2016
Summer
HSA Biology
Resource Packet

JUNE

Name: ___________________________________ June 21, 2016

THE SCIENTIFIC INQUIRY IN MEDICINE

Science has been a latecomer in the world's history. Up until the 20th century, there was no precise testing of any treatment. If the patient didn't die and did recover, there was acceptance that whatever treatment was given must have worked. Most of what was done for the patient was not helpful, but not harmful either. At times, however, it was dangerous. For instance, our founding father, George Washington, was bled in 1799 when he had pneumonia, undoubtedly hastening his death. In the 1800s, things hadn't really changed very much. And why? One main reason was that there were so few good treatments for any medical condition. Even as late as the 1950s, the effective medications were few: the heart medicine digitalis, aspirin, sulfa and another new antibiotic called penicillin, a few toxic diuretics, some hormones, Maalox for indigestion and herbs. Even though there was little to offer (we didn't really know it at the time) patients still came to see physicians and patients did get better.

So what is *[Scientific Inquiry]*—on which all modern medicine and science are based? ***Simply put, it means that a treatment or a hypothesis is subjected to rigorous testing to see if the treatment works or if the hypothesis is true.*** For example, ***a scientist hypothesizes*** that a drug will be effective in treating a certain disease. The fact that the scientist wants to believe it does not make it so. ***Testing must be done.*** Sometimes, it doesn't work or it actually makes the patient worse. [The research process allows the scientific community to accumulate information to verify scientific information.] Still, it is the best system we have. All scientists, not just doctors, use this technique in one form or another.

The federal Food and Drug Administration **(FDA)** uses these scientific guidelines to approve new **treatments**. So whenever someone or some published article mentions a great treatment for some disease, we need to question the data. Testimonials by individuals don't really mean much. They can sound great but, from a scientific viewpoint, they are almost meaningless. In fact, they may actually be damaging, as there may be a serious underlying problem such as cancer, which is not discovered early.

The FDA does an enormous amount of [regulation]. To the extent possible, they assure us that the food we eat is safe. They brought us the new food labels that provide a great deal of valuable information for the consumer on calories, fat, sodium and other nutrients. They **regulate** medical devices. We would never buy a heart valve from Radio Shack and ask a physician to insert it just because a friend said it was great. Likewise, the FDA regulates the pharmaceutical drug industry [by creating a clear process for science to go through a systematic screening. This screening ensures that devices, drugs, and medical best practices are safe and lives up to their claims.] The public benefits by being assured that the prescription medicines they take and the medical devices used on them have undergone ***rigorous scientific testing***, ***(the Scientific Method).*** Who would want it any other way?

By: Frank W. Jackson, MD

<u>**Questions About the Reading**</u>

THE SCIENTIFIC INQUIRY IN MEDICINE

1. According to the author, what are characteristics of scientific inquiry in *medicine*?

2. Why is rigorous scientific testing required?

3. What do you think would happen if medicine didn't have rigorous scientific testing?

4. What is the FDA?

5. What does it mean to regulate something?

6. Do you think it's a good idea to use the scientific method in medicine? Why or why not?

June 24, 2016

Ecology Virtual Lab
"Assessing Water Quality" (and the Effects of Acid Rain)

Go to this website:

http://www.mhhe.com/biosci/genbio/virtual_labs/BL_09/BL_09.html

What is the question you are trying to answer in this lab?

____

____

____

Read the Purpose, Objective, Information, and Procedure sections, and answer the following questions.

1. What organism(s) is/are being used to test the quality of the water?

2. In this model ecosystem, what are you testing the effects of?

3. Acid rain results from the release of_________________in the air.

4. The pollutants come from_________________________such as gasoline, oil, and coal being burned by automobiles, factories, and power plants.

5. When the fossil fuels are burned, they release____________________________and _____________ _____________. These pollutants can combine with_______________and other chemicals to form_________________and sulfuric acid in the atmosphere.

6. When the water falls to Earth as rain, snow, sleet, fog, or dew, it is called_______________ ________________.

7. The_______________________used in this investigation represents acid rain.

8. The strength of acid rain is determined by reading a pH scale. The lower the pH, the more__________the solution.

9. On the pH scale a change of one unit is actually a____________change. For example, pure distilled water is neutral at pH 7. A solution at pH 6 is ten times more acidic than pure water, and a solution at pH 5 is 100 times more acidic than pure water.

10. All rain naturally has some amount of acid in it. Unpolluted rain has a pH of 5.0 - 5.6. By contrast, acid rain has a pH range of_______________.

11. In highly______________________regions, acid rain can be extremely acidic. With pH readings below 4.0, the acid rain in these areas can be as strong as________________(3.3) and sometimes even as strong as______________________(2.3).

12. When acid rain falls, it can produce many problems for the environment, particularly for forest and aquatic habitats because ____.

13. What is an indicator species? ____

List 3 ecological variables that influence their population size:

14. The 3 aquatic invertebrates that were chosen by the computer for me to start with were:

________________________,_________________________, and__________________.

Complete the Data Table – Populations of Aquatic Invertebrates at Various pH Levels.
Once the table is complete, click on the 'Graph' tab to have your information converted into a graph.

ANALYSIS QUESTIONS

1. What are the names of the species used in this experiment? Which of these species was the most tolerant of increased acidity in the aquarium? Which species was the least tolerant?

2. Describe how acid precipitation affects ecosystems.

3. What is an indicator species? How are indicator species used to assess pollution levels in the environment?

4. Suppose you are an ecologist studying the effects of acid precipitation on plant life. Describe an experiment you would perform in order to determine which plant species would be a useful indicator species for acid rain pollution.

5. How do the data represented on the Population Bar Graph compare to the data represented in the line graph titled Populations of Aquatic Invertebrates at Various pH Levels?

Easter's End (Part One)

Students will read the following passage and answer the questions at the end.

Easter's End

by Jared Diamond

From the August 1995 issue

In just a few centuries, the people of Easter Island wiped out their forest, drove their plants and animals to extinction, and saw their complex society spiral into chaos and cannibalism. Are we about to follow their lead?

Among the most riveting mysteries of human history are those posed by vanished civilizations. Everyone who has seen the abandoned buildings of the Khmer, the Maya, or the Anasazi is immediately moved to ask the same question: Why did the societies that erected those structures disappear?

Their vanishing touches us as the disappearance of other animals, even the dinosaurs, never can. No matter how exotic those lost civilizations seem, their framers were humans like us. Who is to say we won't succumb to the same fate? Perhaps someday New York's skyscrapers will stand derelict and overgrown with vegetation, like the temples at Angkor Wat and Tikal.

Among all such vanished civilizations, that of the former Polynesian society on Easter Island remains unsurpassed in mystery and isolation. The mystery stems especially from the island's gigantic stone statues and its impoverished landscape, but it is enhanced by our associations with the specific people involved: Polynesians represent for us the ultimate in exotic romance, the background for many a child's, and an adult's, vision of paradise. My own interest in Easter was kindled over 30 years ago when I read Thor Heyerdahl's fabulous accounts of his Kon-Tiki voyage.

But my interest has been revived recently by a much more exciting account, one not of heroic voyages but of painstaking research and analysis. My friend David Steadman, a paleontologist, has been working with a number of other researchers who are carrying out the first systematic excavations on Easter intended to identify the animals and plants that once lived there. Their work is contributing to a new interpretation of the island's history that makes it a tale not only of wonder but of warning as well.

Easter Island, with an area of only 64 square miles, is the world's most isolated scrap of habitable land. It lies in the Pacific Ocean more than 2,000 miles west of the nearest continent (South America), 1,400 miles from even the nearest habitable island (Pitcairn). Its subtropical location and latitude--at 27 degrees south, it is approximately as far below the equator as Houston is north of it--help give it a rather mild climate, while its volcanic origins make its soil fertile. In theory, this combination of blessings should have made Easter a miniature paradise, remote from problems that beset the rest of the world.

The island derives its name from its discovery by the Dutch explorer Jacob Roggeveen, on Easter (April 5) in 1722. Roggeveen's first impression was not of a paradise but of a wasteland: We originally, from a further distance, have considered the said Easter Island as sandy; the reason for that is this, that we counted as sand the withered grass, hay, or other scorched and burnt vegetation, because its wasted appearance could give no other impression than of a singular poverty and barrenness.

The island Roggeveen saw was grassland without a single tree or bush over ten feet high. Modern botanists have identified only 47 species of higher plants native to Easter, most of them grasses, sedges, and ferns. The list includes just two species of small trees and two of woody shrubs. With such flora, the islanders Roggeveen encountered had no source of real firewood to warm themselves during Easter's cool, wet, windy winters. Their native animals included nothing larger than insects, not even a single species of native bat, land bird, land snail, or lizard. For domestic animals, they had only chickens.

European visitors throughout the eighteenth and early nineteenth centuries estimated Easter's human population at about 2,000, a modest number considering the island's fertility. As Captain James Cook recognized during his brief visit in 1774, the islanders were Polynesians (a Tahitian man accompanying Cook was able to converse with them). Yet despite the Polynesians' well-deserved fame as a great seafaring people, the Easter Islanders who came out to Roggeveen's and Cook's ships did so by swimming or paddling canoes that Roggeveen described as bad and frail. Their craft, he wrote, were put together with manifold small planks and light inner timbers, which they cleverly stitched together with very fine twisted threads. . . . But as they lack the knowledge and particularly the materials for caulking and making tight the great number of seams of the canoes, these are accordingly very leaky, for which reason they are compelled to spend half the time in bailing. The canoes, only ten feet long, held at most two people, and only three or four canoes were observed on the entire island.

With such flimsy craft, Polynesians could never have colonized Easter from even the nearest island, nor could they have traveled far offshore to fish. The islanders Roggeveen met were totally isolated, unaware that other people existed. Investigators in all the years since his visit have discovered no trace of the islanders' having any outside contacts: not a single Easter Island rock or product has turned up elsewhere, nor has anything been found on the island that could have been brought by anyone other than the original settlers or the Europeans. Yet the people living on Easter claimed memories of visiting the uninhabited Sala y Gomez reef 260 miles away, far beyond the range of the leaky canoes seen by Roggeveen. How did the islanders' ancestors reach that reef from Easter, or reach Easter from anywhere else?

Easter Island's most famous feature is its huge stone statues, more than 200 of which once stood on massive stone platforms lining the coast. At least 700 more, in all stages of completion, were abandoned in quarries or on ancient roads between the quarries and the coast, as if the carvers and moving crews had thrown down their tools and walked off the job. Most of the erected statues were carved in a single quarry and then somehow transported as far as six miles--despite heights as great as 33 feet and weights up to 82 tons. The abandoned statues, meanwhile, were as much as 65 feet tall and weighed up to 270 tons. The stone platforms were equally gigantic: up to 500 feet long and 10 feet high, with facing slabs weighing up to 10 tons.

