seen in the pre-dawn sky, it is time to harvest before the first frost. In this way they define a seasonal pattern, a helpful guide for agricultural societies worldwide.

…Among the Hindus they are known as six nurses who cater to the son of the god Shiva. The nurses are depicted as a flame in honor of Agni, the god of fire. In the fall when this flame is last seen at sunrise, a ceremony called the Feast of Lamps is held.

…The Celtic people hold ceremonies to correspond with the first and last appearance of these stars in October and May, respectively. The ceremony in May, called Beltane, or May Day, is for purification and regeneration, a theme common to cultures worldwide, as the disappearance of these stars is so often associated with the coming of the new year. In October, however, when the Pleiades are first seen in the evening, the ceremony called Samhain is held. At this time spirits are said to wander the Earth, seeking their old homes. Witches, goblins and fairies are said to roam freely on this night. Bonfires are lit, games played and parties held during this holiday which sets the precedent for the festival currently known as Halloween.

…In China they are the Seven Sisters of Industry.

…To the Lapps the stars keep warm an unfortunate servant cast into the freezing night by his master. Hence they are known by the name Fur in Frost.

…The Finns of Lithuania know this cluster as a sieve with holes in it.

…**Among Arabs** it is a herd of camels.

…In the Society Islands and Tonga they are the Little Eyes and help determine seasons of the year.

…Native Australians call them the Young Girls. The Young Girls are musicians who play for the Young Men seen in Orion's belt.

…Known in Peru as The Begetters, respect is paid in reference to their role in designating the beginning of the new year's cycle with the creative forces of spring.

…Among the Aztec and Maya, entire cities were constructed in which special alignments of buildings and roads marked the rising point of these stars.

…The Maya know them as the Four Hundred Boys who tried to kill Seven Macaw's son Zipacna (see also Mayan section in Big Dipper, p.48). Zipacna was a crocodilian monster who claimed to be a mover of mountains. The Four Hundred boys fail to kill Zipacna when they try to bury him with a lodge pole. While they celebrate their false victory by drinking alcoholic beverages to excess, The Earth mover knocks their house down on top of them and kills them. To avenge their death, the hero twins trick Zipacna and leave him buried under a mountain. The stars making the Four Hundred Boys are also known as the seeds and help determine the seasons. They also show a rattlesnake's tail with the red star Aldebaran making the eye of the snake.

…Among the Inuit (Aleutian Islands) they are Men on a dog sled hunting a bear.

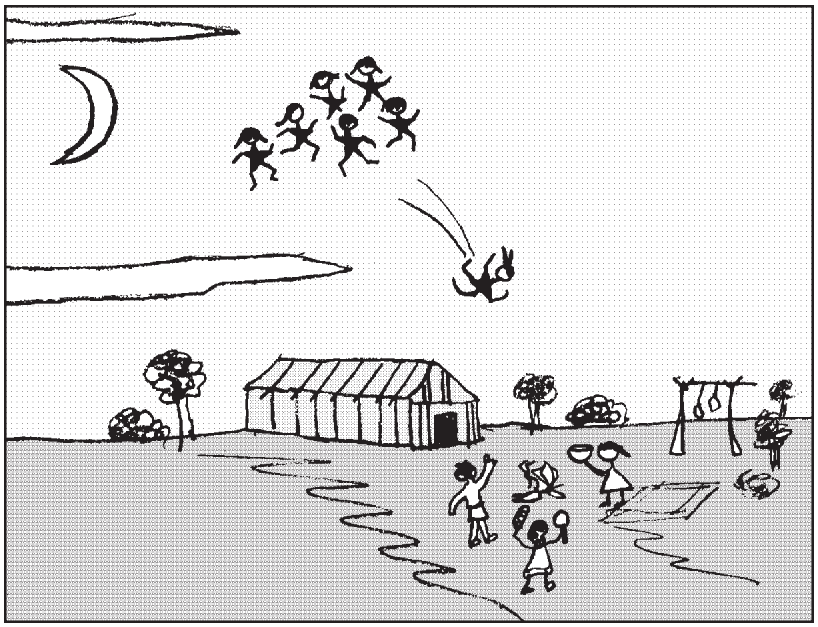
Stories including the Pleiades from Native North America abound and remind the people of the world's creation and teach proper manners and participation in society. In the following teachings, the nature of the parent/child and the husband/wife relationships are explored.

