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A Dramatic World: An Eighth Grade Theater Curriculum for Earth's Future Caretakers

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While a theater teacher might not have seemed a likely candidate for Dr. Turekian's seminar "Global Change, Human and The Coastal Ocean," had Homer not spun a fanciful yarn pitting Odysseus against a tumultuous sea, Aeschylus, Aristophanes and Euripides might never have picked up a pen, a chisel? Needless to say, drama and the ocean are no strangers. From the *Odyssey* to the apocalyptic film, *Waterworld* , the blue planet on which we live has inspired playwrights, film makers, poets, pioneers and scientists alike. It is my intention to explore this union of drama and the Earth's oceans in order to engage my students at Betsy Ross Arts Magnet School on both analytical and aesthetic levels.

A Dramatic World has been designed to build aesthetic awareness of science topics through creative dramatics such as theater games, improvisational exercises, reading plays and short stories, writing, and scene work. While each lesson in this curriculum is concerned with making interdisciplinary correlations largely between Science and theater, the subtextual content of these lessons is intended to foster a sense of appreciation and responsibility in the student for the world in which he or she lives. By making these kinds of connections, I, along with my colleagues, hope to engender critical as well as imaginative thinking within our classes. Our students have inherited a world of complex problems that will demand of them unique and innovative solutions in order to create the future (which has always been the onus of the young). They come to us from diverse backgrounds with sundry interests. It is our mission as educators, not only to build a strong foundation for knowledge by teaching them how to learn, but to help them to develop their innate talents so that they may bring their special gifts to the world. Perhaps the purpose of this unit can best be expressed by our esteemed professor, Karl K. Turekian, as he states in the prologue of his book, *Global Environmental Change* (page 2):

"We depend on the chroniclers, the storytellers, and the poets to give us a sense of place and purpose. We depend on the chroniclers of the physical environment to describe the anatomy, physiology, and pathologies of our planet. Indeed, our perceptions of the place of humans on Earth is strongly conditioned by our views of the history of Earth, whether we are immediately aware of it or not. Our goal is to consider how this grand view of Earth can affect our thinking about the politics and sociology of global change. We must consider what we can reasonably do to influence or ameliorate global environmental change for the benefit of humans as dwellers and caretakers of Earth, and how we can live with what we cannot change. " With this in mind, the goal of the unit is to empower students in their mission of becoming Earth's future caretakers. Therefore, the culminating activity of an eighth grade town meeting addressing the ecological viability of Long Island Sound

is the final objective shared by Lisa Alter (Science), Mary-Alice Howley (Reading), Linda MacNaughton (Study Skills) and myself. (See “An Eighth Grade Town Meeting on Long Island Sound,” the introduction to all four units.)

My theater classes are offered once per week for approximately fifty minutes per class. Since I do not see my students as often as my colleagues see their students, I decided to begin this curriculum in the first marking period and extend it throughout the first semester. My main objective in the first marking period is to focus on an appreciation of the Earth itself. I feel this is requisite to the kind of social awareness of our planet’s ecology that students will be introduced to in the second marking period. Overall, the curriculum addresses four main areas. The first three have been closely aligned to topics that will be presented concurrently to eighth graders in their Science classes, namely: the formation of the universe; the evolution of the Earth’s atmosphere, and the world’s oceans. The last curricular area addresses global citizenship and Long Island Sound, and is largely concerned with the production of our interdisciplinary culminating activity, the eighth grade town meeting. Although not every lesson in the unit has been massaged to work it’s way directly into the town meeting production, it is my hope that students will utilize some of the mythological, philosophical, and dramatic materials that they will be covering in their theater classes, to incorporate into the work they will be doing in their science classes, and where applicable, in their Reading or Study Skills classes as well.

All the activities presented in this unit are aligned to the National Arts Education Content Standards for Theater, which include: script writing; acting by developing basic acting skills to portray characters; set design; directing; researching by using cultural and historical information; comparing and incorporating art forms; analyzing, evaluating, and constructing meanings from dramatic works; and understanding context by analyzing the role of theater, film, television, and electronic media in the community and in other cultures. (*National Content Standards for Arts Education,* The Consortium of National Arts Education, 1994.)

Along with other sources of information, several eighth grade textbooks will be used by students in this curriculum unit. The eighth grade science texts to be used come from the Prentice Hall Science series and include: *Exploring the Universe; Exploring Planet Earth; Dynamic Earth; Exploring Earth’s Weather.* The eighth grade social studies text, *Exploring American History,* will also be employed. (All texts are included in the bibliography.) Also, an appendix containing reduced versions of the handouts mentioned in this unit appears at the end of the unit.

Lastly, student work resulting from the writing and creative dramatics activities in this unit may either be included in our town meeting presentations, or may also be offered in dramatic performances that are given at various times throughout the year, such as our “Theater Night” and “Studio Week,” or Library Media Center performances. Student writing may be included in our school’s anthology, *The Poets’ Posse,* which I produce every year.

IN THE BEGINNING, The Formation of the Universe

. . . So every star and every whirling planet

and every constellation in the sky

revolves around the center of the universe —

that lovely thing called “I.”

“No Way to Stop It” from *The Sound of Music*

(Rogers and Hammerstein)

The first three lessons of this unit address two points of origin: the first is the student, him or herself; the second, the birth of our planet in context with the formation of the universe and the beginning of time. Since this is a theater curriculum that addresses science topics, focus on self-awareness, or the inner world, is key to understanding the relevance of the outer world.

Lesson One: The Infinitesimal

In the novel, *Sophie’s World* by Jostein Gaarder, Sophie Amundsen, a fourteen year old Norwegian girl embarks on an incredible adventure of self discovery when she comes in contact with Alberto Knox, an unusual professor, who through the course of 400 pages, teaches her a 3,000 year history of western philosophy. Published in 1996, *Sophie’s World,* a number one best seller, chronicles the imagination, brilliance, theories and discoveries of such historical thinkers as Socrates, Aristotle, Descartes, Spinoza, Hume, Kant, Darwin and Hubble, among many others. Since the book is written as a discourse between professor and student, a few of its pedagogical sections will be used as a model for introducing key scientific concepts with regard to the curriculum unit. Hence, the first lesson will direct two questions to students, which are also the first two questions that Professor Knox asks of Sophie: *“Who are you?”* and *“Where did the world come from?”*

Without any preamble to these questions other than to let students know that this is stream-of-consciousness writing and that they should jot down whatever pops into their heads, students will be instructed that they have fifteen minutes to draft their answers. Instrumental music will be played during this time (perhaps Beethoven’s Ninth, which was used at the beginning of the film, *2001, A Space Odyssey* might be appropriately inspiring). After this assignment, students will put their papers into their student folders (which will be used to file their paperwork, including handouts and written assignments); the folders will be collected and we will play a game called “Atom.”

Atom is played in an open space, which can be created by pushing chairs (and desks) aside, or weather permitting, going outside. The game begins with music (either played or sung by the teacher) and will be stopped intermittently throughout the game. As the music continues, students move around; walking, skipping, dancing, etc. The music is stopped and the teacher says, “Freeze.” Students then freeze their positions. The teacher calls out “Atom” and a number, e.g., “Atom Five.” Students try to gather together in groups of five. Any students left over from the groupings are out of the game, but can then help the teacher to call out numbers as the activity is repeated. The game ends when two students are left.

After the game, we will gather together in a circle (a typical setting for a theater class). Students will be asked “Why is Lego the most ingenious toy in the world?” (another question from *Sophie’s World*), which will lead to the introduction of Democritus, the Greek natural philosopher (c. 460-370 B.C.), who believed that everything in the world was made up of tiny immutable blocks that were invisible. Because Democritus considered such a block to be “uncuttable,” he called it an “atom,” which means the same thing. Democritus also believed that nature consisted of many kinds of atoms, and that each one had hooks and barbs (not so dissimilar to the

Lego idea) so that it could join with others to make up all sorts of things from flower petals to human beings. Even though science has fine-tuned Democritus' original idea of the atom—adding elemental particles such as protons, neutrons, electrons—we have yet to find the minimal part of all matter; that which is indivisible. However, his basic theory has held up remarkably considering that he thought of it in a time long before microscopes and the Discovery channel. Students will then be asked how this could be? How could someone living over 2,000 years ago without the benefit of modern technology come up with the idea of the atom? We will conclude this first class by discussing how each of us possesses the capacity for logic and reason, and that we will use this capacity to explore the answers to the first two questions asked in this curriculum: *"Who are you?"* and *"Where did the world come from?"*

Lesson Two: The Infinite

The class begins with a variation on the Atom game. This time, students are asked to clump together in the center of the room (or playing area, if outside). The game starts with the teacher shouting, "Bang!" at which point students pretend that they are exploding out from the center. Music is sung or played with intermittent stops as in the first game. The first stop, or "Freeze," is called and "Atom One" is shouted. Subsequent stops and numbers are called depending on the number of students in the class. If there are fifteen students, then the groupings to follow will be "Atom Three," "Atom Five," "Atom Fifteen." For a class of twelve students, the groupings will be "Atom Two," "Atom Three," Atom Four," Atom Six" and "Atom Twelve." As the game continues, the groups become larger and larger until we are left with one group again. At this point, the game is repeated one or two more times, starting off with "Bang!" (Note: for classes where the total number of students offers low divisibility, such as a group of fourteen students, or where the number of students in a class is a prime number, e.g., 11, 13, 17, 19, have one student, or two, remain stationary in the center of the initial grouping.)