Roggeveen himself quickly recognized the problem the statues posed: The stone images at first caused us to be struck with astonishment, he wrote, because we could not comprehend how it was possible that these people, who are devoid of heavy thick timber for making any machines, as well as strong ropes, nevertheless had been able to erect such images. Roggeveen might have added that the islanders had no wheels, no draft animals, and no source of power except their own muscles. How did they transport the giant statues for miles, even before erecting them? To deepen the mystery, the statues were still standing in 1770, but by 1864 all of them had been pulled down, by the islanders themselves. Why then did they carve them in the first place? And why did they stop? **To be continued…**

Answer the following questions.

1. Where is Easter Island?

2. Why is Jared Diamond so interested in this place?

3. What does his friend David Steadman do?

4. What observation did Roggeveen make that made it seem unlikely that the inhabitants got there by boat?

5. Describe the vegetation and animal species Roggeveen saw.

6. What was the evidence that suggested the people were Polynesian?

7. What is the mystery surrounding the huge Easter Island statues?

8. What is your hypothesis of the function of the statues? Why do you think the Easter Islanders went to so much trouble to erect the statues?

Graphing Practice – Part I

Using the estimated data in these two charts, draw two graphs. Make sure the axes are labeled correctly with units and to scale. You may draw both graphs on a single sheet divided into two sections. Answer questions at the bottom of this page.

Number of people alive in specific years (estimated)

Year	Number of people on Easter Island
400	0
600	20
800	45
1000	500
1200	2,500
1400	6,000
1600	2,500
1800	300

"Relative Productivity of Easter Island in Specific Years"

Year	Relative Productivity (kilograms of food)
400	500
600	500
800	500
1000	450
1200	300
1400	50
1600	20
1800	20

Questions

1. Interpret the two graphs in one sentence: "As the population grew, the…

2. Remembering from your ecology study, how does the first graph differ from one showing carrying capacity?

3. Explain the trend in the first graph?

Easter's End (continued…part 2)

by Jared Diamond

From the August 1995 issue.

Students will read the following passage and answer the questions at the end.

How did they transport the giant statues for miles, even before erecting them? To deepen the mystery, the statues were still standing in 1770, but by 1864 all of them had been pulled down, by the islanders themselves. Why then did they carve them in the first place? And why did they stop?

The statues imply a society very different from the one Roggeveen saw in 1722. Their sheer number and size suggest a population much larger than 2,000 people. What became of everyone? Furthermore, that society must have been highly organized. Easter's resources were scattered across the island: the best stone for the statues was quarried at Rano Raraku near Easter's northeast end; red stone, used for large crowns adorning some of the statues, was quarried at Puna Pau, inland in the southwest; stone carving tools came mostly from Aroi in the northwest. Meanwhile, the best farmland lay in the south and east, and the best fishing grounds on the north and west coasts. Extracting and redistributing all those goods required complex political organization. What happened to that organization, and how could it ever have arisen in such a barren landscape?

Easter Island's mysteries have spawned volumes of speculation for more than two and a half centuries. Many Europeans were incredulous that Polynesians--commonly characterized as mere savages--could have created the statues or the beautifully constructed stone platforms. In the 1950s, Heyerdahl argued that Polynesia must have been settled by advanced societies of American Indians, who in turn must have received civilization across the Atlantic from more advanced societies of the Old World. Heyerdahl's raft voyages aimed to prove the feasibility of such prehistoric transoceanic contacts. In the 1960s the Swiss writer Erich von Däniken, an ardent believer in Earth visits by extraterrestrial astronauts, went further, claiming that Easter's statues were the work of intelligent beings who owned ultramodern tools, became stranded on Easter, and were finally rescued.

Heyerdahl and Von Däniken both brushed aside overwhelming evidence that the Easter Islanders were typical Polynesians derived from Asia rather than from the Americas and that their culture (including their statues) grew out of Polynesian culture. Their language was Polynesian, as Cook had already concluded. Specifically, they spoke an eastern Polynesian dialect related to Hawaiian and Marquesan, a dialect isolated since about A.D. 400, as estimated from slight differences in vocabulary. Their fishhooks and stone adzes resembled early

Marquesan models. Last year DNA extracted from 12 Easter Island skeletons was also shown to be Polynesian. The islanders grew bananas, taro, sweet potatoes, sugarcane, and paper mulberry--typical Polynesian crops, mostly of Southeast Asian origin. Their sole domestic animal, the chicken, was also typically Polynesian and ultimately Asian, as were the rats that arrived as stowaways in the canoes of the first settlers.

What happened to those settlers? The fanciful theories of the past must give way to evidence gathered by hardworking practitioners in three fields: archeology, pollen analysis, and paleontology.

Modern archeological excavations on Easter have continued since Heyerdahl's 1955 expedition. The earliest radiocarbon dates associated with human activities are around A.D. 400 to 700, in reasonable agreement with the approximate settlement date of 400 estimated by linguists. The period of statue construction peaked around 1200 to 1500, with few if any statues erected thereafter. Densities of archeological sites suggest a large population; an estimate of 7,000 people is widely quoted by archeologists, but other estimates range up to 20,000, which does not seem implausible for an island of Easter's area and fertility.

Archeologists have also enlisted surviving islanders in experiments aimed at figuring out how the statues might have been carved and erected. Twenty people, using only stone chisels, could have carved even the largest completed statue within a year. Given enough timber and fiber for making ropes, teams of at most a few hundred people could have loaded the statues onto wooden sleds, dragged them over lubricated wooden tracks or rollers, and used logs as levers to maneuver them into a standing position. Rope could have been made from the fiber of a small native tree, related to the linden, called the hauhau. However, that tree is now extremely scarce on Easter, and hauling one statue would have required hundreds of yards of rope. Did Easter's now barren landscape once support the necessary trees?

That question can be answered by the technique of pollen analysis, which involves boring out a column of sediment from a swamp or pond, with the most recent deposits at the top and relatively more ancient deposits at the bottom. The absolute age of each layer can be dated by radiocarbon methods. Then begins the hard work: examining tens of thousands of pollen grains under a microscope, counting them, and identifying the plant species that produced each one by comparing the grains with modern pollen from known plant species. For Easter Island, the bleary-eyed scientists who performed that task were John Flenley, now at Massey University in New Zealand, and Sarah King of the University of Hull in England.

Flenley and King's heroic efforts were rewarded by the striking new picture that emerged of Easter's prehistoric landscape. For at least 30,000 years before human arrival and during the early years of Polynesian settlement, Easter was not a wasteland at all. Instead, a subtropical forest of trees and woody bushes towered over a ground layer of shrubs, herbs, ferns, and grasses. In the forest grew tree daisies, the rope- yielding hauhau tree, and the toromiro tree, which furnishes a dense, mesquite-like firewood. The most common tree in the forest was a species of palm now absent on Easter but formerly so abundant that the bottom strata of the sediment column were packed with its pollen. The Easter Island palm was closely related to the still-surviving Chilean wine palm, which grows up to 82 feet tall and 6 feet in diameter. The tall, unbranched trunks of the Easter Island palm would have been ideal for transporting and erecting statues and constructing large canoes. The palm would also have been a valuable food source, since its Chilean relative yields edible nuts as well as sap from which Chileans make sugar, syrup, honey, and wine.

What did the first settlers of Easter Island eat when they were not glutting themselves on the local equivalent of maple syrup? Recent excavations by David Steadman, of the New York State Museum at Albany, have yielded a picture of Easter's original animal world as surprising as Flenley and King's picture of its plant world. Steadman's expectations for Easter were conditioned by his experiences elsewhere in Polynesia, where fish are overwhelmingly the main food at archeological sites, typically accounting for more than 90 percent of the bones in ancient Polynesian garbage heaps. Easter, though, is too cool for the coral reefs beloved by fish, and its cliff-girded coastline permits shallow-water fishing in only a few places. Less than a quarter of the bones in its early garbage heaps (from the period 900 to 1300) belonged to fish; instead, nearly one-third of all bones came from porpoises.

Nowhere else in Polynesia do porpoises account for even one percent of discarded food bones. But most other Polynesian islands offered animal food in the form of birds and mammals, such as New Zealand's now extinct giant moas and Hawaii's now extinct flightless geese. Most other islanders also had domestic pigs and dogs. On Easter, porpoises would have been the largest animal available--other than humans. The porpoise species identified at Easter, the common dolphin, weighs up to 165 pounds. It generally lives out at sea, so it could not have been hunted by line fishing or spearfishing from shore. Instead, it must have been harpooned far offshore, in big seaworthy canoes built from the extinct palm tree.

In addition to porpoise meat, Steadman found, the early Polynesian settlers were feasting on seabirds. For those birds, Easter's remoteness and lack of predators made it an ideal haven as a breeding site, at least until humans arrived. Among the prodigious numbers of seabirds that bred on Easter were albatross, boobies, frigate birds, fulmars, petrels, prions, shearwaters, storm petrels, terns, and tropic birds. With at least 25 nesting species, Easter was the richest seabird breeding site in Polynesia and probably in the whole Pacific.

Land birds as well went into early Easter Island cooking pots. Steadman identified bones of at least six species, including barn owls, herons, parrots, and rail. Bird stew would have been seasoned with meat from large numbers of rats, which the Polynesian colonists inadvertently brought with them; Easter Island is the sole known Polynesian island where rat bones outnumber fish bones at archeological sites. (In case you're squeamish and consider rats inedible, I still recall recipes for creamed laboratory rat that my British biologist friends used to supplement their diet during their years of wartime food rationing.)

Porpoises, seabirds, land birds, and rats did not complete the list of meat sources formerly available on Easter. A few bones hint at the possibility of breeding seal colonies as well. All these delicacies were cooked in ovens fired by wood from the island's forests.

Such evidence lets us imagine the island onto which Easter's first Polynesian colonists stepped ashore some 1,600 years ago, after a long canoe voyage from eastern Polynesia. They found themselves in a pristine paradise. What then happened to it? The pollen grains and the bones yield a grim answer.

Answer the following questions in your notebook.

1. What evidence is there that there was an organized society on this island?
2. What are two alternate hypotheses for the origins of the Easter Islanders?
3. What crops and animals did the inhabitants bring with them?
4. What do studies of plant pollen reveal about the trees on Easter Island?
5. What do these finding suggest about how the statues were transported?
6. What evidence is there to suggest the Easter Islanders had large boats made out of huge palm trees?
7. Can you suggest an answer to the final question: What happened to the islanders' pristine paradise?