…From the Onandaga of the Six Nation Iroquois Confederacy (Great Lakes Region):

The young ones were bored. Autumn was ending and with the approaching winter, people worked hard to prepare for survival. To pass the time while the others worked, the young ones danced by Beautiful Lake. All day long they danced to pass the time until, one day, an old man appeared with a warning. His hair shone like silver and he dressed all in white feathers. "You must stop your dancing or something terrible will happen," he instructed. The children did not want to hear this so they just kept on dancing. Several times they were warned to stop but never did heed the advice of the holy man.

Now the young ones wanted to dance all day long. But the dancing made them hungry so each went home this time to ask for some food to make it through the next day while dancing at Beautiful Lake. "You are just wasting your energy with foolishness," they were told. "Stay home to eat where you belong," and "I don't have time to tend to your foolish needs," they were told. And thus did the parents misunderstand the needs of those bored youths.

Of course that did not stop them. The young ones went out to the lake anyway. And they danced all day without any food to nourish them. After many hours passed they did not sit down. They kept on dancing until their heads were light from their hunger. Slowly they began to rise up into the sky as a result of their light headedness. "Do not look down. Something is happening!" one cried. As they passed over their family's homes the parents called out, "Please come down!" They held up all sorts of good food to entice the children home. But it was too late. When one looked down he became a shooting star. The parents cried when the rest turned into the stars called Oot-kwa-tah. Now the dancers are seen all winter long to remind everyone about their story. And when a meteor streaks down to Mother Earth, all are reminded of the unfortunate boy who looked down and fell.

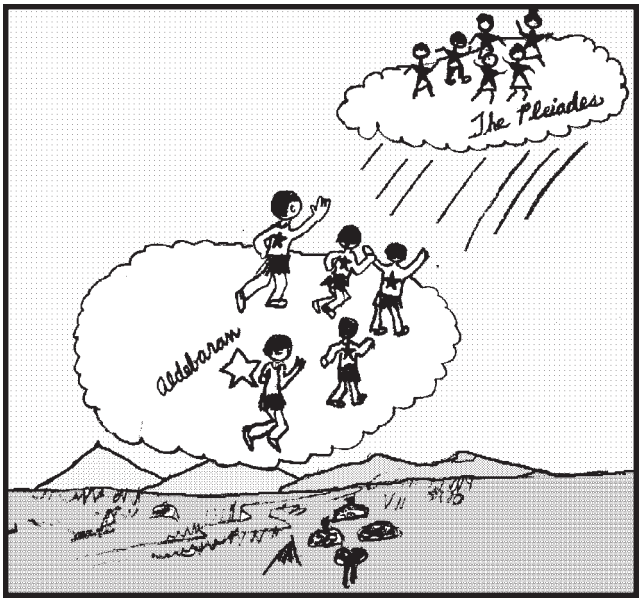


…From the Monache of California's Great Central Valley:

The first women to discover the wild onions really enjoyed the flavor. They couldn't stop eating them and brought bunches home to share. Their men came home from hunting, "Whew! What is that nasty odor?" they wondered. To their discomfort, the odor got stronger as they entered camp—and stronger as they discovered it was coming from their own homes. "Have some of this wonderful tasty new food," the women offered. But all the men could say was, "You stink!" and "Get out now! Sleep outside tonight."

The next day the men came back to camp without any game. The terrible odor of the onions was on their bodies. All the animals were frightened away so the men caught nothing. Now the men were crazy. "Get out for good. Sleep away from us or we will all starve!" they fumed. So the women walked far away to the East. There they said a prayer and threw out a magic rope which lifted them into the clouds. From there they were on their way to the sky world.

By now you can guess how lonely those men were. They must have really wanted their wives back because they followed them and lifted themselves into the sky with a prayer and magic rope of eagle down feathers. "Wait! Come back. We're sorry," they pleaded. But the women's response was only, "We've had enough of your insults. We don't want to come back to you now."



