

STS NOTES 2009-2010

McCoy

TEXTS

Science Matters: Achieving Scientific Literacy (For reference only), Hazen and Trefil.
Brain Facts from Society for Neuroscience.

TOPICS BY QUARTER

1st Quarter

- A. Knowing (*Science Matters*, Ch. 1)
- B. The Road to Discovery (*Big Ideas*, Ch. 1)
- C. The Method of Science (*Big Ideas*, Ch. 7)
- D. Doing Research, Validity of Sources
- E. STS or VJAS Projects begin
- F. Benefit/Risk Analysis (*Big Ideas*, Ch. 8)

2nd Quarter

- A. The Brain and Learning (*Awakenings [movie]*, *Brain Facts [Society for Neuroscience]*)
- B. STS or VJAS Projects end
- C. Energy & Society (*Science Matters*, Ch. 2)
- D. Electromagnetism (*Science Matters*, part of Ch. 3)
- E. The Atom (*Science Matters*, Ch. 4)

3rd Quarter

- A. Nuclear & Particle Physics (*Science Matters*, Ch. 5, 8 & 9)
- B. Numbers in Science
- C. Integrity and the Scientific Community (*Miss Evers Boys [movie]*, *Something the Lord Made [movie]*)
- D. The Cosmos & Astronomy's Big Bang (*Science Matters*, Ch. 11 & *Big Ideas*, Ch. 4)
- E. Relativity (*Science Matters*, Ch. 12)

4th Quarter

- A. Ecosystems (*Science Matters*, Ch. 18)
- B. Earth Cycles (*Science Matters*, Ch. 14)
- C. The Code of Life (*Science Matters*, Ch. 16, *Boys from Brazil [movie]*)

KNOWING

I. Scientific Literacy

- 1) What is it? The knowledge you need to understand public issues (facts, vocabulary, concepts, history, philosophy). You can understand the news of the day as it relates to science.

II. What is science?

- 1) A way of knowing/learning about the world. “The universe is regular and predictable.” (Because of this, we feel we can learn about it. Things happen in predictable ways.
- 2) The first science was astronomy. From that came mechanics (the study of motion). While studying mechanics, scientists came up with the scientific method.

III. What is the scientific method?

- 1) An approach to making sense of the patterns in nature seen around you. See page 3 in *B.I.* book for traditional viewpoint. (How we have been teaching you at TNCS.) In truth, it is much more complicated.
- 2) Much of what we study is “inside a black box” (hidden from view). Ex: atomic structure, black holes

III. Key vocabulary terms/concepts:

observations—facts sensed, can be easily confirmed by others

inferences—judgments based on facts

hypothesis—a prediction of the answer to a problem/experiment; a possible explanation for something observed

law—a statement (usually mathematical) of a cause and effect relationship in the universe

theory—an scientific explanation for a group of related facts that has been accepted by scientists

Occam’s Razor—the accepted hypothesis should be the simplest that explains what is observed

model—a representation or likeness of reality invented to explain or test what is observed

serendipity—a discovery made by accident

IV. The road to discovery

- 1) Scientists believe that the universe is “knowable and predictable.” If we did not believe this, there would be no reason to try to study it.
- 2) Louis Pasteur says “chance favors the prepared mind.” Thus, when Goodyear discovered the vulcanization of rubber, he had to know enough to realize how important his discovery was.

V. Catastrophe (the video)

- 1) Students take notes on variety of data collection techniques used by David Keys.
- 2) triangulation—collecting evidence to support a hypothesis from at least three different sources

THE METHOD OF SCIENCE FURTHER INSIGHTS

I. Hypothesis, Theory, Law

- 1) One fact/observation can disprove a hypothesis. One can *never* prove a hypothesis (you can only support it).
- 2) “No amount of experimentation can ever prove me right: A single experiment can prove me wrong.” Albert Einstein.
- 3) Theories and laws are used to make predictions. If new observations do not fit the theory or law, it must be modified or discarded. EX: The earth is flat.
- 4) “Every scientific belief is tentative by its very nature.....subject to continual revision and refinement.” (Wiggins, A. W., & Wynn, C. M. (1996). *The Five Biggest Ideas in Science (Wiley Popular Science)*. New York, NY: Wiley.)

RISK/BENEFIT ANALYSIS

I. Why?

- 1) There are no easy answers.
- 2) Tries to answer, “How much risk is acceptable?”
- 3) Removes emotional thinking.