After the game, we will gather in our circle for discussion. Students will be asked to define the words "matter," "energy," "space" and "time" in context with the game they have just played, i.e., their bodies are *matter* , which they move with *energy* , from one place to another through *space* , and this action of a particle being energized to move through space from one position to another is what creates *time* . I will then discuss their writing from the first class regarding their views on where the world came from, which will lead into a brief explanation of the Big Bang theory and how the universe was formed. In this overview, I will address that time began about 15 to 20 billion years ago, with all the matter and energy of the universe packed into a point about the size of a period at the end of a sentence. BANG!!! Everything exploded outward in all directions from this extremely hot and dense center (similar to what the students had demonstrated in the Atom game). As energy, or background radiation, moved away from this central point, it became evenly spread throughout the universe. Particles of matter attracted other particles of matter and began to form clumps. This attraction, or gravitational force, pulled the clumps of matter into huge clusters, which in turn formed galaxies. And thus, we have a recipe for making a universe.

Presently, and since its inception, the universe is expanding and will probably continue to expand for billions of years. But most scientists believe that it will reach a point at which time the process will reverse itself, pulling all the matter and energy of the universe back to center (again, similar to what students demonstrated in the game), whereupon it may explode again. In this kind of "closed universe," a big bang may occur every 80 to 100 billion years. On the other hand, if the universe is "open" (which is not the popular view), it will

continue expanding until its stars lose all their energy and die; until nothing remains.

Referring back to the students' views on where the world came from, we will engage in an oral reading of the creation myths of "Gaea, Mother Earth," "The Titans," and "Zeus and His Family" from the *Book of Greek Myths* by Ingri and Edgar Parin D'Aulaire (pages 10-17). A discussion will follow to explore how ancient Greeks created the myth, not only for entertainment, but also as a way to explain the forces of nature; and how the word "myth" comes from the Greek "mythos," which means story. Borrowing from the words of Edith Hamilton in her book, *Mythology, Timeless Tales of Gods and Heroes* ("Introduction To Classical Mythology," page 13.), written in 1940:

"Through [mythology] . . . we can retrace the path from civilized man who lives so far from nature, to man who lived in close companionship with nature; and the real interest of the myths is that they lead us back to a time when the world was young and people had a connection with the earth, with trees and seas and flowers and hills, unlike anything we ourselves can feel." Afterward, students will share other stories, legends and myths that they may be familiar with, which will lead into a "circle story" to create our own creation myth as to how the universe came to be. The circle story is a creative exercise that draws on the imagination and spontaneity of students to create a story. This activity will be tape-recorded. I will start it off with, "In the beginning . . ." and the student to my left will finish the sentence however he or she chooses. Each successive student will subsequently add to the story. The story may be completed in one go-round, or may take several times around the circle before it comes to an end. At this point, I will rewind the tape and play it back. We will listen to our story and critique our work. In this critique, we will discuss how our work is either similar or dissimilar to the Big Bang theory.

Lesson Three: Talking Heads

Isaac Newton, Albert Einstein, Stephen Hawking and Data (an android) enjoy a leisurely game of poker in the holodeck (a holographic imaging playroom) on board the starship Enterprise. Actually, the only one enjoying the game is Stephen. Isaac, who is easily annoyed anyway, becomes increasingly agitated during a light-hearted discussion about the planet Mercury since he hasn't a clue that it even exists, while Albert tries in vain to smooth his ruffled feathers. Data appears befuddled as ever over human psychology, which more often than not defies anything approximating logic and reason, and Hawking grins like the Cheshire Cat, confident in the knowledge that he's about to beat the pants off his esteemed colleagues with a Royal Flush.

Such was the prologue scene to the episode titled, "Decent" from the television series, *Star Trek, The Next Generation* (aired April 21, 1993). Hawing, the Lucasian Professor of Mathematics at Cambridge University, author of *A Brief History of Time,* and an avid *Star Trek* fan, planted the idea for the scene during a visit to Paramount where the series had been shot, and hence (although unbeknownst to Professor Hawking), the idea for this next lesson in which students will learn about characterization and writing scenes. The general topic for these scenes will be an argument about the creation of the universe.

After viewing the clip mentioned above, students will be presented with a *Talking Heads ¥ Profiles* handout that includes brief profiles of the following: Aristotle, Saint Augustine, Ptolemy, Nicholas Copernicus, Galileo Galilei, Johannes Kepler, Isaac Newton, Immanuel Kant, and Edwin Hubble (based on information from from *A Brief History of Time* , pages 1-13, and the eighth grade science text, *Exploring the Universe* , pages 56-62; see "Talking Heads ¥ Profiles" in the appendix). After reviewing the profiles with the class, I will discuss

various aspects of characterization as the playwright's way of showing how each person in a play is unique, and how the playwright reveals characters through dialogue, descriptions, and stage directions. Students will then be instructed to write a scene with two or more of the profiled personalities involved in an argument about the formation of the universe. They will also be given the option of working in pairs or small groups (no larger than four members) if they would like to work cooperatively. Students may add characters, either from the mythology that had been addressed in the last class, or inventions of their own. They must put whatever characters they choose in a particular setting (such as the poker game in the Star Trek clip). In developing their characters, students will be advised to look to the following aspects of characterization: function, physical appearance, social behavior, psychological profile, morality; how the character is typified; how he is individualized; whether or not he is sympathetic to the audience or unsympathetic; a protagonist or antagonist. This activity will take up about half of the class time. We should wind up with four to five drafted scenes since most students usually enjoy working in groups. In preparation for the next class, I will review and lightly edit the scenes, type them, and make multiple copies of each scene so that by the next class, we can have a readthrough of the students' work.

During the last five minutes of class, students will receive back their folders and will be directed to the answers to the first two questions asked of them in this unit— *"Who are you?* and *"Where did the world come from?"* They will be asked to add to these answers in relation to the quote that appears at the beginning of this section (from "No Way to Stop It" by Rogers and Hammerstein). Once again, the writing should be guided by stream of consciousness. This process will be repeated at the end of each of the four major sections of this unit and students will be instructed to be guided by the quotes that head each section respectively.

BREATH OF LIFE, The Evolution of the Earth's Atmosphere

"Whether in Heav'n ye wander fair,

Or the green corners of the earth,

Or the blue regions of the air,

Where the melodious winds have birth"

"To the Muses"—second stanza, William Blake

In the next three lessons, students will gain awareness of the evolution of the Earth's atmosphere. They will also be introduced to Homer and the drama and artistry often inspired by natural processes that affect our planet, as well as an understanding of ancient Greek religious beliefs that grew into festivals and gave rise to theater in Europe.

Lesson Four: A Breathing Planet

The typed scripts from lesson three “Talking Heads,” will be presented to students. We will readthrough each scene, focusing on vocal techniques: volume, relaxation, articulation, flexibility, and comfort level. This readthrough will lead into a further discussion of the Nebular Theory (Kant and Laplace) and how our own planet was formed based on “The Solar System Evolves” from the eighth grade science text, *Exploring the Universe* (page 58). Several charts, photographs and drawings from *The Big Book of The Earth,* a picture book by Dougal Dixon, will also be shown and briefly commented on to further illustrate our planet’s birth as well as its changeable nature. These will include: the Earth’s concentric layers (pages 12-13); oceanic and continental crust movement (page 16); photo of the separation of the North American plate from the Eurasian plate in Iceland (page 17); the Earth’s plates (page 17); diagram of how moving plates produce mountains, rift valleys and oceans (page 18); andesitic and basaltic volcanoes (pages 20-21); and the mechanism of earthquakes (pages 22-23). Afterward, students will cull data from their science text, “The Past Atmosphere,” *Exploring Planet Earth* (pages 16-18) in order to improvise, sketch out scenes, and perform an in-class mini production for a TV weather show about the atmosphere of four billion years ago to 600 million years ago.

A BREATHING PLANET ¥ WEATHER SHOW OUTLINE

¥ Four billion years ago, the atmosphere consists of methane and possibly ammonia.
¥ By 3.8 billion years ago, sunlight triggers chemical reactions in methane, ammonia and water; nitrogen, hydrogen and carbon dioxide are formed; methane and ammonia break down, but water remains—evidence for life as the product of this chemistry and also influencing it.
¥ Lightweight hydrogen escapes gravity and disappears into space; nitrogen in abundance, along with carbon dioxide and water remain in the atmosphere.
¥ In the upper ancient atmosphere, sunlight breaks down water vapor into hydrogen and oxygen gases; but lightweight hydrogen escapes.
¥ Microscopic organisms form in the depths of the ocean where they are protected from the sun.
¥ Oxygen atoms combine with one another to form ozone; the ozone layer forms about 30 kilometers above the Earth’s surface and becomes an “umbrella” for life on Earth, absorbing most of the harmful ultraviolet radiation from sun.
¥ With the protection of the ozone layer, blue-green bacteria form on or near the water’s surface. They use energy in sunlight to combine carbon dioxide from the air with water to produce food.
¥ Green plants grow on land; intaking carbon dioxide and releasing oxygen during the food-making process. This process is called “photosynthesis” and it happens when green plants and other organisms use sunlight as a source of energy to “cook up” or synthesize carbon dioxide and water into carbohydrates (food—organic compounds that include sugars, starches, celluloses, and gums and serve as a major energy source in the diet of animals).
¥ The oxygen released during this food-making process drastically changes the Earth’s atmosphere. With increased oxygen remaining near the Earth’s surface, the planet is able to support life as we know it today.
¥ 600 million years ago, oxygen increases greatly. The amounts of carbon dioxide and oxygen begin to level off and the composition of the atmosphere remains fairly constant to present day.

Since humans had not been around during the formation of the Earth's atmosphere, it only makes sense (or nonsense `a la Theater of the Absurd) that the hosts of this weather show would be Prokaryotes, asexual reproducing "bacteria-like life that dominated Earth until the oxygen level increased strongly" and Eukaryotes, the 2.1 billion year old cells that reproduced by sexual means and were the forerunners of "nonbacterial forms of life from fungi to humans" ("The Evolution of the Atmosphere," *Global Environmental Change* by Karl K. Turekian, pages 57-58).