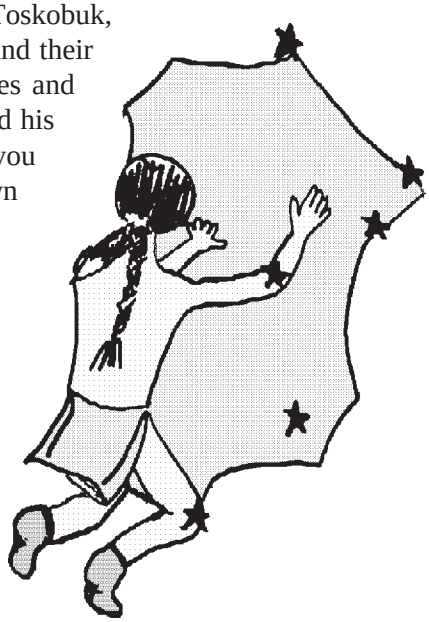
Now everyone can see the men chasing their lost wives across the sky all winter long. The stars known as the Hyades (which make the face of Taurus, the bull) are the men. The Pleiades are the women. Together they are a monument to the selfishness and shortsightedness of those men and women. With this we are reminded to make every effort to keep our sacred family unit in tact.

Circumpolar Constellations…

Cassiopeia

What we call Cassiopeia (The Queen), is other things in many cultures…

…To the Quileute tribe (North America)



When his brothers do not return from a hunting trip, the youngest, Toskobuk, searches for them. At a fork in the river he finds their abandoned canoe and their tracks leading into the brush. Man of the Prairie appears from the bushes and approaches the young man. Toskobuk senses that this is the one who killed his brothers and is planning to trick him in the same manner. "I can see that you are a hunter," the Man of the Prairie begins, "Let me chase some elk down here while you hide." The boy consents, knowing that he can out-smart the trickster. "And why don't you let me trade my magic arrows with you," the giant man continues as he holds up several beautiful looking but deceptively weak arrows, "You will need these powerful arrows to shoot all the elk."

"I believe in the power of my own arrows. I made them with my own hands," the boy replies. The Man of the Prairie enters the brush but reappears as a giant elk with massive head and sharp antlers. He charges the boy just as he did when he killed the brothers. The boy shoots the tremendous monster four times with his own strong arrows, once for each of his four brothers. The elk falls, big as a mountain. When he skins the giant elk, Toscobuk realizes that it is too big to stretch on the prairie. So he heaves the giant elk skin into the sky. The stars we see are the places where he drove stakes through the skin in stretching it.

…In the Middle East it is an arm and hand stained with Henna. Henna is a red dye that women use to protect their skin from the heat. Some call this the hand of Fatima, daughter of Mohammed, stained with blood. These stars are also known as a camel in the Middle East, a region highly dependent on the camel for transportation.

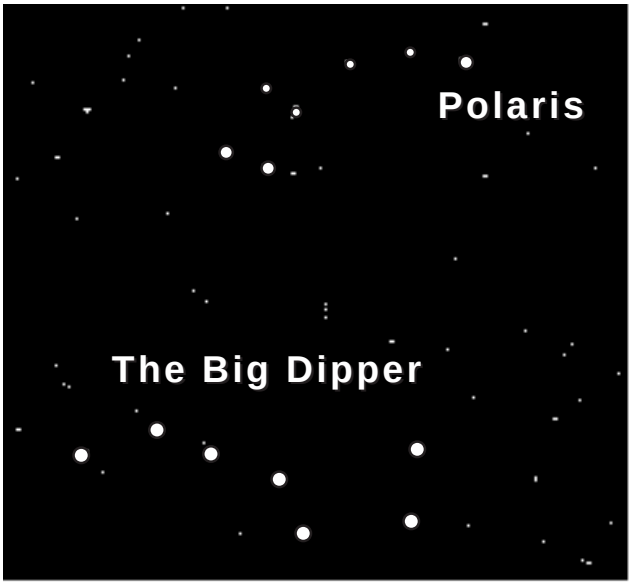
…To the Marshall Islanders of the South Pacific Ocean, it is the tail of a dolphin. Stars in Andromeda and Aries make the body and head of the dolphin.

…In China these stars form the bridge over a moat. In ancient times, governors of outlying areas crossed the moat in order to enter the emperor's palace. The stars also show a chariot in which the king would ride to visit the emperor.

The stars are named for Wang-liang and Tsaou-fou, two charioteers who were so strong, it is said they could pick up and overturn whole chariots, and easily tame wild horses.