June 28, 2016

Graphing Practice – Part II: Graph the data on both charts on a single sheet of graph paper

"Apples Ripening With Exposure to Ethylene"

Amount of ethylene in ml/m^2	Wine sap Apples: Days to Maturity	Golden Apples: Days to Maturity	Gala Apples: Days to Maturity
1	14	14	15
1	12	12	13
2	11	9	10
2	10	7	9
3	8	7	8
3	8	7	7

A. Ethylene is a plant hormone that causes fruit to mature. The data above shows how long it takes for fruit to ripen after spraying ethylene on apple trees.
B. Make a line graph of the data.
C. What is the dependent variable?
D. What is the independent variable?
E. Which apple variety ripens the quickest?
F. What is the least amount of ethylene needed to ripen this apple?

Tree Growth in Two Forests

Age of the tree in years	Average thickness of the annual rings in cm. Forest A	Average thickness of the annual rings in cm. Forest B
1	2.0	2.2
2	2.2	2.5
3	3.5	3.6
3	3.0	3.8
5	4.5	4.0
6	4.3	4.5

A. The thickness of the annual rings indicates the type of environmental situation was occurring at the time of its development. What biotic and abiotic factors do you think could affect the width of rings?
B. Make a line graph of the data.
C. What is the dependent variable?
D. What is the independent variable?
E. What was the average thickness of the annual rings of 40-year-old trees in Forest A?
F. Based on this data, what can you conclude about Forest A and Forest B?

June 29, 2016

Easter's End (continued…third and final part)

by Jared Diamond

From the August 1995 issue

…evidence lets us imagine the island onto which Easter's first Polynesian colonists stepped ashore some 1,600 years ago, after a long canoe voyage from eastern Polynesia. They found themselves in a pristine paradise. What then happened to it? The pollen grains and the bones yield a grim answer

Pollen records show that destruction of Easter's forests was well under way by the year 800, just a few centuries after the start of human settlement. Then charcoal from wood fires came to fill the sediment cores, while pollen of palms and other trees and woody shrubs decreased or disappeared, and pollen of the grasses that replaced the forest became more abundant. Not long after 1400 the palm finally became extinct, not only as a result of being chopped down but also because the now ubiquitous rats prevented its regeneration: of the dozens of preserved palm nuts discovered in caves on Easter, all had been chewed by rats and could no longer germinate. While the hauhau tree did not become extinct in Polynesian times, its numbers declined drastically until there weren't enough left to make ropes from. By the time Heyerdahl visited Easter, only a single, nearly dead toromiro tree remained on the island, and even that lone survivor has now disappeared. (Fortunately, the toromiro still grows in botanical gardens elsewhere.)

The fifteenth century marked the end not only for Easter's palm but for the forest itself. Its doom had been approaching as people cleared land to plant gardens; as they felled trees to build canoes, to transport and erect statues, and to burn; as rats devoured seeds; and probably as the native birds died out that had pollinated the trees' flowers and dispersed their fruit. The overall picture is among the most extreme examples of forest destruction anywhere in the world: the whole forest gone, and most of its tree species extinct.

The destruction of the island's animals was as extreme as that of the forest: without exception, every species of native land bird became extinct. Even shellfish were overexploited, until people had to settle for small sea snails instead of larger cowries. Porpoise bones disappeared abruptly from garbage heaps around 1500; no one could harpoon porpoises anymore, since the trees used for constructing the big seagoing canoes no longer existed. The colonies of more than half of the seabird species breeding on Easter or on its offshore islets were wiped out.

In place of these meat supplies, the Easter Islanders intensified their production of chickens, which had been only an occasional food item. They also turned to the largest remaining meat source available: humans, whose bones became common in late Easter Island garbage heaps. Oral traditions of the islanders are rife with cannibalism; the most inflammatory taunt that could be snarled at an enemy was the flesh of your mother sticks between my teeth. With no wood available to cook these new goodies, the islanders resorted to sugarcane scraps, grass, and sedges to fuel their fires.

All these strands of evidence can be wound into a coherent narrative of a society's decline and fall. The first Polynesian colonists found themselves on an island with fertile soil, abundant food, bountiful building materials, ample lebensraum, and all the prerequisites for comfortable living. They prospered and multiplied.

After a few centuries, they began erecting stone statues on platforms, like the ones their Polynesian forebears had carved. With passing years, the statues and platforms became larger and larger, and the statues began sporting ten-ton red crowns--probably in an escalating spiral of one-upmanship, as rival clans tried to surpass each other with shows of wealth and power. (In the same way, successive Egyptian pharaohs built ever-larger pyramids. Today Hollywood movie moguls near my home in Los Angeles are displaying their wealth and power by building ever more ostentatious mansions. Tycoon Marvin Davis topped previous moguls with plans for a 50,000-square-foot house, so now Aaron Spelling has topped Davis with a 56,000-square-foot house. All that those buildings lack to make the message explicit are ten-ton red crowns.) On Easter, as in modern America, society was held together by a complex political system to redistribute locally available resources and to integrate the economies of different areas.

Eventually Easter's growing population was cutting the forest more rapidly than the forest was regenerating. The people used the land for gardens and the wood for fuel, canoes, and houses--and, of course, for lugging statues. As forest disappeared, the islanders ran out of timber and rope to transport and erect their statues. Life became more uncomfortable-- springs and streams dried up, and wood was no longer available for fires.

People also found it harder to fill their stomachs, as land birds, large sea snails, and many seabirds disappeared. Because timber for building seagoing canoes vanished, fish catches declined and porpoises disappeared from the table. Crop yields also declined, since deforestation allowed the soil to be eroded by rain and wind, dried by the sun, and its nutrients to be leeched from it. Intensified chicken production and cannibalism replaced only part of all those lost foods. Preserved statuettes with sunken cheeks and visible ribs suggest that people were starving.

With the disappearance of food surpluses, Easter Island could no longer feed the chiefs, bureaucrats, and priests who had kept a complex society running. Surviving islanders described to early European visitors how local chaos replaced centralized government and a warrior class took over from the hereditary chiefs. The stone points of spears and daggers, made by the warriors during their heyday in the 1600s and 1700s, still litter the ground of Easter today. By around 1700, the population began to crash toward between one-quarter and one-tenth of its former number. People took to living in caves for protection against their enemies. Around 1770 rival clans started to topple each other's statues, breaking the heads off. By 1864 the last statue had been thrown down and desecrated.

As we try to imagine the decline of Easter's civilization, we ask ourselves, Why didn't they look around, realize what they were doing, and stop before it was too late? What were they thinking when they cut down the last palm tree?

I suspect, though, that the disaster happened not with a bang but with a whimper. After all, there are those hundreds of abandoned statues to consider. The forest the islanders depended on for rollers and rope didn't simply disappear one day--it vanished slowly, over decades. Perhaps war interrupted the moving teams; perhaps by the time the carvers had finished their work, the last rope snapped. In the meantime, any islander who tried to warn about the dangers of progressive deforestation would have been overridden by vested interests of carvers, bureaucrats, and chiefs, whose jobs depended on continued deforestation. Our Pacific Northwest loggers are only the latest in a long line of loggers to cry, Jobs over trees! The changes in forest cover from year to year would have been hard to detect: yes, this year we cleared those woods over there, but trees are starting to grow back again on this abandoned garden site here. Only older people, recollecting their childhoods decades earlier, could have recognized a difference. Their children could no more have comprehended their parents' tales than my eight-year-old sons today can comprehend my wife's and my tales of what Los Angeles was like 30 years ago.

Gradually trees became fewer, smaller, and less important. By the time the last fruit-bearing adult palm tree was cut, palms had long since ceased to be of economic significance. That left only smaller and smaller palm saplings to clear each year, along with other bushes and treelets. No one would have noticed the felling of the last small palm.

By now the meaning of Easter Island for us should be chillingly obvious. Easter Island is Earth writ small. Today, again, a rising population confronts shrinking resources. We too have no emigration valve, because all human societies are linked by international transport, and we can no more escape into space than the Easter Islanders could flee into the ocean. If we continue to follow our present course, we shall have exhausted the world's major fisheries, tropical rain forests, fossil fuels, and much of our soil by the time my sons reach my current age.

Every day newspapers report details of famished countries-- Afghanistan, Liberia, Rwanda, Sierra Leone, Somalia, the former Yugoslavia, Zaire--where soldiers have appropriated the wealth or where central government is yielding to local gangs of thugs. With the risk of nuclear war receding, the threat of our ending with a bang no longer has a chance of galvanizing us to halt our course. Our risk now is of winding down, slowly, in a whimper. Corrective action is blocked by vested interests, by well-intentioned political and business leaders, and by their electorates, all of whom are perfectly correct in not noticing big changes from year to year. Instead, each year there are just somewhat more people, and somewhat fewer resources, on Earth.

It would be easy to close our eyes or to give up in despair. If mere thousands of Easter Islanders with only stone tools and their own muscle power sufficed to destroy their society, how can billions of people with metal tools and machine power fail to do worse? But there is one crucial difference. The Easter Islanders had no books and no histories of other doomed societies. Unlike the Easter Islanders, we have histories of the past--information that can save us. My main hope for my sons' generation is that we may now choose to learn from the fates of societies like Easter's.

Answer the following questions in your notebook.

1. List four likely contributing factors to the destruction of the forests on Easter Islands.

2. What is Jared Diamond referring to when he talks ironically of "new goodies?"

3. Why did Easter Island civilization descend from a highly organized society run by the priesthood, to a state of constant war and tipping over of statues?

4. Describe how Easter Island is an important and relevant lesson for our whole planet.

5. What do we have that the Easter Islanders did not that can give us a better chance of not over-exploiting our resources?

6. Evaluate the strength of Jared Diamond's argument for paying greater attention to conserving our natural resources.

June 29, 2016

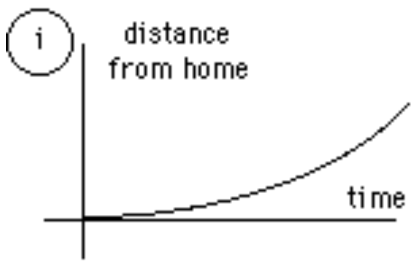
More Graphing Practice – Part III

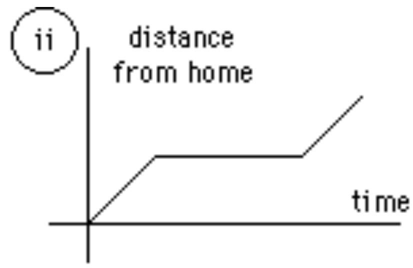
1. **Identify the graph that matches each of the following stories.**

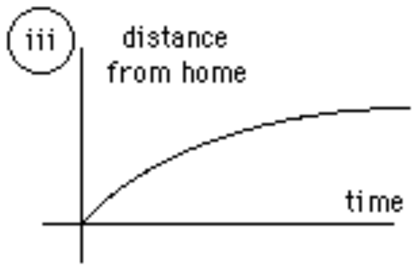
a) I had just left home when I realized I had forgotten my books, so I went back to pick them up.