Students again will work in pairs or small groups in order to sketch out the various weather show components, which are described in the text, "The Past Atmosphere" as mentioned (and outlined) above. Given the theatrical nature of the assignment, students will be given license to present this information as comically or absurdly as they wish. For example, one might personify a prokaryote by having him cough and choke as he describes the deadly methane and ammonia atmosphere of four billion years ago, or in another example, umbrellas could be used as props to demonstrate the ozone layer (odds and ends of costumes and props are always available for students to use in theater class). Each student pair or group will work on a brief presentation and offer their work-in-progress to their classmates for critique.

Lesson Five: Stormy Weather

Referring students back to lesson two, "The Infinite," with respect to the reading of creation myths from the *Book of Greek Myths,* Homer will be introduced as the author of the *Iliad,* which stands today as the first written record of Greece. Hence, our knowledge of Greek mythology begins with him sometime between 900 and 700 B.C., but as Edith Hamilton suggests: "The *Iliad* is, or contains, the oldest Greek literature . . . which must have had behind it centuries when men were striving to express themselves with clarity and beauty, an indisputable proof of civilization" (*Mythology,* page 14). The *Iliad,* named after Ilium or Troy, which is the setting for the story, chronicles the events of the Trojan War, circa 1200 B.C. As Dr. Turekian states in Chapter Six, "Sea Level" from his book, *Global Environmental Change* (page 112):

"Troy is an example of an ancient maritime town made powerful by its access both to the sea and the interior through its river and roads. Its demise gave rise to the story of the Iliad with its beachhead-type invasion and siege. Now Troy is deep inland as its once shallow harbor has silted up. If the Greeks did not 'the labors of the gods destroy and strike to dust the imperial towers of Troy' (Alexander Pope), the city was certainly doomed as a maritime force by the inevitable silting of its harbor." Most likely, the Trojan War was fought for economic control over the shipping trade that flourished in Troy. (In "Lesson Eight: The Great Flood," the effects of sea level changes will be further explored and we will refer back to the Dr. Turekian's passage on Troy above.) But with regard to Homer's epic poem, as further explained by Euripides (one of Homer's contemporaries) in *The Trojan Women,* the war was instigated by Eris, the evil goddess of Discord, who crashed the wedding of King Peleus and the sea nymph, Thetis, by throwing a golden apple marked "for the fairest" into the banquet hall. Zeus, wisely declined to judge such a competition and advised the three finalists, Aphrodite, Hera and Athena to seek out Paris (the son of King Priam of Troy) as he was an excellent judge of beauty. After the goddesses offered Paris bribes—from Hera, power over Europe and Asia; from Athena, victory over Greece, and from Aphrodite, the love of the most beautiful woman in the world—Paris chose the women. Thus, the judgment of Paris precipitated a bloody ten year war as Helen, the designated prize, was also the wife of Menelaus, King of Sparta.

The Odyssey is Homer's sequel to the *Iliad.* The 11,300 line poem tells of the plight of Odysseus' wife,

Penelope, and his son, Telemachus, who await his return from Troy; Odysseus' misadventures in his efforts to return to his home in Ithaca; and his long sought after reunion with his family. In the NBC mini series, *The Odyssey* (aired on May 27th and 28th, 1997), the story begins with the birth of Telemachus and Odysseus' immediate departure to fight in the Trojan War. From that point, the story line follows the capture of Troy and the Trojan Horse (taken from the second book of the *Aeneid* by Virgil). Film clips from this introduction in the mini series (approximately ten minutes running time) will be viewed by students.

Students will share in an oral reading of the handout, *Stormy Weather Odyssey Outline,* which includes several quotes from translations by Edith Hamilton and Robert Fitzgerald and is largely based on Edith Hamilton's exposition "The Adventures of Odysseus" (*Mythology,* pages 202-219). To further illustrate some of the personages and events involved in the *Iliad* and *Odyssey,* several photographs from the *All Color Book of Greek Mythology* by Richard Patrick will be shown to students intermittently throughout our reading. Since the handout is ten pages long, I have included an abridged outline in this unit (see "Stormy Weather Odyssey Outline" in the appendix). Anyone wishing to see and/or use the full-length version, need only contact me at Betsy Ross Arts Magnet School. After reviewing the outline of events in the *Odyssey,* students will be shown another clip from the NBC version involving Odysseus' escape from Polyphemus, the Cyclops, to the strange island of Aeolus, Ruler of the Winds (running time, approximately five minutes). In the clip, Odysseus is befriended by Aeolus who gives him a leather satchel containing all the winds of the world, save one, the westward wind. Aeolus warns Odysseus to keep the bag closed and in this way the westward wind will carry he and his men swiftly and safely home to Ithaca. Odysseus, ever mindful of Aeolus' warning, guards the bag both day and night until he sees the coastline of Ithaca not far ahead. Feeling secure in the knowledge that he is almost home, he rests. During Odysseus' slumber, the curiosity of his men—having peaked throughout the journey with Odysseus' refusal to share the contents of Aeolus' gift—overtakes them and they open the satchel. Thus, the winds of the world are released with a vengeance and "the ship of fools" is blown back into the open sea.

Once we have viewed the clip, we will engage in a discussion of wind based on information from "Winds" (*Exploring Earth's Weather,* pages 22-28). In the discussion, we will define air pressure as the measure of the force of air pressing down on the Earth's surface. We will explain wind as the movement of air from one place to another (both locally and globally) that is caused by cool denser air (high pressure areas) moving underneath warm less dense air (low pressure areas). Additionally, we will review the following kinds of wind that students have studied in their Science classes: local winds—sea breeze, land breeze and monsoons; global winds and the Coriolis Effect (where convection currents stemming from the equator and moving poleward due to unequal heating from the sun are deflected by the Earth's rotation, right and left in the northern and southern hemispheres respectively) —doldrums, trade winds, prevailing westerlies, polar easterlies and jet streams.

Lesson Six: Greek Theater

In this next lesson, Dionysus will be introduced as the god of wine. Dionysus was a tragic figure. Like the vine that produced ripe grapes from which he drew forth sweet nectar in spring, only to be cut back and left to shiver as a gnarled stump in winter, Dionysus embodied both mirth and cruelty, as did his invention of wine. The son of Zeus and the last of the great Olympian gods, he was the only one with a human mother, Semele. Through Hera's trickery, she was killed and banished to Hades from which Dionysus was able to set her free. It

was this story that transformed the paradigm of religious belief among the Greeks. Hitherto, the early Greeks had believed death to be the closure of life (at least where mortals were concerned). The resurrection from the underworld of a human, Dionysus' mother, offered a new view of rebirth to a higher plane of existence. Thus, Dionysus became a central figure to be celebrated in the spring, a time when the Earth renews herself after the hardship of winter has passed. And it was from these early religious celebrations that Greek theater was born. Students will learn about this myth by sharing in an oral reading of "Dionysus" from Ingri and Edgar Parin D'Aulaire's *Book of Greek Myths* (pages 66-69). Included in this account, is the story of how Dionysus transformed some nefarious sailors into dolphins, which according to legend, is why they are the most human of all the creatures that live in the ocean.

To further illustrate some of the components of classic Greek theater, will again refer to Richard Patrick's *All Color Book of Greek Mythology* to offer a pictorial view of the beginnings of European theater that stemmed from Ancient Greek religious festivals.

Plate 57:Hermes with the infant Dionysus (marble statue); Plate 56: The theater at Delphi (location photo). By the fifth century B.C., religious festivals honoring the gods became a mainstay of Greek culture. These festivals consisted of retelling stories about the gods, which became even more elaborate through acting, costuming, and choral orchestration. Audiences 20,000 and 30,000 strong were able to hear these stories owing to the acoustical design of the amphitheaters in which the festivals were held. Padded costuming, elaborate masks, and platform shoes made the actors larger than life, and a chorus of fifteen aided in the aural clarity of the storytelling by joining their voices to narrate and make commentary. Among all the festivals, the Dionysia or City Dionysia, was by far the most noteworthy.

Plate 43: Delphi at the south-west spur of Mount Parnassu (location photo). Delphi was considered one of the most venerated places in Greece where Apollo, Dionysus and Athena were represented by priests and priestesses. The Oracle (shrine) at Delphi is frequently represented in the Greek Classics as the prophetic words of the gods most often set these ancient stories into motion.

Plate 45: A Muse with lyre (first century B.C. relief). After defeating the Titans (which was explained to students in "Lesson Two: The Infinite"), Zeus created nine divine creatures, the Muses. These were the daughters of Zeus and the Titaness Mnemosyne, the goddess of memory. Each daughter grew to preside over a different art or science: Erato, lyrics; Euterpe, music; Thalia, comedy; Melpomene, tragedy; Terpsichore, dance; Urania, astronomy; Clio, history; Polyhymnia, hymns; Callipe, epics. Today, when we think of the muses, we envision the guiding light of inspiration.

Plate 54: Head of a satyr (Etruscan terracotta sculpture). The satyrs resembled Pan, the god of nature. They were woodland creatures with pointed ears, short horns, and goat legs, and are best known for their unrestrained fondness for revelry. As theater developed in the fifth century B.C., satyr plays—short comedic pieces following three tragedies and employing a chorus of actors dressed as satyrs —were presented to audiences as comic relief. The one extant satyr play, the *Cyclops* by Euripides, is a parody of Odysseus' encounter with Polyphemus, the Cyclops from Homer's *Odyssey.* ("The Satyr Play" from *The Essential theater* by Oscar G. Brockett, page 57.)