…Among the Inuit it is steps cut in a heavenly snow bank. The steps link Earth to the Sky country.

The Big Dipper and the North Star…



are among the most widely recognized star patterns in the northern hemisphere. The stories and pictures associated vary greatly among many cultures. Here are some more Big Dipper stories to add to your repertoire…

…The Maya know Seven Macaw as the one who believed himself to be a great god. With jewels in his eyes and for his teeth he pretended to rule the Sun and Moon. This was before there was a real Sun or Moon. In fact, it was not safe for the real Sun and Moon to exist alongside a false prophet such as this. So the hero twins Hunter and Jaguar-Deer wounded Seven Macaw with their blowguns and then, posing as healers, removed his jewels, robbing him of power. His descendants are the macaws of today, with broken, toothless jaws and white patches around their eyes. Seven Macaw and his wife Chimalmat are the Big and Little Dippers. The rising of Seven Macaw in October begins the dry season. His fall to Earth in July marks the great floods of the rainy season.

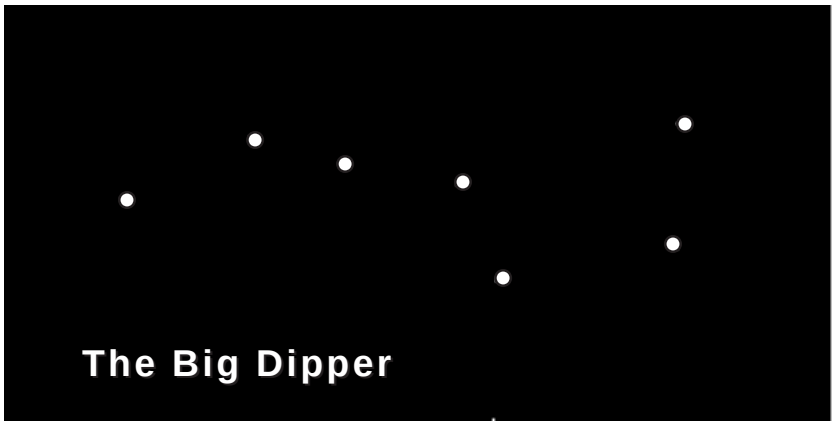
…In Scandinavia, the Norse gods created the universe from grinding up the bodies of ancient enemies, a race of giants. Then they drove a spike into the center of the universe. The jewel on the end of the spike is known as the North Star today.

…To the Chinese, Shang Ti, supreme ruler of Heaven and Earth, lives at the pole star. His two ministers of state help him organize the complex movements of Heaven and Earth. Shang Ti invited Tou Mu, a wise and virtuous woman with knowledge of many mysteries, and her family to live with him. Tou Mu is known to help sailors who are lost. She sits on a throne of lotus, holding the books of life and death in her 18 hands. If you pray to her, it is said she will prolong your life. The Big Dipper's movement is responsible for the seasons. Called the Balance of Jade, it is said to maintain balance between the seasons. Also called the Palace of Fates, it encompasses all of human destiny. The Big Dipper is also known as the Bushel of Measure due to its similarity to the container in which grain is weighed. It's importance is easily understood—the measure of grain is a measure of life.

…To the Arabs, the pole star is a murderer who killed a great warrior who is now lying in a coffin. The coffin is formed by the cup of the dipper. The handle of the dipper makes the mourners who follow the coffin. In fact, all stars move in the funeral procession with the coffin. The murderer is forced to stand out as all the others circle around, safely keeping their distance and ostracizing him.

…Among the Navajo, First Man and First Woman helped form the face of the Earth and Sky. Some stars were carefully placed by them, mirroring all the animals, mountains and everything on Mother Earth. Before they could finish, the impatient Coyote flipped the rest haphazardly into the night sky. That is why some stars are organized to make pictures while others are just random patterns. First Man and First Woman circle their home fire marked by the pole star. Known as Man and Woman Who Walk Around, their movements symbolize the work of all people in their daily lives. They serve to remind people of the law which requires that only one couple may live together in the same home.

…The Inuit know the Big Dipper as a narwhal, a type of whale with a horn. The narwhal tells the time. The bright star Arcturus (found by following the curved handle of the dipper) is called Time Piece of Seal Netters. The North Star is directly overhead at such high latitudes so it is not useful for finding directions.