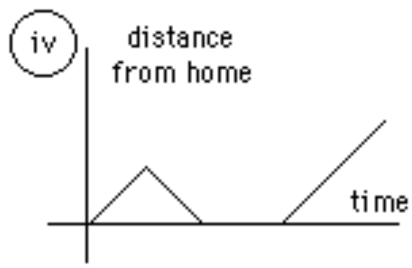
b) Things went fine until I had a flat tire.

c) I started out calmly, but sped up when I realized I was going to be late.









2. **Answer these questions about the graph.**

a) How many total miles did the car travel?

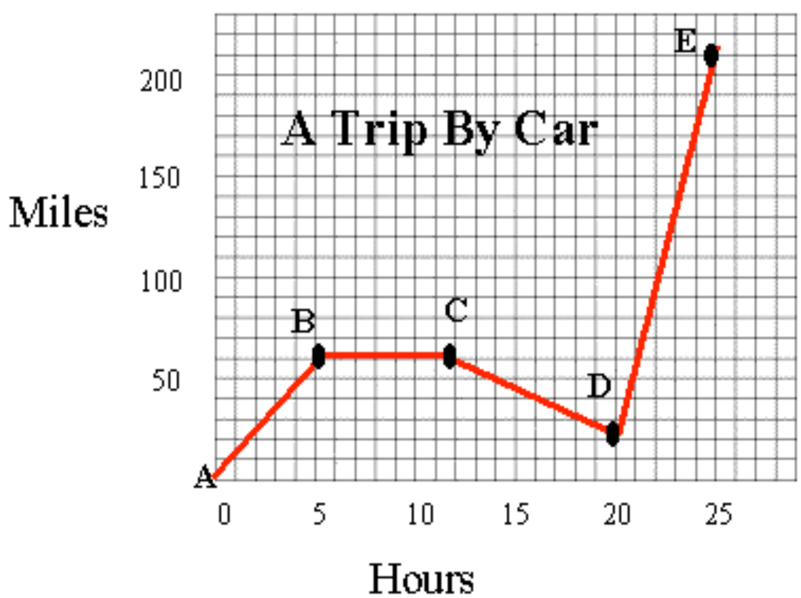
b) What was the average speed of the car for the trip?

c) Describe the motion of the car between hours 5 and 12?

d) What direction is represented by line CD?

e) How many miles were traveled in the first two hours of the trip?

f) Which line represents the fastest speed?

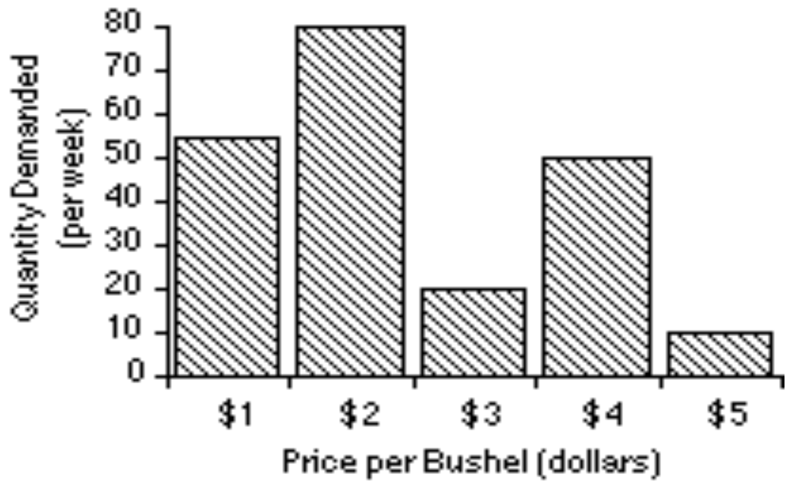


3. Answer these questions about the graph.

a) What is the dependent variable on this graph?

b) Does the price per bushel always increase with demand?

c) What is the demand when the price is $5 per bushel?



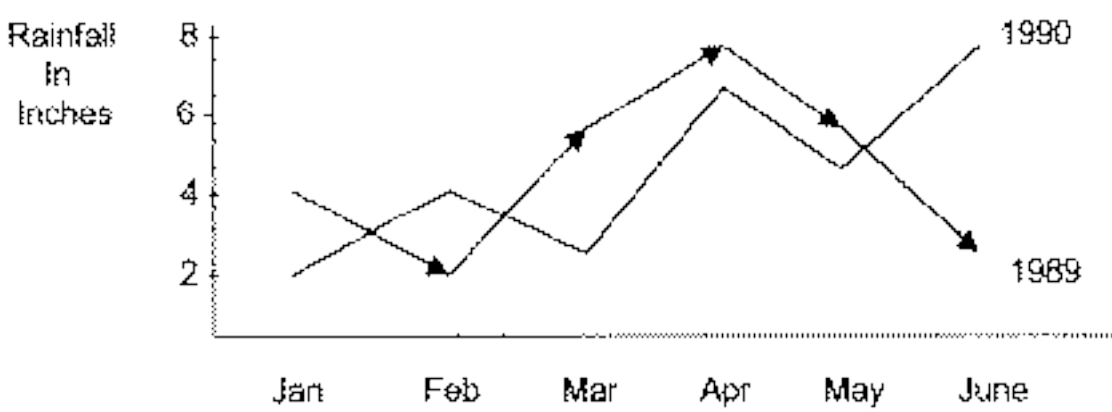
4. Answer these questions about the graph.

a) How much rain fell in March 1989?

b) How much more rain fell in February 1990 than in February 1989?

c) Which year had the most rainfall?

d) What is the wettest month on the graph?



Case Study: Lactose Intolerance

Case Presentation

Jason, a seventeen year-old Asian high school student, had been experiencing occasional discomfort after meals. The discomfort reached a new peak last Thursday evening about an hour after eating a cheeseburger and a large chocolate milkshake. Jason spent much of that night in pain. He had abdominal cramps and diarrhea and also felt sick to his stomach. He went to the clinic and saw a doctor the next day.

The doctor asked Jason a number of questions and noted that Jason's discomfort seemed to be associated with dining out. Jason told the doctor that on most evenings his parents cooked traditional Asian cuisine, and that he seldom experienced any discomfort after eating at home. Jason only experienced discomfort after dining out, especially, it seemed, after eating his favorite fast food meal, a double cheeseburger and a chocolate shake. When asked if he used very much milk or cheese when preparing meals at home, Jason told the doctor that he almost never cooked with any dairy product.

The doctor suspected that Jason could be lactose intolerant and told Jason that she would like to have a test performed to verify her suspicion. Jason was able to be tested on that day because he had not had anything to eat or drink for two hours. At the clinic lab, Jason was given a lactose rich fluid to drink and had his blood glucose level measured several times over the course of two hours. Later, his doctor informed Jason that his blood glucose level had not risen after drinking the lactose rich fluid and that this was evidence that he was lactose intolerant. The doctor provided Jason with information about lactose intolerance and discussed with him how he could best alter his diet in order to avoid any discomfort while still obtaining sufficient calcium. The doctor also told Jason about various products that contain lactase, the enzyme responsible for lactose digestion, and assured him that if he used one of those products, he could probably still have the occasional cheeseburger and chocolate milk shake.

Case Background

Lactose intolerance is the inability to digest significant amounts of lactose. Some individuals are born lactose intolerant. These individuals lack the ability to produce lactase from birth. Most individuals that are lactose intolerant, however, become so gradually as lactase production decreases over time. There is no cure for lactose intolerance, but treatment is fairly simple. Affected individuals are instructed to avoid as much lactose as required in order to avoid discomfort. Different individuals have different levels of intolerance and each affected person needs to determine through trial and error how much lactose he or he can tolerate. In addition to dietary control of lactose intolerance, individuals can also use products that contain lactase.

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JULY

Vitamins

July 1, 2016

If you're like most kids, you've probably heard at least one parent say, "Don't forget to take your vitamin!" "Eat your salad — it's packed with vitamins!" But, what exactly are vitamins?

Vitamins are organic substances that are found in foods we eat. Your body needs them to work properly, so you grow and develop just like you should. When it comes to vitamins, each one has a special role to play. For example:

- Vitamin D in milk helps your bones grow
- Vitamin C in oranges helps your body heal if you get a cut
- Vitamin K helps to clot your blood

Vitamins Hang Out in Water and Fat

There are two types of vitamins: **fat soluble** and **water-soluble**.

When you eat foods that contain fat-soluble vitamins, the vitamins are stored in the fat tissues in your body and in your liver. They wait around in your body fat until your body needs them.

These types of vitamins, fat-soluble, are happy to stay stored in your body for a while — some stay for a few days, some for up to 6 months! Then, when it's time for them to be used, special carriers in your body take them to where they're needed. Vitamins D and K are all fat-soluble vitamins like this.

Other vitamins are different. When you eat foods that have water-soluble vitamins, the vitamins don't get stored as much in your body. Instead, they travel through your bloodstream. Whatever your body doesn't use comes out when you urinate (pee).

So, these kinds of vitamins need to be replaced often because they don't stick around! This crowd of vitamins includes vitamin C.

Vitamins Feed Your Needs

Your body is one powerful machine, capable of doing all sorts of things by itself. But, when it comes to vitamins, it can use some help. That's where food comes in. Your body is able to get the vitamins it needs from the foods you eat because different foods contain different vitamins. The key is to eat different foods to get an assortment of vitamins. Though some kids take a daily vitamin, most kids don't need one if they're eating a variety of healthy foods.

Vitamin C	Vitamin D	Vitamin K
This vitamin is important for keeping body tissues, such as gums and muscles in good shape. C is also key if you get a cut or wound because it helps you heal. This vitamin also helps your body resist infection. This means that, even though you can't always avoid getting sick, vitamin C makes it a little harder for your body to become infected with an illness. Which foods are rich in vitamin C? ● citrus fruits, like oranges ● cantaloupe ● strawberries ● tomatoes ● broccoli ● cabbage ● kiwi fruit ● sweet, red peppers	No bones about it . . . vitamin D is the vitamin you need for strong bones! It's also great for forming strong teeth. Vitamin D even lends a hand to an important mineral — it helps your body absorb the amount of calcium it needs. Vitamin D is made in the skin when exposed to sunlight, or you can get it from the foods you eat. Which foods are rich in vitamin D? ● milk fortified with vitamin D ● fish ● egg yolks ● liver ● fortified cereal	Vitamin K is the clotmaster! Remember the last time you got a cut? Your blood did something special called clotting. This is when certain cells in your blood act like glue, and stick together at the surface of the cut to help stop the bleeding. Which foods are rich in vitamin K? ● leafy, green vegetables ● dairy products, like milk and yogurt ● broccoli ● soybean oil When your body gets this vitamin, and the other ones it needs, you'll be feeling A-OK!

Minerals

Did you ever notice how TV commercials for breakfast cereal always mention vitamins and **minerals**? But, when you think of minerals, food isn't the first thing that comes to mind. Aren't minerals something you find in the earth, like iron and quartz?