II. Ethical Framework:

- 1) Ask yourself:
 - a) Does it respect the rights of the individuals?
 - b) Does it do more good than harm for each individual?
 - c) Is it just and fair to all involved?

III. Everyday decisions

- 1) You take risks every day. Often little thought goes into them.
Some take enormous risks without thinking.
Voluntary risks tend to be less frightening even when the risk is great.
- 2) Risk—how likely it is that something bad will happen.
- 3) Hazard—a source of risk
 - a) EX: fish pond = hazard;
 - b) chance of falling in the pond = risk
- 4) Benefit—how likely it is that something good will happen.
 - a) EX: chance that someone will donate money to the school for environmental purposes because we have such a nice fish pond

| Types of Risks | Types of Benefits |
|--|--|
| injury death pollution costs money obsolescence disease conflict loss of jobs | improved health saves lives improved air/water quality saves money new medicines emotional satisfaction better than the other choice |

IV. Our goal in STS is to reduce risk.

- 1) This always costs money.
- 2) There is no such thing as zero risk.
- 3) How much is one human life worth? There are times when the cost of eliminating a risk is too great. We have a finite amount of money to spend.
- 4) The cost of reducing risk is often hidden.
 - a) The cost is usually passed on to the consumer (increased price of goods, increase in taxes).
 - b) Sometimes jobs are lost.
 - c) Sometimes we are no longer competitive.
 - d) Often we trade one set of risks for another.

USING THE INTERNET TO DO RESEARCH

I. Search engines:

- 1) www.google.com, www.search.com, www.yahoo.com, www.aol.com, www.iwon.com, www.dogpile.com, www.lycos.com,
- 2) Some allow Boolean operators (and, or, not) or search within searches. These are ways to narrow down your search. EX: Aids AND public schools [insert Venn diagram] Aids OR public schools [insert Venn diagram] Aids AND NOT public schools [insert Venn diagram]

II. Deciding what is good info

1) Types of sites:

- a) .com = commercial (be careful about someone trying to sell you something)
- b) .gov = government (usually reliable)
- c) .org = organization (some are good sites, some are not)
- d) .edu = education (usually university level—be careful, you need to know who posted the information)
- e) [See: <http://www.virtualsalt.com/evalu8it.htm>]

THE BRAIN AND LEARNING

I. Brain Stats and Facts

- 1) Your brain generates 25 watts of power while you're awake—enough to light a light bulb.
- 2) Your brain uses 20% of your body's energy, but only makes up 2% of your weight.
- 3) The brain has about 100 billion neurons.
- 4) Your brain weighs about ½ pound more than your great-grandparent's brain did at your age.
- 5) Ivan Turgenev's (died 1883) brain weighed 4.43 pounds—more than a pound heavier than the average.

II. Parts of the Brain

- 1) Brain Stem—regulates life support

- 2) Limbic system—surrounds stem (thalamus, hypothalamus, pituitary gland, pineal gland, amygdala, hippocampus, RAS)
 - a) thalamus—sorts sense messages
 - b) hypothalamus—emotions, regulates temperature, controls hunger/thirst, blood pressure, sexual feelings
 - c) pituitary gland—hormones (master gland)
 - d) pineal gland—growth, maturity
 - e) amygdala—anger/docility
 - f) hippocampus—memories (new)
 - g) RAS (reticular activating system)—alertness, attention
- 3) Cerebellum—coordination and movement
- 4) Cerebrum—reasoning, problem-solving (2 halves), surface is the cortex

III. Mapping the Cortex (diagram, page 5, *Brain Facts*)

IV. The Cerebral Hemispheres (diagram)

- 1) The corpus collosum is what allows the two hemispheres to communicate
- 2) Left hemisphere controls right half of body and vice versa

IV. How Does it all Work? (diagram of neurons, page 7, *Brain Facts*)

1) Steps

neuron receives message
 neuron processes message inside cell body
 neuron sends message out to other neurons by way of the axons (signal is electrical)
 message is sent across the gap using chemicals (signal is chemical)
 gap between neurons is called synapse
 chemicals are called neuro-transmitters
 learning and memory occur at the synapses—as you learn, new links form between neurons—strength and speed of activity increases.