…The Hindu call them the Seven Sons of Brahma. Their wives are the Pleiades and the pole star is the place of Dhruva, the Immovable One, who sits in meditation as the rest of the universe circles around him.

…In ancient Egypt, the Big Dipper was a bull named Meskhetiv and was associated with the god Seth. The handle of dipper makes the bull's front leg. The bull is tied to two posts of flint by a chain of gold. The goddess Isis is in the form of a hippopotamus guarding the bull. She holds the bull so it is unable to travel among the gods. The stars of Boötes help by holding the rope attached to the hind quarters of the bull. The Little Dipper is a falcon-headed god who is seen to be spearing the bull.

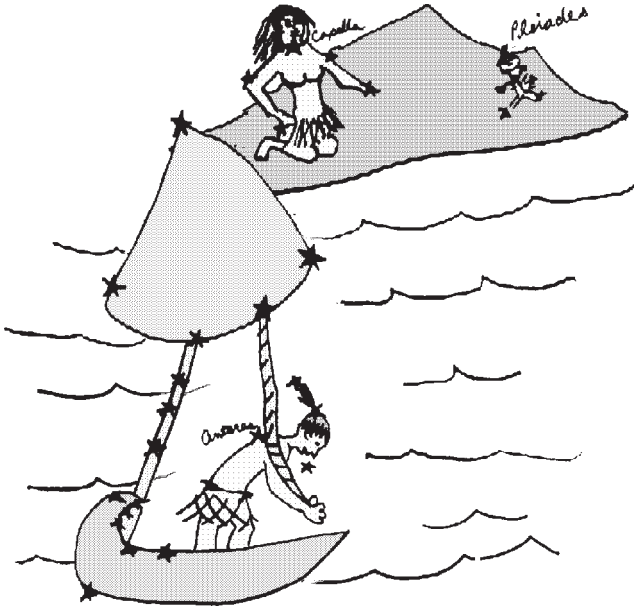
In the Summer Sky…

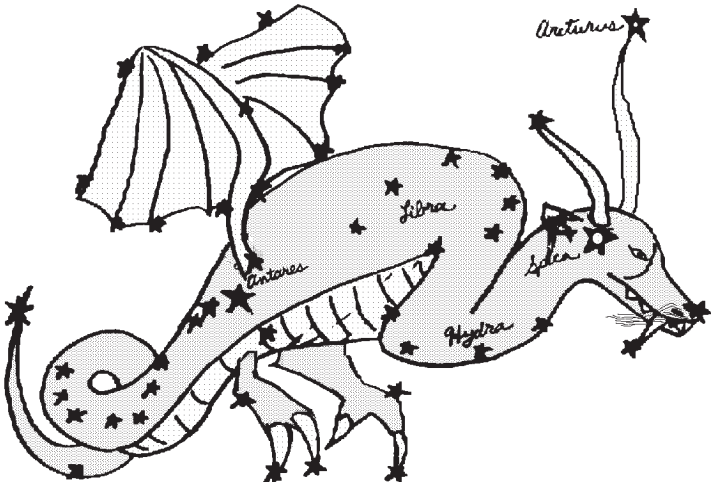
Scorpius

…Marshall Islands (South Pacific)

Ligadener (Capella) is the mother of all stars. All her sons race to an island to see who will be king of the stars. The bright star (Antares) is Dumur, her oldest son. She offered her help to all the sons, but only the youngest was willing to ride with his mother. Ligadener set up a sail in the canoe. With this new trick, she and her youngest son would easily win the race. But Dumur forced them to trade canoes and his mother and youngest brother jumped out into the water. What Dumur didn't know is that they had taken part of the mast away with them. In order to sail, Dumur was forced to tie the sail to his shoulders. That is why his back is so bent over.

Ligadener and the youngest son (the Pleiades) swam on to the island, winning the race. Dumur was so angry when he finally arrived that he wished never to see his brother again. That is why the Pleiades and Antares are never seen together in the sky.