Well, yes, but small amounts of some minerals are also in foods — for instance, red meat, such as beef, is a good source of iron.
Just like vitamins, minerals help your body grow, develop, and stay healthy. The body uses minerals to perform many different functions — from building strong bones, to transmitting nerve impulses. Some minerals are even used to make hormones or maintain a normal heartbeat.

Macro and Trace
The two kinds of minerals are: **macrominerals** and **trace minerals**. Macro means "large" in Greek (and your body needs **larger** amounts of macrominerals than trace minerals). The macromineral group is made up of calcium, phosphorus, magnesium, sodium, potassium, chloride, and sulfur.

A trace of something means that there is only a little of it. So, even though your body needs trace minerals, it needs just a tiny bit of each one. Scientists aren't even sure how much of these minerals you need each day. Trace minerals include iron, manganese, copper, iodine, zinc, cobalt, fluoride, and selenium.

Let's take a closer look at some of the minerals you get from food.

Calcium	Iron	Potassium
Calcium is the top macromineral when it comes to your bones. This mineral helps build strong bones, so you can do everything from standing up straight to scoring that winning goal. It also helps build strong, healthy teeth for chomping on tasty food. Which foods are rich in calcium? ● dairy products, such as milk, cheese, and yogurt ● canned salmon and sardines with bones ● leafy, green vegetables, such as broccoli ● calcium-fortified foods — from orange juice to cereals and crackers	The body needs iron to transport oxygen from your lungs to the rest of your body. Your entire body needs oxygen to stay healthy and alive. Iron helps because it's important in the formation of hemoglobin (say: **hee**-muh- glo-bun), which is the part of your red blood cells that carries oxygen throughout the body. Which foods are rich in iron? ● meat, especially red meat, such as beef ● tuna and salmon ● eggs ● beans ● baked potato with skins ● dried fruits, like raisins ● leafy green vegetables, such as broccoli ● whole and enriched grains, like wheat or oats	Potassium (say: puh-**tah**-see-um) keeps your muscles and nervous system working properly. Did you know your blood and body tissues, such as muscles, contain water? They do, and potassium helps make sure the amount of water is just right. Which foods are rich in potassium? ● bananas ● broccoli ● tomatoes ● potatoes with skins ● leafy, green vegetables, such as broccoli ● citrus fruits, like oranges ● dried fruits ● legumes, such as beans, peas, lentils, and peanuts

TASK 1: Match the properties of water with their description.

POLARITY

COHESION

SURFACE TENSION

CAPILLARY ACTION

UNIVERSAL SOLVENT

ADHESION

Because water molecules stick together, they form a thin film on the surface of pools of water, on which some organisms can walk.

Water molecules are able to move against the force of gravity up plant stems.

Because of its polarity, water molecules are attracted and stick to other molecules, making water really good at dissolving a wide variety of substances.

Because of its polarity, water molecules are attracted and stick to one another.

A water molecule has slight positive and negative charges. This makes the molecule sticky."

Because of its polarity, water is attracted to and sticks to other substances.

TASK 2: Finish filling in the table using the information provided.

Type of molecule	Made of…	Used for…
		Store and transmit hereditary information
	Fatty acids	
Carbohydrates		
		Immune response Control chemical reactions Build tissue like muscle and bone

TASK 3: Finish filling in the table using the information provided.

Molecule	Organic or Inorganic?	Contain carbon or does not contain carbon?	Used for?
Vitamin C			
			Assists in bone growth
			Assists in blood clotting
Minerals			1. 2.

Task 4: Explain which 3 properties of water are the most important to living things. (There is no correct answer.) Please explain all responses.

Catalase (Enzyme) Investigation

Background Information: What is the enzyme catalase?

What would happen to your cells if they produced a poisonous chemical hydrogen peroxide (H_2O_2)? You might think they would die. If fact, your cells are always making poisonous, or "toxic," chemicals. The cells do not die because they use enzymes to catalyze the reactions that break down these poisonous chemicals into harmless chemicals. You have hundreds of different enzymes in each of your cells. Each of these enzymes is only responsible for one particular reaction that occurs in the cell. You can tell that something is an enzyme because its name usually ends in "ase."

In this lab, you will study the enzyme catalase that is found in the cells of many living tissues. Catalase breaks down hydrogen peroxide (so it is also known as "peroxidase") because otherwise it is toxic to living cells.

H_2O_2 (hydrogen peroxide) = $2H_2O$ (water) + O_2 (oxygen gas)

Pre-Lab Questions:

1. What is the function of an enzyme?
2. What are the reactants (things you start with) in the reaction above?
3. Are these reactants toxic?
4. What are the products (things you end with) in the reaction above?
5. Are these products toxic?
6. We can use certain clues to tell if a chemical reaction is occurring. For example, we can look for a color change, a change in temperature, or the formation of a gas. What clue could you use to know that the reaction with catalase is occurring?

Experimental Question:

How does changing the pH, temperature, or mashing a potato affect the activity of catalase?

- What is the independent variable?

- What is the dependent variable?

Procedure:

1. First, place a piece of potato in water (control) on your plate in the section labeled "water."

2. Carefully drop 4-5 drops of H_2O_2 (hydrogen peroxide) directly onto the potato.

3. Observe the reaction for about 1 minute. Take careful note of how many bubbles you notice. This amount will serve as a "3" on your bubbling scale for your data table. Record the number 3 in the data table for this control.

    - How does this potato serve as a control group?

    - Why is it important to have a control group?

4. Now take another potato piece from a different beaker (the order does not matter) and place it on your plate in the correct section.

5. Drop 4-5 drops of hydrogen peroxide on the potato.

6. Again, observe the reaction for about 1 minute and record your observations. Assign the amount of bubbles you see a number from 1-5 as compared to the control reaction.

7. Repeat steps 5 - 8 for the remaining types of potato cubes. Make sure everyone in your group has had a chance to observe the reaction and record data before moving on to the next type of potato.

8. Repeat the control trial with the **same piece of potato after doing all the other types of potatoes to see if the enzyme still works.**

9. After recording your data, think about what you observed and answer the post-lab questions below.

Data:

Treatment	Observations	Bubble ranking (0-5)	Was peroxidase working? (yes/no/a little)
Potato in water (control)		3	
Boiled potato			
Potato in acid (lemon juice)			
Potato in base (ammonia)			
Mashed up potato			
Repeated control potato			

July 15, 2016

Analysis Questions (Conclusions):

1. In which potato(es) was catalase working properly?
2. What is your evidence that it was working?
3. In which potato(es) was catalase not working properly?
4. What is your evidence that is was not working?
5. What do you think happened to catalase that prevented it from working?
6. What happened when you put more hydrogen peroxide on the control potato at the end?
7. Do you think enzymes get "used up" in a reaction? Give evidence for your answer.

Yeast Metabolism and Temperature

Directions:
Read the article. While reading, highlight words that you do not know. Try to figure out their meanings based on context clues within the article. If you cannot determine the meaning of a word, look up the definition and write it in the margin. After reading, complete the questions at the end of the article.

The tantalizing aroma of bread baking in the bakery is due to a process called fermentation of baker's yeast, or *Saccharomyces cerevisiae*. Yeast is a single-celled fungus that undergoes alcoholic fermentation to make ethyl alcohol (ethanol) and carbon dioxide gas. These organisms have long been used to ferment the sugars of rice, wheat, barley, and corn to produce alcoholic beverages and in the baking industry to expand, or raise, dough.

Dry yeast available in the grocery store is a collection of dormant yeast spores. Once these spores are mixed into water and dough, the culture is active. They are active in that they begin to undergo alcoholic fermentation. To start this process and make the bread rise faster, the baker sometimes mixes yeast with water or milk before adding to the dough. Yeast fermentation, and thus yeast metabolism, is temperature-dependent, meaning that temperature affects the rate of yeast metabolism.

The yeast's function in baking is to ferment sugars present in the flour or added to the dough. This fermentation gives off carbon dioxide and ethyl alcohol (ethanol). The carbon dioxide is trapped within tiny bubbles and causes the dough to expand, or rise. Their usefulness is based on their ability to convert sugars and other carbon sources into ethanol in the absence of air (anaerobic), and into carbon dioxide and water in the presence of air (aerobic).

Yeast Metabolism and Temperature

Complete the following questions.

1. What is fermentation?

2. What are the products of fermentation?

3. What is yeast?

4. What is yeast used for?

5. What does yeast do fermentation?

6. List 4 factors that you believe can affect the rate that yeast does fermentation.

7. Create a hypothesis about yeast and the rate that it performs fermentation that you will test in a group of 4. Speak with your group in order to come up with the best possible hypothesis.

July 21, 2016

Life Span of Human Cells

LIFE SPANS OF VARIOUS HUMAN CELLS		
Cell Type	**Life Span**	**Cell Division**
Lining of esophagus	2-3 days	Can divide
Lining of small intestine	1-2 days	Can divide
Lining of large intestine	6 days	Can divide
Red blood cells	Less than 120 days	Cannot divide
White blood cells	10 hours to decades	Many do not divide
Smooth muscle	Long-lived	Can divide
Cardiac (heart) muscle	Long-lived	Cannot divide
Skeletal muscle	Long-lived	Cannot divide
Neuron (nerve cell)	Long-lived	Most do not divide

Like all organisms, cells have a given life span from birth to death. In multicellular organisms, such as humans, the health of the organism depends on cells not exceeding their life span, this is especially true of cells that tend to divide rapidly. If these cells did not die on schedule, overcrowding of cells would occur, causing uncontrolled growth that could be life-threatening.

The data table shows the life spans of various human cells. It also contains information about the ability of the cells to multiply through cell division.

1. **Inferring** – White blood cells help protect the body from infection and disease-producing organisms. How might their function relate to their life span?

- What is the function (job, role) of white blood cells?

- According to the data table, what is the life span of white blood cells?

- How might the function affect the life span of white blood cells? In other words, **how might their function relate to their life span**?

2. **Comparing and Contrasting** – Based on the data, how are the consequences of injuries to heart, and spinal cord similar to each other? How are they different from the consequences of injuries to smooth muscle?

    - What is the life span of cardiac (heart) muscle cells?
    - Can heart cells divide?
    - What is the life span of neuron (nerve) cells, which make up your spinal cord?
    - Can nerve cells divide?
    - How might the life spans of heart and spinal cord cells, and whether or not they can divide, affect whether or not those parts of your body can repair themselves after an injury?
    - What is the life span of smooth muscle cells? Can they divide?
    - How might the life span of smooth muscle cells, and whether or not they can divide, affect whether or not those parts of your body can repair themselves after an injury?

3. **Formulating hypotheses** – Propose a hypothesis to account for the data related to the cell life spans of the lining of the esophagus, small intestine, and large intestine.