After the presentation (above) students will receive their folders back to review their answers thus far to the questions *"Who are you?"* and *"Where did the world come from?"* They will be instructed to look at some of the quotations in the *Stormy Weather Odyssey Outline* handout (see "Lesson Five: Stormy Weather"). We will then discuss the structure of Homeric Simile and students will try their hands at creating a couple of their own. Once again, they will be directed back to the quote by William Blake at the beginning of this section to guide

their focus.

A WORLD OF WATER, The Earth's Oceans

"There are many incidents which can eviscerate the stalwart and bring the mighty down. In order to survive, the ample soul needs refreshments and reminders daily of its right to be and to be wherever it finds itself." Maya Angelou (*Wouldn't Take Nothing for My Journey Now,* page 79) Early Greek natural philosophers argued over the significance of air, water, earth and fire in attempts to discern the fundamental element that made everything else in the natural world possible. These early thinkers began to make a break with the more widely accepted beliefs represented by Greek mythology that had personified the forces of nature as deities, such as Gaea, Mother Earth and her grandsons: Zeus, god of thunder and Poseidon, god of the sea. Yet both ancient Greek "dramatists" and "scientists" shared in an evocative world view in their attempts to navigate the course of humanity in the grand scheme of things.

The play below will be read in class. I wrote the mini play to introduce students to three natural philosophers from Miletus (circa 600 to 500 B.C.): Thales, Anaximander and Anaximenes. As natural philosophers, these men were concerned with the natural world and it's transformations and were dedicated to the proposition that there had to be a basic substance that created all things. In this regard, they relied on their reason and their senses, rather than mythology. Because they tried to understand nature by studying it directly, they took the first steps in scientific reasoning.

Lesson Seven: The First Element

Three Guys from Miletus —a mini play

(At the home of Thales and his wife)

THALES: (Sitting, reading a paper titled *The Miletus World News, 585 B.C.*) What are you doing, honey?
WIFE: Nothing (as she tinkers with some sticks and cloth).
THALES: Doesn't look like nothing to me. Looks like you're making something.
WIFE: Oh, it's really nothing, dear. (We hear a crack of thunder and see a pulse of bright light.)
THALES: This weather is really beginning to get on my nerves.
WIFE: I know. I pray to Zeus every day for it end.
THALES: Don't waste your time. Zeus is only an old shepherd's tale. There are no gods.
WIFE: Do you really think so?
THALES: I know so. We're much more sophisticated in the world today.
WIFE: Well, if there aren't any gods, where did the sky, the earth, the plants and animals . . . all this . . . you and me . . . where did it all come from?!! Nothing?!!
THALES: Don't be ridiculous. Any fool knows that something cannot come from nothing.
WIFE: Yes. . . I'm waiting. What's the something then?

THALES: Well, the water, of course. The first element of which all things are made.
WIFE: Water?
THALES: Water.
ANAXIMENES: (Entering soaking wet from the rain outside) I beg to differ, Thales. Don't you mean the air?
THALES: Don't you ever knock? And no, I most certainly do not mean the air. It's water. That's the first element. The one you appear to be drenched in at the moment.
ANAXIMENES: Oh this, this is what you mean (wringing his garment)? This is simply condensed air.
WIFE: Let me take that for you, Anaximenes. I'll hang it over here by the fire to dry.
ANAXIMENES: And that (pointing to the fire) is simply rarefied air.
THALES: And the mud you've gotten all over my newly tiled floor, I suppose that's air, too?
ANAXIMENES: (Proudly) Super condensed air!
THALES: (Under his breath) What an air-head, stupid idiot.
ANAXIMANDER: (Knocks and enters, having overheard Thales last statement) Calm yourself, friend, our young philosopher has a point—not the right point, mind you, but a point just the same.
WIFE: Good evening, Anaximander. (Handing him a cup of wine) Here, this will warm you up.
ANAXIMANDER: Good evening my dear lady, and thank you. (Looking at her cloth and sticks) What are you making?
WIFE: Well, if you really want to know, I had an idea to . . .
THALES: (Annoyed and cutting his wife off) So you'll tell old Anaxi' what you're doing, but not me, heh?
WIFE: (Nodding to Anaximander, resigned) It's nothing really.
THALES: Nothing . . . that's how this argument started in the first place, isn't it?
WIFE: The only one I see arguing is you! Anyone tries to express an idea and you jump all over them . . . water, air . . . who cares what the first element is anyway? If you really don't believe in the gods anymore, what difference does it make? Or do you plan on praying to thin air from here on in?
THALES: (Sarcastically) Thin water perhaps.
ANAXIMENES: (Embarrassed) Well, I guess I'd better be going.
WIFE: (Consoling) You'll do no such thing. Don't mind him (nodding toward her husband). I'm interested in hearing what you have to say even if my husband is behaving like a tyrant. Besides, your cloak is still wet. So . . . you think that everything that exists is made up of air?
ANAXIMENES: Yes ma'am . . . everything starts with air . . . water, fire, earth . . . everything.
THALES: Nonsense. Everything is made up of water! Look at what happens near water. Animals and people drink it, plants grow because of it. And water can change form. It can get cold and turn into ice or hot and turn into vapor, and the ice can melt and the vapor can turn into droplets of . . . (again, sarcastically) let's see . . . what are we talking about? . . . Water!!!
ANAXIMENES: (Enthusiastically) But that's only because it's all really air in the first place, either packed tightly or spread out very thin (checking himself) . . . uh . . . sir.
ANAXIMANDER: Hmm. Interesting ideas. But perhaps this world is only one of many worlds . . . worlds that are born and die in something I like to call "the boundless."
THALES: The boundless? (Nodding towards his wife) No more wine for Anaximander.
ANAXIMANDER: The boundless. That substance that comes before and remains after all things have come and gone.

THALES: (Sarcastically) Oh, *that* boundless.
WIFE: Well, I'm finished (holds up her creation). And now I think I'll take a walk.
THALES: Are you crazy? It's pouring out there.
WIFE: That's why I made this (opening up her makeshift umbrella), a protection from the rain. While you were all so busy nitpicking over your chicken-or-the-egg theories of the first element, I decided to do something useful. (She leaves the house.)
THALES: (Exasperated) Women.

In the case of Thales—who accurately predicted a solar eclipse in 585 B.C. and believed the source for all things to be water—his early views are not so far removed from the following excerpt from "The Circulation of the Atmosphere and Oceans" (Chapter Five, *Global Environmental Change* by Dr. Turekian, page 87):

"The atmosphere and the oceans are both fluids. The absorption and release of heat from the sun drives the movement of each of these fluids on Earth. The oceans and the atmosphere are in intimate contact and influence each other's behavior. The oceans, with their large reservoir of heat, tend to control the temperature of the air. The winds, on the other hand, control the circulation of the surface oceans. Both the atmosphere and the oceans respond to the differences in heat delivery from the sun seasonally and with latitude."
Students will be introduced to Aristotle (384-322 B.C.) who was born in Macedonia, but lived in Athens. Aristotle believed that the human soul was a reflection of the natural world or that people basically learned to think and feel through the senses (sight, hearing, tasting, touching, smelling). He thought that each aspect of nature had *substance* , which simply meant that it was made up of something. And that each thing had *form* , which meant that it did something; it functioned. From these ideas, he felt that the changes that happened in nature were accomplished by the transformation of substances from possible or potential forms to actual forms, and that there were four causes that changed or transformed nature: material (its substance), efficient (conditions that affect it), formal (what it does) and final (purpose or reason for existing). This became the nature of scientific reasoning today, although we no longer look to science to understand the purpose or reasons for the existence of the universe and nature.

Chart Demonstration: Referring to their Science text, *Exploring Planet Earth,* students will be instructed to draw and label a chart (using large white sheets and color markers) depicting the water cycle. The labeling must also include: *Material Cause, Efficient Cause, Formal Cause,* and *Final Cause* (the latter will, of course, be a product of the student's imagination). They will also present their work to the class. An example is given below:

> MATERIAL CAUSE (Substances): Water and Sunlight exist
> EFFICIENT CAUSE (Conditions that affect water): Sun provides energy that causes water to **evaporate** (go from a liquid state to a gas) and rises high into the atmosphere where the gas (or vapor) forms into clouds.
> FORMAL CAUSE (The nature of water to fall and flow back to the ocean): When the gas particles cool, they **condense** into liquid form and fall as rain, or **precipitate** . They can also fall in solid form as snow or hail. The water that falls to Earth will return to the ocean at some point. Sometimes water soaks into the ground and comes up again in springs; this water flows into rivers and gets carried back to the ocean. Sometimes the water that is soaked into the ground stays there as ground water, which moves directly into the ocean.
> FINAL CAUSE: Water's purpose is intended to support life on Earth (among some other things)

Lesson Eight: The Great Flood

Ancient stories about a great flood covering the Earth have come to us from various cultures around the world. Perhaps the most well-known in the west is the Biblical story of Noah. In Greek mythology there is also a deluge story where only Deucalion (Prometheus' son) and Pyrrha (Pandora's daughter) are saved. In both accounts the respective deity in power floods the Earth, saving only the faithful. Similarly, the endings to these stories offer hope as the world is renewed and a new "family" of humankind begins: Noah's sons venture forth to father new cultures—Shem becomes the father of the Semitic people, his brother Ham, the father of African nations, and so forth; Deucalion and Pyrrha veil their heads and cast behind them "the bones of their mother"—Mother Earth, that is—and in so doing, the stones (her bones) take human form as they fall, becoming the first inhabitants of the Stone Age. While Charles Darwin undoubtedly would have had a difficult time accepting these inventions as the evolution of man, the cataclysmic event of global flooding tearing the Earth asunder is not so far off the mark. (Although, according to Dr. Turekian, Darwin didn't pay much attention to the paleontologic evidence of his day either.) Yet, as Dr. Turekian also points out: "Before the identification of characteristic glacially induced features, these [recent unconsolidated sedimentary] deposits were perceived to be relicts of the great flood recording in the Bible associated with the story of Noah and the ark." ("Temperature Variation Over Time," *Global Environmental Change,* page 73.)