V. What is Intelligence?

- 1) very difficult to define—relates to ability to think, perform, and problem-solve—how smart you are
- 2) some believe you are born with your intelligence and your environment doesn't matter (NATURE)
- 3) some believe your intelligence comes from your environments (NURTURE)

- 4) truth is that genes AND environment both contribute to intelligence
- 5) this disagreement is known as “nature verses nurture”

VI. Right Brain/Left Brain [diag. see page 21 in *Brain Facts*]

ENERGY AND SOCIETY

I. Low Energy Society

- 1) one where energy comes from plants and animals immediately around them. EX: Massai (E. Africa)—wood for cooking, cut/carry wood; eat what they grow, catch, or gather; never travel more than a few miles from where they are born; never read or write; live in fear of wild animals or fierce neighbors or weather; are hungry/starving; are sick/diseased; life expectancy of 35

II. High Energy Society

- 2) one where energy comes indirectly from plants and animals. EX: USA—drive cars (source is oil which came from plants); only 2%-3% are involved with raising food; people eat what other people grow, herd, or catch; travel is common; most read and write; violence is of a different sort (in some countries, very little); healthy; life expectancy of 70+

III. Steps from Low to High

- 1) learned how to garden and raise animals—provided a larger and more reliable food supply (more time!)—(approx. 8000BC)
- 2) learned to use wind energy for sailing—(600BC to 1800AD)
- 3) used slaves of other families and non-friends
- 4) learned to make windmills and water wheels (500 to 1300)
- 5) **used fire for industrial purposes (1800)
- 6) **used coal instead of wood (1700s)
- 7) **steam engine invented (1774)
- 8) **discovery and understanding of electricity (mid-1800s)
- 9) **used oil and natural gas (1920s)

**pollution became a problem

IV. Trade off

- 1) when you get one thing, but you have to give up something to get it. Example: I can drive to school in a car and get to school faster, but I have to give up clean air to get it.

ENERGY

CHAPTER 2: *Science Matters*: Energy

I. Energy is conserved.

- 1) This means in a closed system, the total amount of energy remains the same even when it changes from one form to another. This is also known as *The First Law of Thermodynamics* and also *The Law of Conservation of Energy*.

II. Energy always goes from more useful forms to less useful forms.

- 1) This means that when energy changes forms, there is always heat energy generated that cannot be used for anything. This is also known as *The Second Law of Thermodynamics* and also as *The Law of Entropy*.

III. Important Vocabulary

- 1) thermodynamics—"heat" "changing"
- 2) heat—the amount of atomic kinetic and potential energy in a material
- 3) kinetic—energy being used (in motion)
- 4) potential—energy stored up (waiting to be used)
- 5) work—force X distance (force moving a mass through a distance)
- 6) energy—the ability to do work (ability to exert a force)
- 7) power—a measurement of how quickly work is done (work/time)

IV. In the 20th century, a new form of energy was recognized

- 1) mass. The equivalence of mass and energy is expressed in Einstein's famous equation: $E = mc^2$

V. Heat energy can move in three different ways

- 1) conduction: heat moving through a material (such as a spoon that gets hot when sitting in a pot on the stove)
- 2) convection: heat moving in currents of water or gases (such as ocean currents)
- 3) radiation: heat moving through space (does not require matter, such as from the sun to the earth)

VI. Heat, Temperature, and Absolute Zero

- 1) Heat and temperature are not the same thing.
- 2) Heat refers to the amount of energy in a material. Temperature is a relative term. One object is “hotter” or “colder” than another. If objects are at the same temperature, then no heat moves between them.
- 3) Heat flows from hot to cold. (If you put an ice cube on the table, heat will flow into it from the surrounding air.)
- 4) If no more heat can be extracted from a system, we say it is at “absolute zero.”

