Lecture 2 Notes for Biology 3

* The Game of Biology: How to win!
	+ Shows up over and over through semester
		- So what is game?
		- What is the objective?
			* Live forever
				+ Unless you are a 19-24 year old male

That will not happen!

* + - * DNA=Code
			* ½ of your DNA is passed on in your children
	+ Genetics lights!
		- Somatic Cells
			* Most cells in your body
			* All have 2 copies of each chromosome
			* Chromosomes are chains of genes!
				+ Genes = you-your traits
		- Gametes
			* Sperm and egg
			* Both have only 1 copy of each chromosome
			* So each gamete has 50% of your DNA
	+ Winning?
		- Must produce viable offspring: viable meaning capable of reproducing.
	+ The game influences Behaviors
		- To win, you need a mate
			* Hopefuly one with good characteristics to bring to the offspring
		- So you have to compete to get the best one.
		- All sorts of behaviors can be explained by this
	+ DISCLAIMER
		- We don’t think consciously about it, or even know why we do them
		- Hardwired into DNA
		- Behaviors are instinctive
		- Like hidden scripts running the computer all the time
		- Why some women are more attractive than others, men don’t realize that ugliness/attractiveness is instinctive
	+ Strange behaviors of animals
		- Dogs: Whomever controls the best territory gets the bitch
		- Declaration of health: a really good reason to give urine sample to doctors
		- Scent: Dogs depend on scent. Urine is not only a declaration of territory, it is a declaration of health
		- Lots of other animals do it too
			* Pandas go into a handstand to mark their territory higher
		- Humans are no exception: look at your neighbors’ fences
		- Scent industry: $30 Billion a year industry
			* Strange because it’s mostly camouflage: it’s masking the smells that give us indicators of a man’s/woman’s immune system
			* Think Korrissa from work, she walks in the door and you know she’s here
	+ Suckers
		- Males don’t make the selections: women do
			* Why? Female devotes the most time and effort and has more risk associated with having children
	+ Effects the game
		- Female
			* 1 egg/month
			* Carrying the baby internally
				+ Feeding, complications, sharing
			* Needs to carefully consider provider/protector companions
		- Males
			* Sperm is made by millions
			* Can move on any time
		- Gameplay?
			* Flowers? Think monkeys giving food for sex
			* Dinner? Birds have to feed mate before being allowed to copulate
	+ Size DOES matter!
		- Size=health
		- Larger size = more resources = better defender
		- Females selecting for specific characteristics can change behavior and looks over time of the species

Three part definition of evolution

Change in gene frequency

In a given population

Over time

* + Example in nature
		- Peacock
			* Big freaking tail for a reason
			* Healthier it was, the brighter the colors
		- Narwhale
			* Only have two teeth, in males one grows into a tusk that sticks straight out
		- Irish Elk
			* Antlers got bigger over time: about 10 feet wide
			* Suddenly went extinct
			* Climate changed, more trees grew
			* Humans came and used trees against them
			* Womans’ fault
	+ Human behavior
		- Free time = complex behaviors
		- We see GoB, but in social situations
			* Social interactions
			* Driven by the subconscious
	+ Still not convinced?
		- All mammals are controlled by these instinctive desires
			* Royalty, Peewee Herman, you name it.
		- Boob jobs?
	+ FAT!! Muahaha!
		- Fat has three times the calories as sugar
		- That means all that fat is energy
		- Fat was important for survival
		- Fat storage is an indication of health, ability to find food and use Calories
		- Those that don’t store fat well usually died, in effect losing the game of biology
	+ Fat storage
		- Humans require fat (believe it or not) for vitamin delivery, protection, long term energy storage
		- Females: support fetus
		- Males: hunting/surviving
		- Becomes a selected characteristic
		- Selected for ability to store fat (evolution, ha!)
	+ Cultures
		- Fertility Goddesses
			* 40,000 year old fertility idols
				+ Usually fat
				+ Showed ability to store enough energy for a baby
		- Pacific Islanders
			* Special because it’s isolated
				+ Not a lot of food
			* Royalty was usually bigger, an excess of 300 lbs.
		- Middle Ages
			* Dukes, Earls, Bishops, etc.
				+ Usually fat because of the wealth of food
				+ Commoners could buy fake belly to appear rich
		- Rubenesque
			* Peter Paul Ruben painted many portraits of royalty
			* Often presented as curvaceous, fat, large
			* Women can be described as Rubenesque
	+ Alas that evolution is flawed
		- Not a directed process
			* Doesn’t make perfection
			* Simply selects traits for the current conditions
		- Conditions change?
			* Any trait evolved may be a disadvantage should that happen.
	+ So what happened?
		- Agriculture partially to blame
			* Calories became easy to access
			* Food available year round
			* Easier to obtain
		- Humans still have the ability to store fat
			* Causes humans to become overly fat
			* Genes still say that we still have to store fat
		- 7-11
			* Calories available 24/7
			* Calories made far too easy to get
		- Denny’s, McDonald’s, Taco Bell
			* Don’t even have to work for your Calories
			* Ready to eat Calories
		- Effects?
			* Grossly obese humans
				+ Even grossly obese children
				+ Healthy body fat for adults max 22%, children 12%