Students will share in an oral reading of the stories of "Pandora" and "Deucalion" from D'Aulaire's *Book of Greek Myths* (pages 74-79), followed by a discussion about flood myths and facts. To illustrate the process of glaciation, I will review with the class the section on "Glaciers" from *The Big Book of The Earth* picture book (pages 46-47). In this regard, we will also discuss the geologic history of Long Island Sound (which students will be studying in Science class, and for some, in Reading or Study Skills class as well). During this presentation, we will review that starting about 2.5 million years ago, continental ice sheets began to grow and wane, spreading out across North America and Europe. As glaciers moved from their areas of accumulation, these enormous rivers of ice ground their way across the terrain carrying rock-laden loads (with everything from boulders to tiny particles of clay). As the glaciers moved southward and began to retreat by virtue of the melting at their southern ends, they left behind till (rocks and soil deposited directly from a glacier), which at the terminus of the glacier formed ridges called moraines. Long Island is an example of the effects of glaciation with its terminal moraines, Ronkonkoma and Harbor Hill. The basin situated between these moraines and the coastline of Connecticut filled with water and became a glacial lake. As sea level rose from melting glaciers, salt water overflowed into the lake, wearing away at the eastern end and eventually clearing a second opening near New York City. Thus Long Island Sound became an arm of the sea; the estuary it is today.

Referring back to our flood myth and the Odyssey as well, I will further point out that rising sea level as the result of melting glaciers also flooded coastal areas, forming large bays, such as the Persian Gulf. An example on a smaller scale is the ancient harbor of Troy, which eventually silted up (as mentioned in a quote by Dr. Turekian in "Lesson Five: Stormy Weather"). Looking to Odysseus' journey from Ithaca to Troy and eventually back again, one might consider the flooding that had taken place to make the setting for this story possible, since Odysseus had to wander about for quite some time in the Aegean Sea, the waters of which occupy a graben (an area of land that had dropped down between faults). The topography of Greece, a product of tectonic forces—with its southern coasts situated very near to where the Eurasian and African plates meet today—is the result of major faulting that had thrust some lands higher and caused others to sink, resulting in its abundance of mountains, narrow coastal plains and 1450 islands (several of which Odysseus managed to escape from).

Owing to space-age technology, we have been able to view our planet from high above Earth's atmosphere and to witness a vast ocean covering most of its surface, and with its dispersed cloud cover, making it appear like a blue marble. Intuitively, the Greeks must have shared this view in their belief of Oceanus, the legendary ocean-river that ran past the Straits of Gibraltar to encompass the world; and of which Homer, with no small degree of prescience, believed to be the source of all things, including the gods. (Darwin may have found this idea a tad more palpable.) Using illustrations from the eighth grade science text, *Dynamic Earth,* regarding continental drift and plate tectonics, I will show that the world's oceans are, in fact, one great ocean-river, whose circular flowing currents form a continuous worldwide pattern of circulation. Perhaps it is easier to envision a world ocean by looking back 250 million years when the major continents of Earth converged into the mega continent, Pangaea, which was surrounded by ocean. After 50 million years, Pangaea began a long labor that would give birth to the world we know today. In that process, convection currents within the Earth's mantle created new divergent boundaries as rising magma weakened continental areas resulting in rift valleys. The V-shaped rift valleys subsequently filled with water and the lava eruptions that came up through their bases, cooled at the surface, leveling in new ocean floor. 115 million years after its formation, Pangaea diverged into three continents: North America, Eurasia, and Gondwanaland. 35 million years after that, Gondwanaland diverged into South America, Africa, India and Anarctica-Australia. 45 millions years ago, Europe broke free from Asia and Australia broke free from Antarctica. From that time forward, Europe and Asia converged again and connected with the north-eastern portion of Africa; North and South America became linked by what we now call Mesoamerica, and India collided into the Eurasian plate, which literally gave rise to the Himalayas (17 million years ago). In this long process of diverging and converging land masses, the major oceans of the world were formed.

At the end of this presentation, students will engage in a discussion about what the future will be like 250 million years from now when most of the Earth's continents may once again form into a mega continent surrounded by water, and with a new ocean in its center and the Antarctica/Australia continent not far off its southern coast. (*Dynamic Earth,* page 72.) Lastly, we will practice presentation skills by students taking turns to narrate the geological history of Long Island Sound (the text to be taken from *The Soundbook* introductory section, pages 10-11). This activity will be fine-tuned later on to be included in our curricular team's culminating activity of the town meeting.

Lesson Nine: "Current" Events

As mentioned in "Lesson Eight: The Great Flood," ocean currents form a continuous worldwide pattern of water circulation. Similar to air currents, surface ocean currents are also effected by heating from the sun and the Coriolis Effect, but are driven by wind. Ocean water retains heat longer than air does, and so serves to control the temperature of air. Wind-driven surface currents move from the equator to the poles as do global wind patterns, and are similarly deflected right in the northern hemisphere and left in southern hemisphere by virtue of the Earth's rotation. Because of the Coriolis Effect, surface currents do not exactly flow in the exact path of the winds driving them, but are deflected slightly to the right of the wind's path. The ocean, like the atmosphere, also has layers, which become colder and therefore, denser as they descend—making surface currents move more rapidly than deeper layers of ocean water. As a surface current pushes forward (slightly to the right of the wind driving it), the next deeper layer of water also pushes in the direction of the surface current, deflecting slightly right. And so does this layer effect the layers of water beneath it with each subsequent layer deflecting slightly to the right of the one above it. To visualize this phenomenon called The

Ekman Spiral (from "Circulation and Atmosphere," *Global Environmental Change,* Turekian, page 92), students will be directed to think of a spiral staircase, but with a difference. Our spiral staircase not only has steps turning clockwise as they descend, but becoming increasingly shorter in step-width as well, with the bottom step almost nonexistent. In this example, the top step represents the wind direction; the next step is the surface current; all subsequent steps circularly descending represent deeper and deeper levels of the ocean until there is no movement at all. Students will be instructed to sketch this "diminishing staircase" and to label the steps accordingly with respect to the Ekman Spiral.

The Gulf Stream is one of eight major surface currents—or rivers since they span several thousand kilometers in length—that make up the pattern of worldwide circulation: As described by Dr. Turekian:

"Consider the northern hemisphere of the Atlantic Ocean. The prevailing westerlies and easterlies blowing across the ocean cause surface water to 'pile up' in the Sargasso Sea as the result of the Coriolis force acting on the surface ocean layer and its resulting Ekman Spiral. As water piles up it flows downhill as the result of gravity. This flow results in the development of a gigantic oceanwide clockwise gyre. The current is intensified on the western side of the ocean because of Earth's rotation. As this water has come from a tropical zone where heating of the surface ocean is the most intense, the intensified boundary current transports warm water northward at a high velocity in a narrow ribbon we call the Gulf Stream." ("The Circulation of the Atmosphere and Oceans," *Global Environmental Change,* Turekian, page 92.) As in the examples given thus far of nature setting the stage for fiction (or belief)—Noah, Deucalion and Pyrrh, Odysseus—The Gulf Stream also sets the very real story of Cinqué in motion. (Steven Spielberg will be releasing his film version of this story, *Amistad,* around January, 1998, starring Anthony Hopkins, Morgan Freeman and Matthew McConnaughey; screenplay by Steven Zaillian, who also wrote *Schindler's List* .)

Cinqué—who has become a hero of civil liberties, and whose statue appears in front of Town Hall in New Haven—was a Mende from Sierra Leone (a country on the northwest coast of Africa). Captured by Africans and sold to Portuguese slave traders, Cinqué, along with approximately 600 other men, women and children, was shipped to Cuba. There, José Ruiz and Pedro Montés bought him and 52 other people, four of them children. Having contracted an American-built schooner especially designed for slave trade, the Amistad set sail for Puerto Principé (about 300 miles from Havana). After three nights at sea—and in view of the tremendous hardships and indignities he and his countrymen had suffered—Cinqué got free of his chains and led a revolt to take control of the Amistad. The Captain (Ferrer) and one of his personal slaves (Celestino) were killed by the Africans; the sailors jumped ship; Montés and Ruiz were wounded; several Africans died, although it is not known how many. The Africans knew well enough that they must sail toward the rising sun to travel east toward their homeland. But night-time traveling posed a problem since they did not know how to navigate by the stars, and so they had to place their trust in Montés and Ruiz to sail at night. Two months hence, the Amistad—with Montés and Ruiz surreptitiously maneuvering her north at night, carrying the schooner at a clip of approximately 1.5 meters per second along the Gulf Stream—anchored at Culloden Point (the northern peninsula of the eastern tip of Long Island).