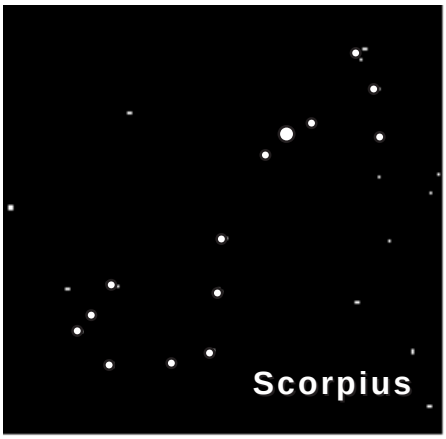


…China

The stars which become visible in the spring are called The Blue Dragon of Spring. The dragon is associated with the productive forces in Nature, and the beginning of the humid season. The dragon's body includes many parts, each of which have special meanings of their own. The meaning correlates to people's activites during the events which occur in the spring. When, in spring, the Earth's fertility is restored, the appearance of the Blue Dragon coincides with the planting and cultivation of food and the ceremonies which accompany these activites.

The horn (Spica) appears, and the Blue Dragon has opened the earth for the new plants to grow. Sprouts push out from the earth as the horn pushes up from the horizon. The people similarly break through the earth in ploughing their fields. Appearance of the dragon's great horn (Arcturus) is the first sign to the people that spring has come. The neck (the tail of Hydra), signals the people's visit to wish the King a happy new year. Prisoners were freed, and animals released from their stables. These events correlate with release from hardships associated with winter: coldness, hunger, and threat from invasion.

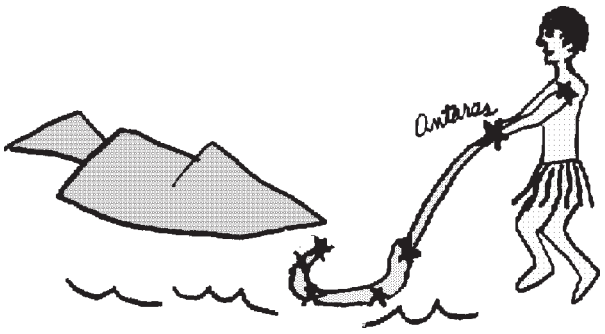
Other parts of the dragon include chariots, horses, servants, and soldiers, all of which have a place in the ceremonies and events of the spring. The heart of the dragon (Antares) is the Sun. Its appearance is a signal to hold the important ceremony of the Renewal of the Fire.



All the pieces of the Blue Dragon of Spring and their many meanings are tied together. As in other traditional societies, the stars depict the complex relationship between the events occurring in Nature and the intricacies of Chinese religion and culture. Understanding this relationship enables the people to align the events in their lives with those in the natural world. It is said that study of this relationship can give insight into the possible outcome of future events.

…New Zealand (Maori)

Maui's fish hook is carved from a jawbone. The hook gets stuck so he pulls and pulls until finally a huge fish surfaces. The fish is an island with plants and people already living on it. Against Maui's warning not to harm the fish, the first people of the island begin to cut the fish up. After much hacking, the fish/island is cut in two. The two pieces make what is commonly called the North and South islands of New Zealand today. The rugged shoreline of the islands still show the scars the first people made in ancient times.



Maui pulled the hook so forcefully that it shot right out of the water and stuck in the sky where it can still be seen. The stars that we sometimes called the Tail of the Scorpion are the ones that make up Maui's fish hook.