THE ATOM

CHAPTER 4: *Science Matters*: The Atom

CHAPTER 5: *Science Matters*: The World of the Quantum

I. Historical Perspective

- 1) Democritus (460-370 BC) Greek Philosopher; Matter is made of atoms (you can't see them nor divide them).
- 2) Aristotle (384-322 BC) Greek Philosopher; Matter is continuous. Matter could be divided forever and you would never get the smallest piece. There are 4 elements (earth, air, fire, water).
- 3) Alchemists (1600s); Their goal was to make gold and a potion that would make them live forever. Their contribution to science was to do many experiments (changing only one thing at a time), keep careful records. They are the first to use a scientific method.
- 4) Dalton (1803); Used experimental evidence to show: Atoms of one element are all alike. Atoms unite to make compounds. Atoms themselves remain unchanged when compounds form.
- 5) J.J. Thomson (1898); Experimental evidence that discovered the electron. Gave us the "Plum Pudding Model" of the atom. (The atom is like a bowl of pudding with raisins evenly distributed throughout.)
- 6) Rutherford (1900); Experimental evidence that the nucleus was small and dense in the center of the atom. He believed the electrons orbited around it like in a solar system. (Solar System Model). His famous experiment was called Rutherford's Gold Foil Experiment.
- 7) Bohr (1913); Gave us the first modern theory. Theory applied to hydrogen atom (it fell apart when trying to apply it to larger, more complicated atoms). There are certain energy levels (orbits) allowed where the electrons can travel. Electrons can jump to higher energy orbits if given extra energy. When the electrons return to the lower energy level, they can release light.
- 8) Quantum Mechanical Model of Atom (1927-today); A quantum is the smallest allowed increment of energy gained or lost at the atomic level by an electron. Rather than orbits, there is a mathematical probability model that predicts where the electrons should be. Each electron has a specified amount of energy, but we can not know for sure where it is.
- 9) Heisenberg's Uncertainty Principle: you can not know both how fast and where an electron is, because the very act of measuring its speed changes its location or measuring its location changes its speed.
- 10) The quantum theory explains all the experimental evidence we see with all atoms.

11) Quarks (1960s-today); Scientists discover even smaller particles that make up protons and neutrons. Today we believe there are twelve fundamental particles that make up matter: six types of quark and six particles called leptons (which includes electrons).

II. The Structure of the Atom

- 1) atom: the smallest part of an element that shows the properties of the element
- 2) nucleus: (Rutherford) the small dense core of the atom (protons & neutrons; almost all the mass)
- 3) protons: positively charged particles inside the nucleus (mass of one)
- 4) neutrons: neutrally charged particles inside the nucleus (mass of one)
- 5) electrons (JJ Thompson) negatively charged particles that travel outside the nucleus (1/1800 the mass of a proton or neutron)

III. The Electron Structure of Atoms

- 1) electron cloud: the space occupied by rapidly moving electrons; The electrons occupy different energy levels (Bohr Model): first level holds 2 electrons; second level, 8; third level, 18 etc. [insert drawing of periodic table “box” containing fluorine and then draw the corresponding diagram] The electrons in the outermost energy level are called valance electrons. These electrons are involved in chemical reactions.
- 2) The nuclear force holds the protons and neutrons inside the nucleus (very strong).
- 3) Atomic number: the number of protons; what identifies the atom.
- 4) Atomic mass number: the total of protons and neutrons.
- 5) Isotopes: atoms of the same element that have different numbers of neutrons (thus different masses).
- 6) Average atomic mass: the average mass of a group of the element’s atoms. [insert drawings of atoms of hydrogen, a drawing of hydrogen with parts labeled, water showing chemical bonding, lithium and an isotope of lithium]

IV. What We Know About Atoms

- 1) All matter is made of atoms.
- 2) Atoms are small! (In one drop of ocean water there are 50 billion atoms of gold.)
- 3) Atoms (or combinations of them) are continually in motion.

- 4) Kinetic Molecular Theory states that all matter is made of small particles and these particles are always moving.
- 5) Atoms have an intricate inner structure.
- 6) Chemical changes (reactions) involve the orbiting electrons.
- 7) Sometimes light is produced when electrons jump energy levels.
- 8) Nuclear changes (reactions) involve particles in the nucleus.

RADIATION

CHAPTER 3: *Science Matters*: Electricity and Magnetism

CHAPTER 8: *Science Matters*: Nuclear Physics

I. How Radiation Was Discovered

- 1) The first to be studied was visible light.
- 2) Democritus said it was a stream of tiny bullets that bounced off of what they hit and warmed it (400 B.C.).
- 3) Euclid studied how light reflected off surfaces and how it bent when it went through water (400 B.C.).
- 4) Newton (1665) discovered that white light is a mixture of colors. He believed light to be a stream of particles because it made sharp shadows and did not bend around corners.
- 5) Thomas Young (1803) showed with his pinhole experiment that light behaved more like a wave.
- 6) Faraday, Maxwell, others (1850s) discover the electromagnetic spectrum.
- 7) Today we know that light behaves like both a wave and a particle. This is called the “dual nature of light.”