In 1841—three years after his capture—Cinqué and 35 survivors were able to return home, but not until five court cases had been conducted. While the law of the land served eventually to set them free, the moral issue of slavery had yet to be addressed since their case had depended upon determining whether or not they were legally property or, in fact, human beings. As Jeannette Rogers so eloquently puts it:

"The story of the Amistad Affair is a confrontation on the national and international level of law, morality and treaties . . . It is a very important case in the history of slavery and abolition. It is also a very important story

in the history of the relationship between those people whose ancestors were brought to this country as slaves and those whose ancestors came here seeking freedom." Students will share in an oral reading of an account of of this story titled *The Amistad Affair* by Jeannette Rogers, which is a condensed version from her original work under the same title (published by YNHTI in 1990, *Learning Through Drama,* Vol. 2, under the name Jeannette Gaffney). When discussing this story, we will take a look at how the Gulf Stream, in part, was responsible for Cinqué's thwarted escape attempt and eventual arrival in Connecticut. Furthermore, we will discuss the American judicial system in relation to the court cases that took place and students will work on improvising court room scenes related to these cases. Lastly, students will receive their folders back to review their answers thus far to the questions *"Who are you?"* and *"Where did the world come from?"* They will be given approximately five minutes to add to their answers in relation to the Maya Angelou quote at the beginning of this section.

As a final note with respect to YNHTI, it should be noted that Josiah Gibbs, linguistics professor for Yale University at this time, was instrumental in locating a translator for the case in the person of James Covey—a Mende and a sailor at New York Harbor—by using the numbers one to ten in Mende.

GLOBAL CITIZENSHIP and Long Island Sound

"Greed, tribal feuds, and international manipulations have led to massive programmed destructions of large populations. Our capacity as a species for self-destruction by direct killing far transcends our ability to do it by the subtle procedure of altering the environment." Karl K. Turekian (*Global Environmental Change,* page 194) As the ancient Greeks looked from the shore, they beheld a fluid magnificence that provided food and served as a highway; one they could immerse themselves in; one that they could stand back from, gaze at and wonder about its infinite expanse. As Homer illustrated in *The Odyssey,* this was a force that could be beneficent or formidable. Overall, it was one that early man was powerless to control, but would have to reckon with in order to survive. Initially, in their fear and awe, the ancient Greeks came to call this force Poseidon and worshiped it as a god. Later on, natural philosophers would attempt to discern the nature of this puissance through observation, reason and logic. In modern times, scientists can explain much of the ocean. They can divide it into zones, map its floor, categorize the life that abounds within, and predict annual shifts of tectonic plates within inches per year. But for the most part—for many of us—we still remain ignorant of this ubiquitous aspect of our world. Moreover, unlike our ancient counterparts, we have become irreverent of its power. We have maligned it through our carelessness, our shortsightedness, our greed and our violence. Considering that we live on a water planet as approximately 70% of the Earth's surface is covered by oceans—that we, ourselves, are made up of approximately 65% water—learning about the ocean is not only academically sound, it is essential to our education as global citizens.

Lesson Ten: A Living Time Line of Long Island Sound

"The time will soon be here when my grandchild will long for the cry of a loon, the flash of a salmon, the whisper of the spruce needles, or the screech of an eagle. But he will not make friends with any of these creatures and when his heart aches with longing he will curse me. Have I done all to keep the air fresh? Have I left the eagle to soar in freedom? Have I done everything I could to earn my grandchild's fondness? Chief Dan George 1899-1981 (from *My Spirit Soars,* 1982) Global citizenship begins at home by taking a look at Long

Island Sound's history (which students will cover in their Science classes as well). Students will engage in an oral reading of "History Along the Sound" from *The Soundbook* (pages 11—14). After reading these four pages, they will be given the *Long Island Sound Historical Timeline* handout, which I composed by summarizing information from this text (see appendix). Five groups of students from both of my eighth grade Theater classes will be formed. The assignment for each group will be to depict (in pantomime) a series of events along the time line that demonstrate one of the five main categories represented therein: 1) Native Americans; 2) English and Dutch Settlers; 3) Maritime Development; 4) Transportation; 5) Industrial Development. Each group will select one of its members to act as a narrator, who will read a segment from the "History Along the Sound" text as the group performs their pantomime. At the end of the segment, the group should strike a tableau (actors remain frozen in a picturesque fashion). The groups will present their works-in-progress in the last half of their respective classes. Since this living time line will be included in the town meeting presentations, students will be rehearsing their creations in later classes.

Lesson Eleven: Becoming a Global Citizen

"Can anyone believe it is possible to lay down such a barrage of poisons on the surface of the earth without making it unfit for all life?" (Rachel Carson, *Silent Spring,* 1962) Rachel Carson's words of warning against pesticides, especially DDT, as set forth in her work, *Silent Spring,* published in 1962, issued in a new era of ecological awareness for the American public. Prompted by growing concern from voters in the early 60's, John F. Kennedy, then president, formed a special commission to study the effects of pesticides. Almost a decade later, on January 1st, 1970, President Nixon signed the National Environmental Policy Act into law. In April of that same year, I along with thousands of other college students and concerned citizens, celebrated (if not demonstrated) the first Earth Day. And for that day, for those of us who participated nationwide, we were not only Americans, but global citizens as well. Students will learn more about these events and the early beginnings of environmental protection by reviewing Chapter Nine, "Protecting the Environment" from their social studies text, *Exploring American History* (pages 664-667). Using the information in this text regarding the Exxon Valdez oil spill—which occurred on March 24, 1989 when an oil tanker hit a reef and spilled 11 million gallons of crude oil into Alaska's Prince William Sound—as a more recent unnatural disaster, we will engage in a discussion about the effects of the oil spill on local ecology, as well as its impact on Americans and the rest of the world.

Next, students will be presented with definitions for the word, "ecology" taken from the *American Heritage Dictionary:* 1.a. The science of the relationships between organisms and their environments. Also called bionomics. b. The relationship between organisms and their environment. 2. The branch of sociology that is concerned with studying the relationships between human groups and their physical and social environments. Also called human ecology. 3. The study of the detrimental effects of modern civilization on the environment, with a view toward prevention or reversal through conservation. Also called human ecology.

Afterward, we will have a discussion concerning how one can take responsibility for the ecological viability of the Earth, i.e., locally, nationwide and globally. In this discussion we will refer to the work that students have been doing with respect to Long Island Sound ecology in their Science class and Reading or Study Skills classes. Lastly, students will refer back to their folders with regard to the questions *"Who are you?"* and *"Where did the world come from?"* They will be given approximately twenty minutes to expand upon their answers thus far, this time focusing on ecology in relation to Dr. Turekian's quote at the beginning of this section.

Lessons Twelve to Twenty: Town Meeting Presentation Production

The pedagogy for the eighth grade town meeting production appears below in lesson plan format.

LESSON PLAN

TOPIC:
An Eighth Grade Meeting on Long Island Sound

OBJECTIVES:
Students will utilize the research, writing and dramatic work that they have covered thus far (in Science, Reading Enrichment, Study Skills and Theater classes) with respect to oceanography and Long Island Sound in order to present the fruits of their labors in an all-day event featuring various presentations, skits, a life-size diorama, and an exhibition of student graphics.

INTRODUCTION (and Method):
The goals and objectives of this curriculum unit will be reiterated to students, with particular emphasis on the upcoming town meeting. By this point in the unit, students will be well on their way into researching topics (in their Science, Reading and Study Skills classes) for presentation in the culminating activity of the town meeting. We will review the work they have done thus far in these classes, as well as the work we have done in Theater class.

Students will receive the *Presentation Schedule & Production Objectives* handout (below), which shows the presentations that will be offered in our town meeting; length of each presentation; technical requirements; and individuals who will need to be scheduled for rehearsal. (An outline of the town meeting also appears in the introduction to "The Betsy Ross Arts Magnet School Team.") Students will be invited to offer comments and suggestions for improvement with regard to the schedule and these will be incorporated into the overall plan. In these next six to eight classes, students will be involved in every aspect of the town meeting production. The roles and responsibilities of technical production will be determined and rehearsal schedules will be set.

PRESENTATION SCHEDULE & PRODUCTION OBJECTIVES

1. Introduction and the Geologic History of Long Island Sound (5-7 minutes); 35mm slide presentation; narration rehearsal.
2. Long Island Sound, A Living Time Line (5-7 minutes); costumes and props; narration and acting rehearsal.
3. Sound Ecology, Profile of a Tidal Wetland (10 minutes); life-size diorama and slide presentation; narration and stage crew rehearsal.
4. Protecting The Environment (3 minutes); narration rehearsal.
5. What is a Town Meeting?" (5 minutes); giant flow chart; narration and acting rehearsal.
6. "The Ecological Viability of Long Island Sound" (six individual presentations; 3 minutes each); slide presentations; speakers rehearsal.

7. “What We Can Do”—a panel discussion (45 minutes); dias and audience microphone stand.

Each presentation will also require lighting and sound technicians. (See an Eighth Grade Town Meeting on Long Island Sound in the introduction to “The Betsy Ross Arts Magnet School Team.”)

APPLICATIONS:

In hands-on fashion, students will be apprised that technical production includes: sets, props, costumes, makeup, sound, lighting, and sometimes slide and video projection, or special effects. These are the things that help to make a play believable or a presentation effective. In a play, we want the audience to feel like they are really in a different time and place. During a presentation, we want to grab their attention and hold it. As our town meeting will take place in our auditorium, students will be instructed in the preparation for various aspects of technical production (as shown below). Students will also be involved in the scheduling of rehearsals, directing, stage managing and performing. Presentation narrations and mini performances will be rehearsed, focusing on vocal technique, movement and blocking, method acting, and utilizing visual aids.

TECHNICAL PRODUCTION

¥ Microphones; sound system
¥ Screen for slide/video projection
¥ Projector and stand (audience center aisle)
¥ Lighting technician’s equipment
¥ Speaker’s podium (on stage)
¥ Set Design for a platform (off-stage; to left or right of proscenium) displaying life-size diorama of a section of the beach and sound such as Wilson’s diorama in the Peabody
¥ Exhibition wall space right and left of audience seating, plus additional flats to display poster projects, charts, photography and information culled from student research and field trips

Two weeks before our final presentation, we will hold after-school rehearsals and fine-tune any technical production aspects as need be. Students who put in this extra time, obviously will receive extra credit. Finally, *An Eighth Grade Town Meeting on Long Island Sound* will be presented to an audience of eighth graders (all of

whom will have participated in some capacity in bringing this project to fruition), their teachers, school administrators, parents and invited guests.