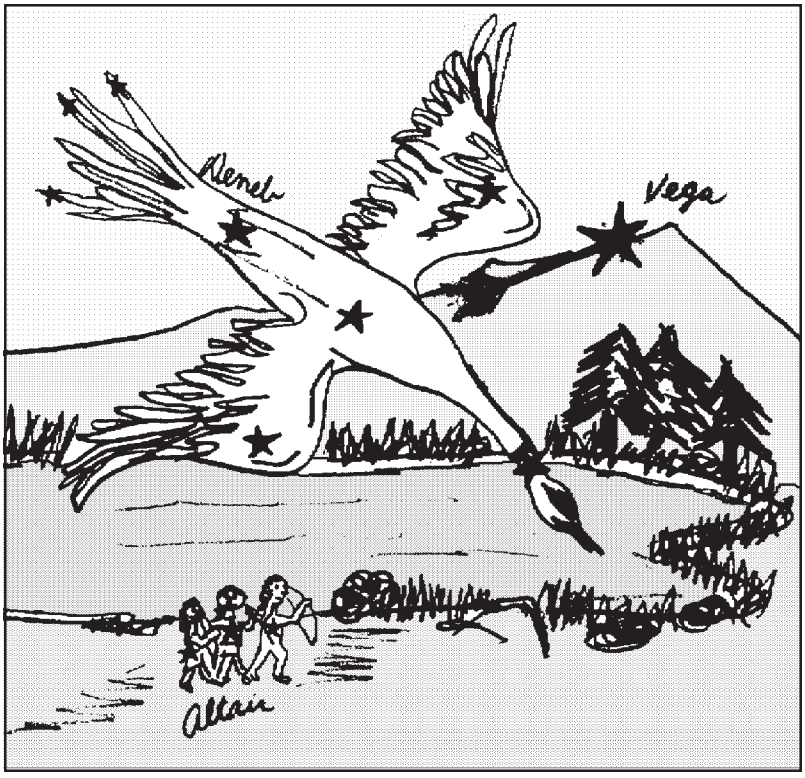
Summer Triangle

…China

Chih Nu is daughter to the Lord of the Universe and also Goddess of Weaving. She falls in love with her father's herdsman, Chien Niu. The lovers marry and live happily together. Their infatuation with each other eventually distracts them from their heavenly duties. The unattended oxen of heaven begin to wander throughout the sky and the loom upon which the fabric of the heavens is woven is left empty. After repeatedly warning them to attend their responsibilities, the King of Heaven must separate the lovers to opposite sides of the Heavenly River of Stars.

With help from the Birds of Heaven, the lovers are allowed to rejoin each other for one day each summer. On this day, magpies from all over the world fly to the edge of the river and form a bridge with their wings. Tears of happiness fall as a light rain in the morning. By evening, it is said, the rain begins to downpour as tears of joy turn to tears of sorrow and the couple is forced to separate for yet another year.

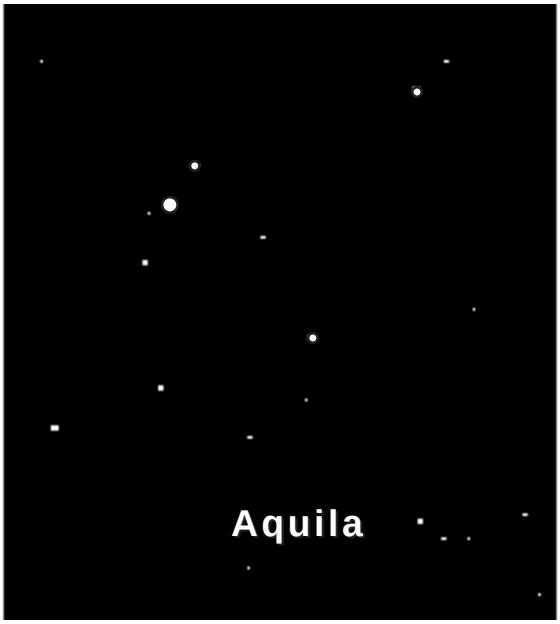
…Coer d'Alene People (North America)



One evening, three young hunters find a magnificent snow goose resting at a peaceful lake. They discuss whether they should consider shooting the bird. One suggests that the goose will make an excellent trophy with which to return to their village. The others call the snow goose a holy bird and insist that it be protected. An argument ensues during which the bird opens its wings and rises up into the twilight sky. Before the others can stop him, the youngest hunter reaches for his bow and shoots the bird. With a cry, the snow goose flies straight down into the deep water of the lake. The boys search until dark for the goose but can not find a trace of it. When the stars appear, the boys see the goose reflected in the water of the lake. Looking up to the sky, the spirit of the snow goose can be seen reflected in the stars.

Three bright stars in the constellation known as

Aquila the Eagle are…



…To the Hindu, the footsteps of Vishnu. The god Vishnu made three great strides in measuring the heavens. The three stars signify the rising, midday, and setting Sun.

…In China, the Drum of the River. The drum lies at the edge of the Milky Way, known as the Celestial River (see story above under Summer Triangle.) High overhead at midnight in the winter, it marked the time when attacks from nomadic tribes were likely to occur. When an attack was imminent, sentinels warned the townspeople by sounding drums from the village entrance. Thus it is also known as the Celestial Drummers. Two bright stars below the drum make the drumstick.