II. Electromagnetic Spectrum

- 1) Electromagnetic radiation is radiation produced by the interaction of electric and magnetic fields.
- 2) E. spectrum is the range of wavelengths of e. radiation from gamma to the longest radio waves.

- 3) Wave characteristics [insert drawing of wave, label crest, wavelength, amplitude, trough].
- 4) Frequency is the speed of vibration. Higher frequency produces a shorter wavelength. Shorter wavelengths are associated with higher energy levels.
- 5) Beyond visible [insert drawing of e. spectrum, label different types of waves].

III. Rays not on the spectrum:

- 1) three particles that come out of the nucleus of radioactive atoms of radium and uranium are:
 - a) alpha—two protons and two neutrons (same as helium nucleus)
 - b) beta—an electron
 - c) neutron
- 2) electromagnetic radiation (except for gamma) comes from leaps of electrons on atoms or from vibrations of atoms and molecules
- 3) alpha, beta, gamma and neutron radiation come from changes inside the nucleus (or for beta, from a free neutron). See p. 117-118, *SciMatt*.

IV. Important Vocabulary

- 1) Fission is when certain heavy nuclei break into two or more parts releasing great amounts of energy.
- 2) Fusion is when certain light nuclei combine releasing great amounts of energy.
- 3) Radioactive decay is the spontaneous disintegration of a radioactive atom by the emission of ionizing radiation in the form of alpha, beta, or neutron particles or gamma rays.
- 4) Ionizing radiation is radiation that can ionize atoms (strip electrons). It is especially dangerous to living tissue. Sources: radioactive decay, fission, fusion, x-rays, gamma.
- 5) REM means Roentgen Equivalent in Man. It is a measure for how dangerous radiation is to living tissue.
 - a) From 30-150 millirem occurs naturally per year. One chest x-ray is about 17 millirem. One dental x-ray is about 300 millirem. Radiation industry workers are allowed up to 5000 millirem per year. One million millirems at one time is fatal. One hundred thousand millirems per year is dangerous and it increases your risk of cancer.

BIG BANG THEORY

CHAPTER 11: *Science Matters*: The Cosmos

I. Historical Perspective

- 1) Ptolemy (140AD) believed that the earth was the center of the universe. This model is called a geocentric model (geo=earth). This fit well with religious beliefs that man was the most important thing in the universe.
- 2) In 1543, Copernicus believed that the earth and the other planets orbited the sun. This is called a heliocentric model (helio=sun). Many rejected this model because it placed man as less important. Galileo's telescope gave supporting evidence for this model. He was not a popular person!
- 3) Some ideas are harder to accept than others.
 - a) Ideas that are most difficult to accept are those that:
 - i) Are difficult or impossible to observe directly.
 - ii) Conflict with religious beliefs.
 - b) These are often rejected by society. Today, we continue to argue about ideas like evolution for these same reasons.

II. Cosmology

- 1) The branch of science searching for answers to the questions about the origin of the universe, where the universe is going, how it is put together, etc. is called cosmology.
- 2) Cosmology is based on the fact that the universe was born at a specific time in the past, and it has been expanding ever since.
- 3) Edwin Hubble discovered that other galaxies exist, but that was not his most important discovery. He also noticed that light coming from distant galaxies was always shifted toward red (redshifted) and the further away from us they were the more they were redshifted.
- 4) This redshift is caused by the Doppler Effect. [insert diagram]
- 5) This means that the more distant a galaxy is, the faster it is moving away from us. It also means that there must have been a time when the entire universe was located in one spot (the primeval fireball).
- 6) This theory is called the "Big Bang Theory" because it indicates that the universe must have started with a huge explosion that set everything in motion.

- 7) Some believe that the universe will expand forever; others believe that it will stop expanding at some point and start shrinking (Oscillating Universe Theory).
- 8) The Big Bang probably occurred between 12 and 15 billion years ago.

III. Supporting evidence for the Big Bang:

- 1) There is microwave radiation coming from the entire universe. The amount was predicted to be left over from the explosion.
- 2) All measurements for the amount of helium fall in the range of 23-27%. This also is predicted.
- 3) Redshifted light (as described above).