EVALUATION:
Students will be evaluated on their willingness to participate, effort given to the tasks at hand, imagination and creativity with regard to design work and writing, organizational skills, and presentation effectiveness.

MATERIALS:
(As stated above in "Applications" with respect to setups.) Additionally, we will need period costuming for students appearing in the "Long Island Sound Living Time Line" (which we will gather from our Theater Department); and art supplies for construction of our diorama (which will gather from our Art Department). Major equipment regarding microphones, sound and projection are also available in our school.

In conclusion, by using the curricular approach discussed herein, where students work on "real world" targets for "real world" activities; where they are given ample support to explore a variety of resources and to "experience" their topics, it is my hope that they will gain the kind of bone-marrow learning that results in critical as well as creative thinking, evocative and provocative exposition and persuasive and articulate speech. It is also my hope that by the end of the unit, students will be able to freely express themselves with confidence in their answers to the first two questions asked of them: *"Who are you?"* and *"Where did the world come from?"*

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(Science books appear in bold; Student Reading *)

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APPENDIX ¥ HANDOUTS

(figure available in print form)

TALKING HEADS ¥ PROFILES ***(Lesson Three Handout)***

Aristotle (340 B.C.) realized that the Earth was round in two ways, which he wrote about in his book *On the Heavens.* First he saw that the shadow the Earth cast on the surface of the moon during eclipses (when the Earth is between the sun and the moon) was always round. If the Earth had been a flat disc, then it would have cast a long oval shaped shadow instead. He also realized from Greek travelers that the North Star shown lower in the sky the further south one traveled, and higher the further north one traveled. (From the North pole, the star would appear overhead; from the equator, it appears to lie at the horizon.) Yet another clue to the round earth idea was the fact that when one observed a ship sailing into shore, he saw the sails of a ship coming over the horizon first and as the ship came closer to shore, he saw its hull. Aristotle also believed that the Earth was the center of the universe and that the universe had always existed and would continue to exist forever.

Saint Augustine (6th c. A.D.), in his book *The City of God,* expressed that the universe probably began about 5,000 B.C., which also fit with the story of "Genesis" from the Bible. Jewish and Muslim beliefs also asserted that the universe had a beginning since everything that existed had been caused or created by something that existed before it, therefore there had to be a "First Cause" to explain how the universe came to be. St. Augustine also believed that time was part of the universe that God had created and so, it too, had a beginning.

Ptolemy (2nd c. A.D.) believed that the Earth was the center of the universe and that it was surrounded by eight concentric spheres that carried the heavenly bodies around it. The first sphere carried the moon; the next, Mercury; then Venus, the sun, Jupiter, and Saturn; the final sphere held the fixed stars, which did not move individually, but orbited around the Earth in a fixed group.

Nicholas Copernicus (1514) did not believe that the Earth was the center of the known universe, but that the planets orbited the sun. He proposed a simpler model than Ptolemy's, but circulated it anonymously. As a Polish priest, he felt he had to be careful since the Catholic Church at that time felt it necessary to punish people whose ideas might challenge their own religious beliefs.

Galileo Galilei (1609) believed in Copernicus' theory. With the new invention of the telescope, he observed that the moons of Jupiter orbited around the planet, which also meant that everything did not directly around the Earth.

Johannes Kepler (1609)—in the same year that Galileo discovered Jupiter's moons—suggested that the planets did not move in circular orbits around the sun, but elliptical (elongated circle) orbits. He was not particularly happy with this discovery because it was believed (since the time of Aristotle) that the circle was a pure and perfect form. Therefore, elliptical orbits seemed less perfect, but they did seem to explain the pattern of planets that could actually be observed in the night sky far better than earlier ideas.

Isaac Newton (1687)—the author of one of the most important works ever published in the physical sciences, *Philosophiae Naturalis Principia Mathematica*— postulated (claimed as a principle of truth) that each body in the universe was attracted to every other body. The larger and closer the bodies, the more attracted to one another they became. This attraction is called universal gravitation and Newton was able to explain mathematically how planets and their satellites (moons) followed elliptical paths around the sun.

Immanuel Kant (1781)—in his work, *Critique of Pure Reason* —called the questions about whether or not the universe had a beginning "antinomies" (contradictions) because the "thesis" (proposed idea believed to be true) that time had a beginning and the "antithesis" (proposed idea believed to be untrue) that it did not, could be argued equally. So far as Kant was concerned, both his thesis and antithesis were backed by his assumption that time continued backwards forever. If the universe didn't have a beginning, then there would be no starting point, which meant that time was infinite backwards and forwards. If the universe did have a beginning, he proposed that there would be an infinite period of time before it, so why would it start at any particular point?

Edwin Hubble (1929) made the landmark observation that distant galaxies were moving away from us, which meant that the universe was expanding. With the knowledge that the universe was expanding, it could be reasoned that it had been doing so over a period of time, which also meant that at some point in the very distant past, it had been contracted into a very small, infinitely dense mass (since all this expansion had to come from somewhere). Since time is the product of matter being energized to move through space from one place to another—if nothing was moving in this tiny, supercondensed point, then time would not exist. Then something moved. Bang!—a great explosion that dispersed all the matter of the universe into space and in this process, time itself, was created.

(Information Sources: *A Brief History of Time* by Steven Hawking; *Exploring The Universe,* Prentice Hall, 1994.)

STORMY WEATHER ODYSSEY OUTLINE (Lesson 5 Handout)

PROLOGUE: When Trojan King Priam's daughter, Cassandra (also a prophetess, but no one paid attention to her), was dragged from Athena's temple by Ajax (a lesser chieftain with the same name as the great Ajax) after the fall of Troy, the gods were outraged. Athena asked for Poseidon's help:

> *Help me to vengeance . . .*
>
> Give the Greeks a bitter homecoming.
>
> Stir up your waters with wild whirlwinds when they sail.
>
> Let dead men choke the bays and line the shores and reefs.
>
> (Hamilton, p. 203)

Poseidon laid aside his anger against the Trojans and stirred up a tempest after the Greeks set sail for home. Agamemnon (King of Mycenaie) came close to losing all his ships; Menelaus (King of Sparta) was blown to Egypt; Ajax was drowned. (The Prologue is taken from THE TROJAN WOMEN by Euripides.)

THE BEGINNING OF THE ODYSSEY

Penelope and Telemachus await Odysseus' return

Athena intervenes with the gods on Mount Olympus and Zeus decided to sends Hermes with a message for Calypso

Telemachus learns from Menelaus that his father had been captured by Calypso.

Hermes brings Zeus' message to Calypso and she sets Odysseus free.

Nearly destroyed by Poseidon on his way home, Odysseus cries:

> *Oh, happy the men who fell gloriously on the plains of Troy*
>
> . . . for me to die this ignobly.
>
> *(Hamilton, p. 208)*

Odysseus arrives in the Land of the Phaeacians where the young Princess NausicaŠ tactfully directs him to see her father, King Alcinoüs:

> *People's tongues are so ill-natured . . .*
>
> If they saw a handsome man like you with me,

they would be hinting all sorts of things.

And you can easily find my father's house,

it is so much the most splendid.

Enter boldly and go straight to my mother,

who will be spinning at the hearth.

What my mother says, my father will do. *(Hamilton, p. 210)*

ODYSSEUS BEGINS HIS STORY

Having been welcomed by King Alcinoüs and after a night's rest, Odysseus began the story of his adventures for the Phaeacian chiefs.

The Cicones seek revenge for the raid upon their home, driving Odysseus back to the sea with the loss of thirty-six of his men.

A storm had drives the fleet across the sea for nine days.

Now Zeus, the lord of cloud roused in the north

a storm against the ships, and driving veils

of squall moved down like night on land and sea. . . .

We saw death in that fury, dropped the yards,

unshipped the oars, and pulled for the nearest lee:

then two long days and nights we lay offshore

worn out and sick at heart, tasting our grief. *(Fitzgerald, p. 490)*

Odysseus saves his crew from the Lotus Eaters and chains three of his men who had tasted their narcotic fruit to the ship.

Odysseus comes to the island of the Cyclops and becomes trapped in the cave of Polyphemus along with twelve of his men—six of whom Polyphemus eats.

A prodigious man

slept in this cave alone, and took his flocks

to graze afield—remote from all companions,

knowing none but savage ways, a brute

so huge, he seemed no man at all of those

who eat good wheaten bread,

but he seemed rather a shaggy mountain

reared in solitude. *(Fitzgerald, p. 490)*

Odysseus tricks the Cyclops, Polyphemus, blinding him and narrowly escaping to his ship.

Realizing his defeat, Polyphemus prays to his father, Zeus:

"O hear me, lord, blue girdler of the islands,

if I am thine indeed, and thou art father:

grant that Odysseus, raider of cities, never

see his home."

(Fitzgerald, p. 503)

Aeolüs, Keeper of The Winds, offers a satchel of hope that nearly carries Odysseus and his men home until their greed and curiosity turn them into a ship of fools.

Odysseus and his men make a narrow escape from The Laestrygonians, but the rest of the fleet is lost to the giant cannibals who caught them like fish.

Odysseus and his men dally at Aeaea, the home of Circe, a beautiful, but dangerous witch, who fell in love with Odysseus whose magic was more powerful than her own.