    - What are the cell life spans of these three types of cells?
        i. Esophagus:
        ii. Small intestine:
        iii. Large intestine:
    - What is the function (job, role) of these three parts of your body?
    - How might the function of these three parts of your body affect the life span of their cells?

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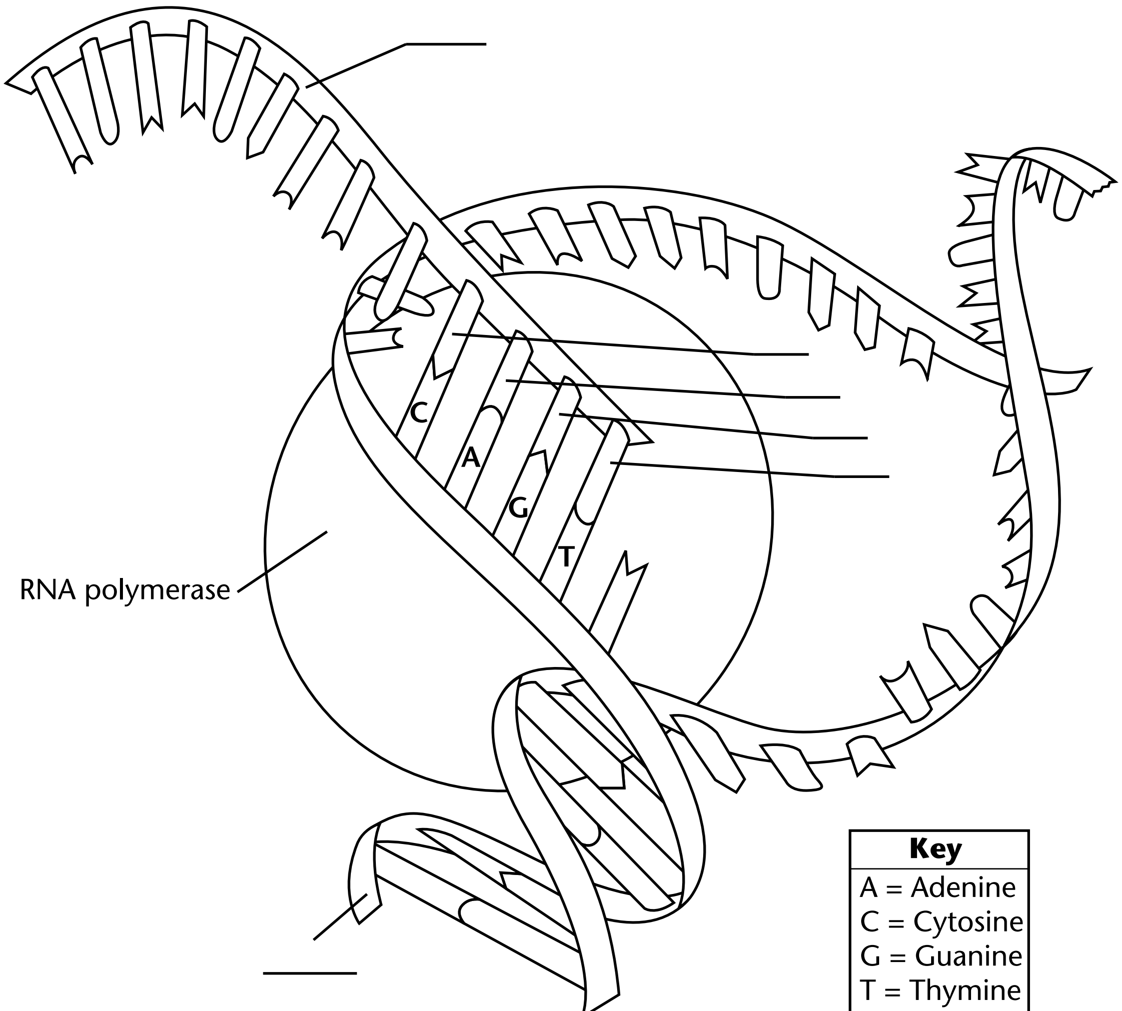
AUGUST

Name____________________________ August 3, 2016

Transcription

In transcription, RNA polymerase splits the two halves of a strand of DNA. RNA then uses one half as a template to make a copy of the other half. RNA contains the nucleotide uracil instead of the nucleotide thymine.

Label the DNA *and* RNA. *Then, label the missing nucleotides marked on the diagram.*



Key
A = Adenine
C = Cytosine
G = Guanine
T = Thymine
U = Uracil

Use the diagram to answer the question. Circle the correct answer.

1. In RNA, which nucleotide is always paired with uracil?

adenine guanine

Name_____________________________ Class ___________________ Date __________

Comparing DNA Replication and Transcription

DNA replication is the process by which a cell copies its DNA. During replication, both strands of the double helix are used as templates to make complementary, or matching, strands of DNA. DNA transcription is the process by which a single strand of DNA is used as a template to generate a strand of mRNA.

Fill in the missing information. One row has been completed for you.

Template DNA	Complementary DNA	Messenger RNA (mRNA)
TTACG	AATGC	AAUGC
	GGCGG	
		ACGUAGC
AGACTC		
	GATAAGA	
		CUGGCUAC

Use the table to answer the question.

1. Give another example of a template DNA code that is at least four base pairs long. Then give its matching complementary DNA and mRNA codes.

____

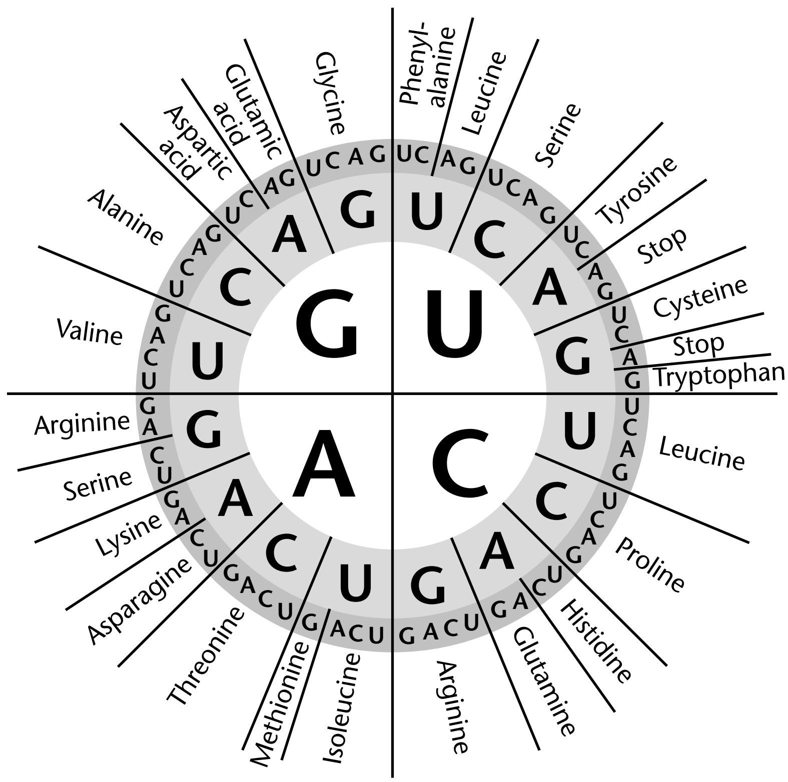
____

Name___________________________ **August 4, 2016**

Decoding mRNA

The diagram shows the mRNA codes that correspond to amino acids and stop codons. Read the diagram from the center outwards. For example, the mRNA code UAC corresponds to the amino acid tyrosine.

Write the name of the amino acid that corresponds to each mRNA code. The first one has been done for you.



mRNA Code	Amino Acid
AAA	lysine
GCG	
GAU	
CAA	

Use the diagram to answer the questions.

1. Which two mRNA codes correspond to histidine?

____

2. How many different mRNA codes correspond to arginine?

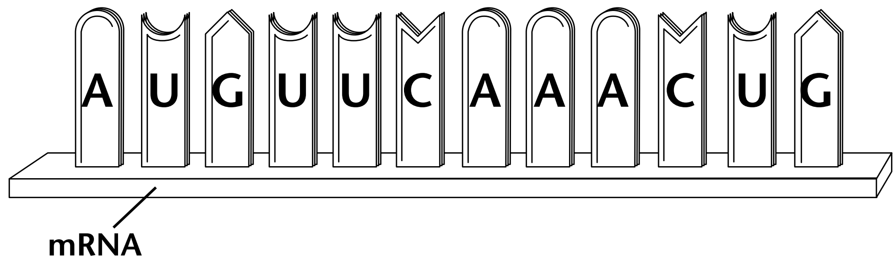
____

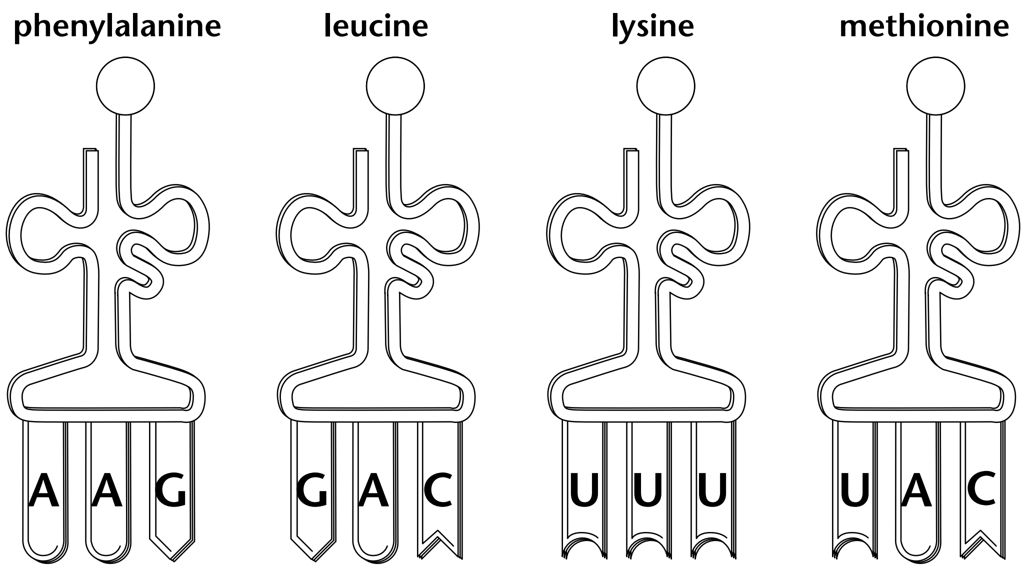
Name____________________________

Translation

During translation, transfer RNA (tRNA) anticodons match to messenger RNA (mRNA) codons. Each tRNA molecule can carry one particular amino acid. The amino acids are joined to form a polypeptide.

Number the four tRNA anticodons in the order in which they should appear to match the codons in the mRNA strand.