RELATIVITY

CHAPTER 12: *Science Matters*: Relativity

I. Relativity

- 1) Albert Einstein discovered relativity by thinking about how the universe must be. It gives you a whole new way of looking at the universe.
- 2) Relativity can be stated: Every observer sees the same laws of nature.
- 3) There is no one correct place from which to view the universe. Sometimes events seem to be impossible because we are looking at them from a “frame of reference” which is different from our normal viewpoint. Different observers give different descriptions of the same events. [diagram]

II. Special Relativity

- 1) Light travels at the same speed no matter whether it is already moving or whether it is from a stationary source. Special relativity deals with objects moving at a constant speed. Special relativity predicts that time must slow down when objects move. [See diagrams on pages 162-163 in *Science Matters*.] To an observer moving with the object, time would seem to move at normal speed. You could travel away from earth at great speeds, return in what seems to you to be a few months, but the people who stayed on earth might have experienced 30 years of time. You would actually age only a few months, but they would age 30 years.

III. Special relativity also means

- 1) that moving yardsticks are shorter than stationary ones
- 2) moving objects are more massive
- 3) energy and mass are the same thing ($E=mc^2$)
 - a) There is experimental evidence to support special relativity.

IV. General Relativity

- 1) Someone in an accelerating frame of reference experiences exactly the same effects as those normally associated with the force of gravity.
- 2) General relativity deals with objects that are accelerating.
- 3) For Newton, motion is along curved lines in a flat space.
- 4) For Einstein, motion is along straight lines in a curved space. [diagrams]

- 5) General relativity predicts the existence of black holes.
 - a) There is experimental evidence to support general relativity.

ECOLOGY

This section's notes will be handled differently. You will be taking notes from lecture and PowerPoint.

THE GENE

I. Historical Perspective

| Scientist | Contribution |
|-------------------------|---|
| Aristotle (400 B.C.) | spontaneous generation |
| Redi (1668) | proved spontaneous generation was not correct |
| Mendel (1854-65) | traits inherited through special sexual cells in parents |
| Darwin (1860s) | believed in blending |
| Weismann (1885) | there is a definite chemical structure that carries hereditary information |
| Crick & Watson (1950s) | discovered molecular structure that carries the information—architecture of DNA |
| Morgan & Muller (1950s) | located genes on the chromosomes of fruitflies |
| Muller | x-rays can cause mutation |

II. Important Vocabulary

- 1) DNA—*deoxyribonucleic acid*; a large molecule found in the nucleus of most cells (not red blood cells)—carries a computer-like code that tells your cells how to make you
- 2) a *chromosome* is made of a single strand of DNA;
 - a) chromosomes are protective protein coats winding around every cell's nucleus;
 - b) you received one-half of your chromosomes from each parent;
 - c) you have a total of 46 chromosomes;
 - d) each chromosome has 50 million to 250 million base pairs
- 3) DNA is made of 1000s of genes
- 4) the gene is a molecular structure;
 - a) the *gene* carries hereditary information;

- b) the patterns/sequences of genes is the code which makes a particular living being what it is;
- c) all living things are built and operated following instructions from the DNA

5) DNA has a *double helix structure*

- a) backbone is phosphate sugar;
- b) connecting the two sugar “ribbons” are pairs of four chemical *bases*
 - i) *adenine, cytosine, guanine, thymine*
 - ii) guanine connects to cytosine, adenine connects to thymine

6) the DNA is long enough that almost an infinite number of sequences is possible

7) when cells reproduce, the DNA must be copied exactly in the new cell; this is called *DNA replication* [see diagrams from handout in class]

8) *Cloning*—reproducing an organism without sexual recombination using body cells from the parent organism.

- a) cloning has been done for centuries with plants;
- b) mammals have only been recently cloned;
- c) exact copies of mammals have been produced, but their DNA actually came from two parents, this is not true cloning

III. Experimenting with DNA

1) we can transfer a gene from one plant to another, one animal to another

2) we use *restriction enzymes* to locate and cut away a portion of DNA in order to replace the gene with another, more desirable one; this can create entirely new organisms such as bacteria that eat oil

3) we can make certain synthetic genes

4) we have successfully cloned a mammal

IV. Using DNA technology

1) genetic engineering—using recombinant DNA technology to create a new organism (or change an existing one for the better)

2) genetic therapy—using recombinant DNA technology to treat illness

3) genetic screening—using DNA technology to determine whether someone is carrying a specific gene

LEARNING AND MEMORY (this is a bonus section of notes!)