Teiresias foretells Odysseus' future in Hades, the underworld, warning him against harming the sacred oxen of the Sun God, Hyperion.

The Sirens try to lure Odysseus off course with their magically tempting song, but Odysseus has his men put wax in their ears and makes them tie him to the mast so that he can hear what no other man has:

"We know all things which shall be hereafter upon the earth."

(Hamilton, p. 214)

Odysseus avoids Charybdis' maelstrom by sacrificing six of his crew to Scylla, the six-headed monster:

A man surf-casting on a point of rock

for bass or mackerel, whipping his long rod

to drop the sinker and the bait far out,

will hook a fish and rip it from the surface

to dangle wriggling through the air:

so these

were borne aloft in spasms toward the cliff.

(Fitzgerald, p. 512)

Odysseus' crew commit sacrilege on Thrinacia, the island of the sun god. When Hyperion sees his precious oxen slaughtered, he prays to Zeus:

"O Father Zeus and gods in bliss forever,

punish Odysseus' men! So overweening,

now they have killed my peaceful kine, my joy

at morning when I climbed the sky of stars,

and evening, when I bore westward from heaven.

Restitution or penalty they shall pay -

and pay in full—or I go down forever

to light the dead men in the underworld."

And Zeus replies after Odysseus and his men set sail:

Then Zeus who drives the stormcloud made reply:

"Peace, Helios: shine on among the gods,

shine over mortals in the fields of grain.

Let me throw down one white-hot bolt,

and make splinters of their ship in the winedark sea." *(Fitzgerald, p. 516)*

Calypso restores Odysseus to health, but keeps him her beloved prisoner for seven years on the paradise island of Ogygia.

ODYSSEUS RETURNS HOME AT LAST

Alcinoüs, the Phaeacian King, helps Odysseus with a ship laden with gifts and a crew to take him back to Ithaca. When Odysseus meets Athena (disguised as a young shepherd, he spins a tall tale.

Athena then appears as herself and laughs:

> *"You crooked, shifty rogue!*
>
> Anyone who could keep pace with your craftiness
>
> must be a canny dealer." *(Hamilton, 315)*

Athena, Goddess of Wisdom, has a plan and disguises Odysseus as a beggar and sends him off to Eumaeus, the swineherd.

Telemachus has a telling dream and secretly returns to Ithaca to seek out Eumaeus.

Odysseus and Telemachus are reunited with the help of Athena. At first Telemachus thinks his father is a god:

> *"No god. Why take me for a god? No, no.*
>
> I am that father whom your boyhood lacked
>
> and suffered pain for lack of. I am he."
>
> Held back too long, the tears ran down his cheeks
>
> as he embraced his son.
>
> (Fitzgerald, p. 521)

Upon the advice of Athena, Telemachus returns to the palace to hide all the weapons except for his and his father's. Odysseus returns home a little later that morning in disguise and no one but his old hunting dog, Argo, recognizes him.

Penelope makes an announcement to the obnoxious suitors that she will choose a new husband, but must be treated properly and expects the suitors to present her with gifts to show their good intentions.

Penelope meets the old beggar (Odysseus in disguise) who tells her about her husband's (his) bravery during the Trojan War. She sends for Eurycleia (Odysseus' old nurse), to bathe the stranger's tired feet, but when the old woman sees the scar on the beggar's foot, Odysseus covers her mouth, and makes her promise not to reveal his identity.

Penelope challenges the suitors; whoever among them can string Odysseus' great bow and shoot an arrow straight through twelve rings set in a line, will become her new husband.

Odysseus easily meets Penelope's challenge:

Odysseus easily meets Penelope's challenge:

> *But the man skilled in all ways of contending,*
>
> satisfied by the great bow's look and heft,
>
> like a musician, like a harper, when
>
> with quiet hand upon his instrument
>
> he draws between his thumb and forefinger
>
> a sweet new string upon a peg: so effortlessly
>
> Odysseus in one motion strung the bow.
>
> Then slid his right hand down the cord and plucked it,
>
> so the taut gut vibrating hummed and sang
>
> a swallow's note.
>
> (Fitzgerald, p. 534)

After shooting an arrow straight through the twelve rings, Odysseus takes revenge against the wicked suitors who would steal his beloved Penelope, with the help of Telemachus and Eumaeus.

Still not able to trust that he is who he says he is, Penelope tests Odysseus by telling Eurycleia to set his bed outside the bedchamber:

> *"Woman, by heaven you've stung me now!*
>
> . . . An old trunk of olive
>
> grew like a pillar on the building plot,
>
> and I laid out our bedroom round that tree
>
> . . ."
>
> "Their secret! as she heard it told, her knees
>
> grew tremulous and weak, her heart failed her.
>
> With eyes brimming tears she ran to him,
>
> throwing her arms around his neck, and kissed him." *(Fitzgerald, p. 543)*

Knowing that only her husband would know of their marriage bed, Penelope was finally secure in knowledge that Odysseus had at last come home.

(Information Sources:
Edith Hamilton's exposition "The Adventures of Odysseus,"Mythology, pp. 202-219; 8th Grade English handout, An Epic Poem, translations by Robert Fitzgerald, pp. 488-544)

ALL COLOR BOOK OF GREEK MYTHOLOGY photos:

Plate 13: The peak of Mount Olympus (location photo).
Plate 14: Gold death mask found in Mycenaie by Schliemann, the archaeologist who believed it to represent the face of Agamemnon.
Plate 21: Zeus enthroned (marble statue).
Plate 32: Demeter (marble statue, fourth century B.C.).
Plate 39: The birth of Athena (pottery painting).
Plate 41: Apollo (Etruscan terracotta statue of the fifth century B.C.).
Plate 48: Artemis (statue).
Plate 52: Aphrodite (marble statue).
Plate 29: Poseidon (bronze statue).
Plate 94: Menelaus and Hector, the Trojan Prince, in combat ("Euphorbus Plate," painted plate named after Euphorbus).
Plate 95: Hector and Achilles face to face at the Scaean Gate (pottery painting).
Plate 96: Apollo watching Ajax drag Cassandra away from the alter of Athena (fourth century lekythos painting).
Plate 98: Odysseus blinding Polyphemus (pottery painting).
Plate 101: Odysseus, protected by Hermes' magic herb, accepts the drink offered by Circe (Theban vase, fourth century).
Plate 100: Odysseus bound to the mast of his ship as he and his men sail past the Sirens (an Attic vase painting of the fifth century B.C.).
Plate 102: Odysseus home in Ithaca, disguised as a beggar, with Eumaeus and Eurycleia (Roman relief of the first century A.D.).

A LIVING TIME LINE OF LONG ISLAND SOUND (Lesson 10 Handout)

NATIVE AMERICANS

A few thousand years ago: Early ancestors of Native American tribes come to the Connecticut coast. Native Americans rely on the Sound for fish and shellfish.

1600s: About 5,000 people from thirteen tribes live on Long Island when the first settlers come. Wampum, made from sea shells, is used by Native Americans as money.

ENGLISH & DUTCH SETTLERS

1614: Dutch explorer, Adriaen Block, sails through Hell Gate and discovers Long Island Sound. (Block Island is named after him.)
1620: Southhold settlement is established on the North Shore of Long Island.
1623: Wading River settlement is estab-lished on the North Shore of Long Island
1632: Representatives of Dutch West India Company purchase Old Saybrook from Native Americans. Jacob Van Curler buys Hartford. The English begin purchasing land and settling in Connecticut and Long Island.
1633: Windsor, the first English settlement in Connecticut is established.
(1633-1658): Coastline towns are pur-chased: Greenwich, Stamford, Norwalk, Stratford, New Haven, Branford, Guilford, Norwich and New London.
1636-1637: Pequot War: Pequot village near Mystic River in Connecticut is raided.
1653: Cold Spring Harbor is established on the North Shore of Long Island.
1655: Port Jefferson is established on the North Shore of Long Island.
1676: War between settlers and Native Americans in Connecticut, Rhode Island and Massachusetts. Many die on both sides. Settlers win. Many Indians die of smallpox.

MARITIME DEVELOPMENT

early 1700s: Native Americans are gone from the eastern seaboard. Trade routes between

Connecticut and the West Indies become a money-making source. Oystering is regulated by Connecticut laws.
1754-1763: French and Indian War affects seafaring business.
1776-1783: Revolutionary War also affects seafaring business. British occupy Long Island, but not Connecticut coastline towns. Privateers (privately owned armed ships) sail into Connecticut ports and capture almost 500 British ships. Connecticut becomes a leader in making firearms and gunpowder.
after the Revolution: West Indian trade drops off. New York and other ports com-pete for business. People develop new and useful products to sell. Coastline factory villages are established.
1790s: Commercial fishing for shad and salmon are threatened by manmade dams built along the Connecticut River. Fish cannot get up the river to spawn.
1798: American factory system starts in New Haven, Connecticut. Eli Whitney fills an order for 10,000 muskets for the federal government.
19th century: The steam engine is invented, making steamships and railroads possible.
mid-1800s: Shipbuilding is a profitable business, especially because of the whaling boom. Oyster cultivation begins.

TRANSPORTATION

1832: The New York and Stonington Railroad was chartered. The Long Island Railroad was started as an alternative route from New York to Boston; a ferry made the connection across the Sound from Greenport to Stonington.
1844: New Haven line connecting New York with New Haven opens.
1850: The Long Island Railroad of the day is bankrupt.
INDUSTRIAL DEVELOPMENT
late 1800s: Petroleum is discovered, which makes the whaling industry decline. Menhaden is an important business as the fish are used for fertilizer, but dies out later on.
1900s: Industrial development changes Connecticut's economy from farming to manufacturing.
(Information Source: *The Soundbook* , Soundkeeper Fund, 1994)