________ ________ ________ ________

Use the diagrams to answer the question.

1. List the amino acids in the order they would appear in the polypeptide coded for by the mRNA.

____

____

Transcription and Translation

Practice Worksheet

Example:

DNA : G T A C G C G T A T A C C G A C A T T C

mRNA: C A U G C G C A U A U G G C U G U A A G

Codons: AUG-CGC-AUA-UGG-CUG-UAA

Anticodons: UAC-GCG-UAU-ACC-GAC-AUU

Amino Acids: METHIONINE-ARGININE-ISOLEUCINE-TRYPTOPHAN-LEUCINE

Using the example above, transcribe the following DNA strand into mRNA and translate that strand into a polypeptide chain, identifying the codons, anticodons, and amino acid sequence.

1. DNA: A T A C G A A A T C G C G A T C G C G G C G A T T C G G

   mRNA:

   Codon:

   Anticodon:

   Amino Acids:

2. DNA: T T T A C G G C C A T C A G G C A A T A C T G G

   mRNA:

   Codon:

   Anitcodon:

   Amino Acids:

3. DNA: T A C G G G C C T A T A C G C T A C T A C T CA T G G A T C G G

   mRNA:

   Codon:

   Anitcodon:

   Amino Acids:

4. DNA: G T A C G C G T A T A C C G A C A T T C

   mRNA:

   Codon:

   Anitcodon:

   Amino Acids:

Transcribe the following DNA strand into mRNA and translate that strand into a polypeptide chain, identifying the codons, anticodons, and amino acid sequence.

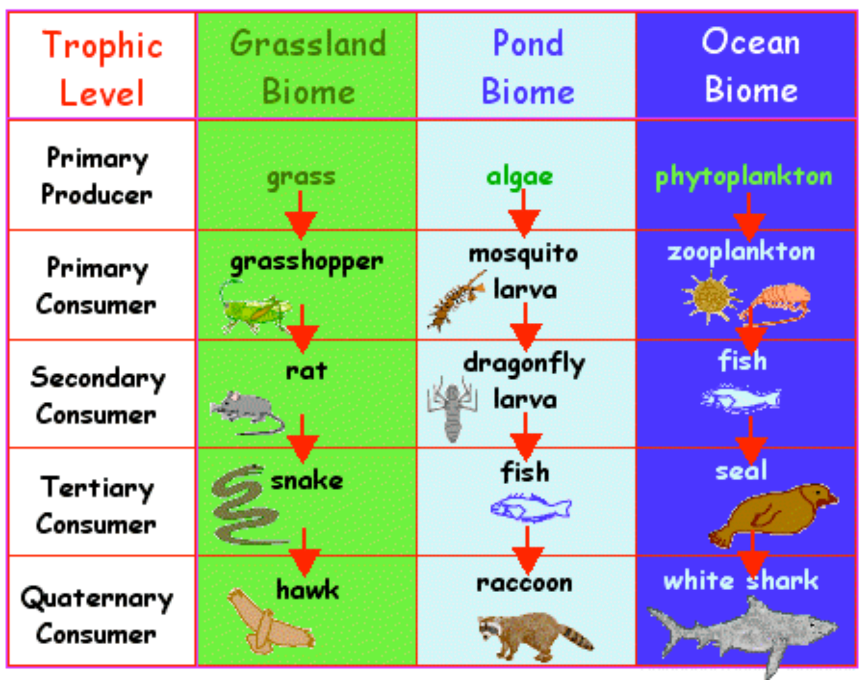
DNA: C G A T A C A A T G G A C C C G G T A T G C G A T A T C C

Lesson - Food Chains and Webs --- "What's for dinner?"

Every organism needs to obtain energy in order to live. For example, plants get energy from the sun, some animals eat plants, and some animals eat other animals.

A **food chain** is the sequence of who eats whom in a biological community (an ecosystem) to obtain nutrition. A food chain starts with the **primary energy source**, usually the **Sun** or boiling-hot deep-sea vents. The next link in the chain is an organism that makes its own food from the primary energy source -- an example is **photosynthetic plants** that make their own food from sunlight (using a process called **photosynthesis**) and **chemosynthetic bacteria** that make their food energy from chemicals in hydrothermal vents. These are called **autotrophs** or **primary producers**.

Sample Food Chains



Next come organisms that eat the autotrophs. These organisms are called **herbivores** or **primary consumers** -- an example is a rabbit that eats grass. The next link in the chain is animals that eat herbivores. These are called **secondary consumers** -- an example is a snake that eats rabbits. In turn, these animals are eaten by larger **predators** -- an example is an owl that eats snakes. The **tertiary consumers** are eaten by **quaternary consumers** -- an example is a hawk that eats owls. Each food chain ends with a **top predator** and animal with **no natural enemies** (like an alligator, hawk, or polar bear).

The Food Web

The arrows in a food chain show the flow of **energy** from the sun or hydrothermal vent to a top predator. As the energy flows from organism to organism, energy is lost at each step. A network of many **food chains** is called a **food web**.

Trophic Levels:
The trophic level of an organism is the position it holds in a food chain.

1. **Primary producers** (organisms that make their own food from sunlight and/or chemical energy from deep sea vents) are the base of every food chain. These organisms are called **autotrophs**.
2. **Primary consumers** are animals that eat primary producers. They are called **herbivores** (plant eaters).
3. **Secondary consumers** eat primary consumers. They are **carnivores** (meat eaters) and **omnivores** (animals that eat both animals and plants).
4. **Tertiary consumers** eat secondary consumers.
5. **Quaternary consumers** eat tertiary consumers.
6. Food chains "end" with top predators, animals that have little or no natural enemies.

When any organism dies, it is eventually eaten by **detrivores** (like vultures, worms, and crabs) and broken down by **decomposers** (mostly bacteria and fungi), and the exchange of energy continues.

Some organism's position in the food chain can vary as their diet differs. For example, when a bear eats berries, the bear is functioning as a **primary consumer**. When a bear eats a plant-eating rodent, the bear is functioning as a **secondary consumer**. When the bear eats salmon, the bear is functioning as a **tertiary consumer. T**his is because salmon is a secondary consumer, since salmon eat herring that eat zooplankton that eat phytoplankton, that make their own energy from sunlight. Think about how people's place in the food chain varies - often within a single meal!

Numbers of Organisms:
In any food web, energy is lost each time one organism eats another. Because of this, there have to be many more plants than there are plant eaters. There are more autotrophs than heterotrophs, and more plant-eaters than meat eaters. (Each level has about 10% less energy available to it because some of the energy is lost as heat at each level.) Although there is intense competition between animals, there is also **interdependence**. When one species goes extinct, it can affect an entire chain of other species and have unpredictable consequences.

Equilibrium:
As the number of carnivores in a community increases, they eat more and more of the herbivores, decreasing the herbivore population. It then becomes harder and harder for the carnivores to find herbivores to eat, and the population of carnivores decreases. In this way, the carnivores and herbivores stay in a relatively stable equilibrium, each limiting the other's population. A similar equilibrium exists between plants and plant eaters.

Complete the Food Chains Worksheet

Circle the organisms that complete the food chains below.

Sun →

a. plankton
b. alligator
c. fish
d. grass
e. chicken

→

zebra

→

a. spider
b. guppy
c. lion
d. wheat
e. human

Sun →

algae

→

a. moth
b. snail
c. whale
d. caterpillar
e. snail

→

a. lion
b. starfish
c. fish
d. grass
e. crow

→

raccoon

Sun →

plants

→

a. javelina
b. anaconda
c. falcon
d. grass
e. spider

→

jaguar

Sun →

grass

→

a. weasel
b. spider
c. seaweed
d. wolverine
e. cricket

→

snake

→

a. sheep
b. goat
c. ant
d. owl
e. moose

Sun →

phytoplankton

→

a. zooplankton
b. algae
c. seal
d. walrus
e. moss

→

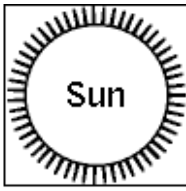
a. jellyfish
b. spider
c. krill
d. starfish
e. clam

→

humpback whale

Food Chain Worksheet

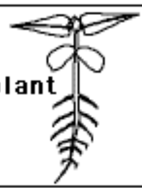
Read the passage then answer the questions below.



A food chain is a sequence of who eats whom in a biological community. It starts with a primary energy source, like the sun or boiling-hot deep sea vents. The arrows in the chain show the flow of food energy.

↓

plant



The energy source provides the energy for organisms that are able to convert that raw energy into their own food. These organisms (such as plants, phytoplankton, and algae) are called autotrophs or primary producers.

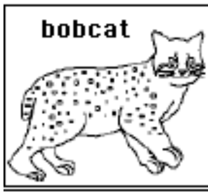
↓

rabbit

The next link in the chain is organisms that eat autotrophs like plants and algae. These organisms are called primary consumers or herbivores. Some examples are rabbits, deer, tadpoles, and caterpillars.

↓

bobcat



The next link is organisms that eat primary consumers. These organisms are called secondary consumers. Some examples are bobcats and lions. Chains can be longer than this. The animal at the end of a chain is the top predator (it has no natural enemies).

Questions

1. What do the arrows in a food chain represent? ______________________________

____

2. A food chain starts with an ________________________________ source.

3. Organisms that make their own food are called ______________________________

or ____.