I. The Learning Process

- 1) Perception (sensory input, sensory receptor pathways, brain stem and hypothalamus, neocortex)
- 2) Attention (not everything is acted on) can pay attention to only one conscious thing at a time; primarily pay attention to things with meaning and emotional connection
- 3) Short Term Memory (hippocampus)
- 4) Encoding into Long Term Memory (Assimilated); must hook to something you already know; be assimilated as an experience (this requires time, the brain must look for patterns of recognition so that it can make sense of something new); requires rehearsal (rote/elaborative)
- 5) Elaborative rehearsal is where the information is “chunked” together into things that make sense; (a series of neurons that fire)
- 6) Because new information must first pass through the emotions part of the brain, there must be the right amount there—too little, and new learning is ignored, too much, and new learning is blocked

II. Things That Affect Memory

- 1) lack of sleep
- 2) strong emotions
- 3) medications, drugs, alcohol

III. Mnemonics—memory aids

- 1) Acronyms: uses first initials of short list
 - a) Ex: NASA (National Aviation and Space Administration)
 - b) HOMES (the Great Lakes—Huron, Ontario, Michigan, Erie, Superior)
- 2) Rhymes:
 - a) In fourteen hundred and ninety-two, Columbus sailed the ocean blue.
 - b) I before E except after C or when sounded as A as in neighbor and weigh.
- 3) Acrostics:
 - a) To remember the layers of the earth’s atmosphere in order—
 - b) This system makes it easy!
 - c) Troposphere, stratosphere, mesosphere, ionosphere, exosphere.

- 4) *Link or Story Method: uses either images or a story to remember a list of facts
- a) You may want to remember this list of counties in the South of England:
Avon, Dorset, Somerset, Cornwall, Wiltshire, Devon, Gloucestershire,
Hampshire, and Surrey.

Use a story:

An AVON lady is walking up a path towards a strange house. She is hot and sweating slightly in the heat of high SUMMER (Somerset). Beside the path someone has planted giant CORN in a WALL (Cornwall), but it's beginning to WILT (Wiltshire) in the heat. She knocks on the DOOR (Dorset), which is opened by the DEVIL (Devon).

In the background she can see a kitchen in which a servant is smearing honey on a HAM (Hampshire), making it GLOSSY (Gloucestershire) and gleam in bright sunlight streaming in through a window. Panicked by seeing the Devil, the Avon lady screams 'SoRRY' (Surrey), and dashes back down the path.

[*this entry is from <http://www.mindtools.com/memory.html>]

IV. Note Taking

- 1) Use your textbook to outline the pages you will be covering that day in class. Leave extra space so that you can add to your notes as the teacher teaches.
- 2) Check the teacher's website for the day's notes or Powerpoint. Print them ahead of time (double or triple space if word processed) so you can add comments in class.
- 3) Do not try to copy everything the teacher says. Think about what he/she is saying, decide what they are emphasizing, emphasize those things in your notes.
- 4) Try three-column note taking: Key Words/Notes/Summary or Comments or Pictures
- 5) Make a visual map of the day's notes within a day of leaving class.
- 6) Learn to use some abbreviations. Always use the same ones for all your classes. (Ex., ppl, govt., imp., rx., rem., ?)
- 7) Use symbols and highlighting to mark important things.
- 8) If you hear "this is important," note it in your notes.

9) Add color and pictures to your notes later.

V. Other Hints

- 1) Purchase the study guide that matches your textbook.
- 2) Go to your textbook website and see if they have practice tests or study guides.
- 3) Do not allow your computer to distract you from the lesson. If you can draw something faster by hand, do so. Label the drawings and print out your notes as soon as you leave the class. Keep everything organized and together.
- 4) Plan at least an hour outside of class for every hour you spend in the class.
- 5) Teachers will not wait on you to complete a task before they go on.
- 6) Teachers do not like to be asked, “What are we doing today?” “Do we have homework tonight?” “Are we going to watch a video?” “May I go to the bathroom?” “Are there any tissues in here?”
- 7) There is way too much information on each test to wait until just before the test to learn it.
- 8) You cannot pass if you are not in class.

VI. Know Yourself

- 1) If you hate mornings, try to take your classes later in the day.
- 2) Your brain must spend time thinking about what something means before it will ever be able to use the new information.
- 3) Sleep relates to memory.
- 4) You do not have to answer your cell phone every time it rings. Nor do you have to text message or instant message. You control your technology.