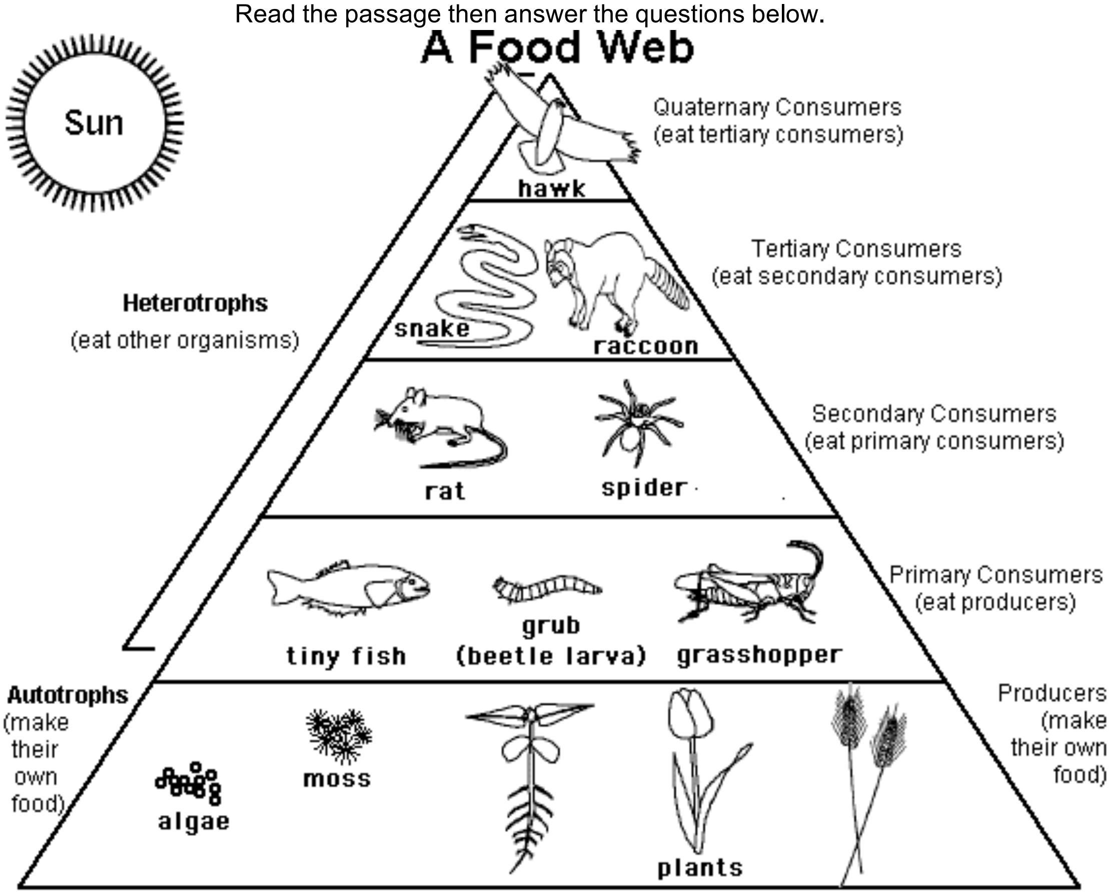
4. Organisms that eat plants are called ______________________________________

or ____.

5. An animal with no natural enemies is a ____________________________________.

Food Web Worksheet

Read the passage then answer the questions below.



Questions

1. There are many more ____

than there are primary consumers.

2. Organisms that eat other organisms are called ____________________________.

3. Organisms that make thir own food are called ______________________________

or ____.

4. Grass is ____.

5. Zebras (grass-eaters) are ____.

6. Lions (zebra-eaters) are ____

Worksheet – Food Webs

1. Define and provide examples for each of the following groups of heterotrophs.

a) Herbivores -

b) Carnivores –

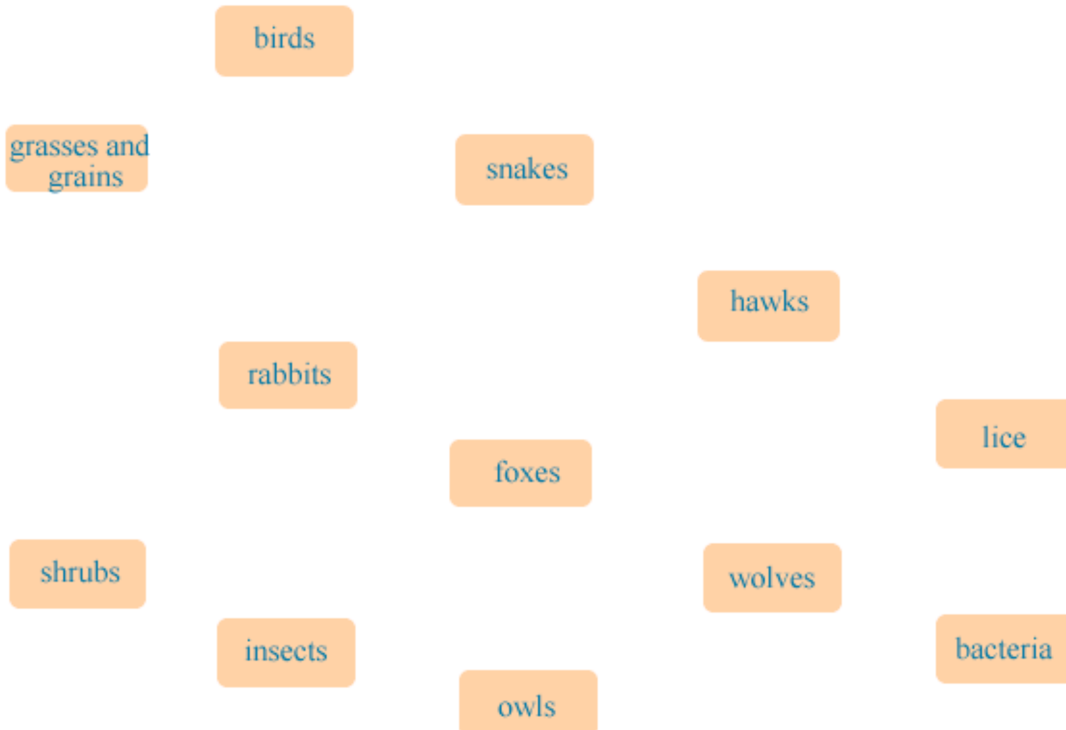
c) Omnivores –

d) Saprophytes –

e) Decomposers –

2. Using the organisms named below create a food web which represents the flow of energy between organisms by using arrows to connect the organisms.

(Note: You should have more then one arrow pointing towards and pointing away from any given organism.)



What's For Dinner?

August 10, 2016

Lab Exercise – From Land to Mouth

A field of corn contains a certain amount of food energy. If cattle eat the corn, they will gain some of the food energy. How does the amount of energy in the corn compare with the amount of energy in the cattle? Is it more efficient to feed on corn or beef? In this activity, you will compare the energy content of some familiar human foods.

You will need: graph paper, calculator, and colored pencils/markers

What to do:

1. The table below lists the average amount of energy (in kilojoules per square meter of land per year) in different organisms that people use for food.

Organism	Energy (KJ/m^2/year)	Ranking
Wheat cereal	3 400	
Oranges and grapefruits	4 200	
Peanuts	3 850	
Rice	5 200	
Potatoes	6 700	
Carrots	3 400	
Other vegetables	840	
Apples	6 300	
Peaches	3 800	
Beet sugar	8 300	
Cane sugar	14 650	
Corn	6 700	
Milk (cow)	1 800	
Eggs (chicken)	840	
Chicken	800	
Pork (pig)	800	
Beef (cow)	550	
Fish	8	

   a. Organize the data from LEAST energy to MOST energy. (Do this under the "Ranking" column in the table above.)
   b. Make a bar graph to compare the relative amounts energy in each organism:
      i. Include a LEGEND:
         → Use one color for producers and another color for consumers
      ii. Label bottom with the names of each organism
      iii. Label the left side with the energy

YOU WILL NEED GRAPH PAPER.

2. Calculate the AVERAGE energy of all the producers.

3. Calculate the AVERAGE energy of all the consumers.

4. Which organisms (producers or consumers) can offer more energy (on average)?

5. Do you think it is more efficient for people to eat plant products or animal products? Why?

What's For Dinner?

August 11, 2016

Food Chain Quiz – Multiple choice comprehension questions Color the circle by each correct answer.

1. A plant is ...
   - A. an autotroph
   - B. a heterotroph
   - C. a primary producer
   - D. A and C

2. A cow is ...
   - A. a primary consumer
   - B. a heterotroph
   - C. an herbivore
   - D. all of the above

3. Autotrophs ...
   - A. make their own food
   - B. are the base of the food chain
   - C. are primary producers
   - D. all of the above

4. A lion that eats a zebra that ate grass is a ...
   - A. primary producer
   - B. primary consumer
   - C. secondary consumer
   - D. quaternary consumer

5. A bear that eats a fish that ate bugs that ate algae is a ...
   - A. primary producer
   - B. primary consumer
   - C. secondary consumer
   - D. tertiary consumer

6. A person who eats a chicken that ate grain is a ...
   - A. primary producer
   - B. primary consumer
   - C. secondary consumer
   - D. quaternary consumer

7. Primary consumers eat ...
   - A. primary producers
   - B. primary consumers
   - C. secondary consumers
   - D. quaternary consumers

8. Secondary consumers eat ...
   - A. primary producers
   - B. primary consumers
   - C. tertiary consumers
   - D. quaternary consumers

9. Tertiary consumers eat ...
   - A. primary producers
   - B. primary consumers
   - C. secondary consumers
   - D. quaternary consumers

10. Quaternary consumers eat ...
    - A. primary producers
    - B. primary consumers
    - C. secondary consumers
    - D. tertiary consumers

Food Chain Quiz #2 - Multiple choice comprehension questions
Color the circle by each correct answer.

1. A heterotroph ...
   - A. is an autotroph
   - B. eats other organisms
   - C. is a primary producer
   - D. A and C
   - E. none of the above

2. A cow (that eats plants) is ...
   - A. a primary consumer
   - B. a heterotroph
   - C. an herbivore
   - D. all of the above
   - E. none of the above

3. If a person eats a vegetable, the person is acting as ...
   - A. a primary producer
   - B. a primary consumer
   - C. a secondary consumer
   - D. a tertiary consumer
   - E. a quaternary consumer

4. If a person eats a steak (from a cow), the person is acting as ...
   - A. a primary producer
   - B. a primary consumer
   - C. a secondary consumer
   - D. a tertiary consumer
   - E. a quaternary consumer

5. If a person eats a salmon (that ate smaller fish that ate algae), the person is acting as ...
   - A. a primary producer
   - B. a primary consumer
   - C. a secondary consumer
   - D. a tertiary consumer
   - E. a quaternary consumer

6. A top predator...
   - A. has no natural enemies
   - B. is a meat eater
   - C. is a heterotroph
   - D. all of the above
   - E. none of the above

7. A detrivore ...
   - A. is an autotroph
   - B. eats decomposing matter
   - C. kills animals
   - D. all of the above
   - E. none of the above

8. As nutritional energy passes through the food chain, energy ...
   - A. is lost
   - B. is gained
   - C. remains constant
   - D. increases, then decreases
   - E. decreases, then increases

9. There are more primary producers than there are ...
   - A. primary consumers
   - B. secondary consumers
   - C. tertiary consumers
   - D. quaternary consumers
   - E. all of the above

10. There are more tertiary consumers than there are ...
   - A. primary consumers
   - B. secondary consumers
   - C. tertiary consumers
   - D. quaternary consumers
   - E. all of the above

Match each Food Chain Word to its Definition.

Draw a line from each word on the left to its definition.

food chain	The network of all the inter-related food chains in a biological community.
food web	The sequence of who eats whom in a biological community.
autotroph	An organism that gets its energy by eating other organisms.
heterotroph	An organism that makes its food from light or chemical energy without eating.
carnivore	An organism that eats plants.
herbivore	An organism that eats meat.
primary consumer	A meat-eater that eats primary consumers.
secondary consumer	A meat-eater that eats tertiary consumers.
tertiary consumer	A meat-eater that eats autotrophs.
quaternary consumer	A meat-eater that eats secondary consumers.