A lot of children have 40%

* + - * Other health problems
				+ Diabetes

231,404 deaths in 2007

Heart disease & stroke

2-4 times more likely

High blood pressure

Blindness

Nerve damage

Amputation 68% of all

Kidney failure

Is the inability to store and break-down sugar

* + - Back to fat storage.
			* Breasts basically a sweat gland with fat around it.
				+ Breast is a visual indicator of fat storage
				+ So is the ass
			* Brazil, all about the ass
			* US all about the boobs
		- Human nature
			* Bigger is better
			* Billions of dollars in plastic surgery.
			* Porn
			* Push up bras
		- Pretty stupid
			* Apparently humans are captive to biological background
			* Self-worth should not be tied to mammary glands or a big ass
* Chapter 2: Chemistry
	+ Learning Objectives
		- Understand water’s features that help it support life
		- Lipids
		- Carbohydrates
		- Proteins
		- Nucleic acids
	+ Atoms
		- Elements cannot be broken to other substances
		- Atom is the smallest part of the element
	+ Body
		- 25 found, but 4 major
			* 65% O
			* 18.5% C
			* 9.5% H
			* 3% N
			* Other 4% Ca, P, K, S, Na, Cl
	+ Water
		- Cohesion & Adhesion
			* Trees depend on these properties to save energy
				+ Tubes in trees 1-5 molecules wide
				+ Cohesion and adhesion keep the water moving up from the roots
			* Cohesion
				+ Same molecules sticking together
			* Adhesion
				+ Other molecules sticking to H2O
			* Both properties create a high surface tension
				+ Hydrogen bonds connects the water molecules together
		- Large heat capacity
			* ~ 4.84 J
			* Mainly because as hydrogen bonds are made as quickly as they are broken
			* Can absorb massive amounts of calories
		- Low density as solid
			* Molecules forms a crystalline structure that takes up more space than as a liquid
		- Good solvent
			* Positively charged side of H2O “grabs” negative ions
			* Negatively charged side of H2O “grabs” positive ions
			* Helps chemical reactions to happen in your body
	+ Living systems are sensitive to acids and bases
		- pH scale
			* the amount of H+, or lack thereof, in a solution is pH
			* acid have a high concentration of H+
			* bases have a high concentration of OH-
		- Blood
			* Is a natural buffer
				+ Too much H+, absorbs it
				+ Too much OH-, releases built up H+
	+ Four types of Macromolecules
		- Sugars/Carbohydrates
			* Fuel for living things
			* C, H and O
			* Used for cell structure
			* Most carbs converted to glucose (Blood Sugar)
			* Glucose used for energy because of the massive amounts of C-H bonds
				+ Glucose made

Energy needed-glucose broken down and turned to energy

Not needed-short term turned to glycogen

Not needed- long term turned to fat

* + - * Carbo-loading?
				+ Marathoners carbo-load for energy
				+ Not all energy used right away
				+ Glycogen stored in muscles for easier access
			* Water-weight?
				+ Every ounce of glycogen has as much as four ounces bound to it.
				+ Using glycogen uses the water too
			* Starch
				+ >100 of glucose molecules joined together
				+ Barley, wheat, rye, corn, and rice
				+ Glycogen = “Animal Starch”
			* Complex Carbs: “Time-release” fuel pellets
				+ Different types

Fructose quick but brief burst of energy

Complex carbs slow but persistent energy

* + - * A few carbs can’t be broken down
				+ Chitin

Carb that can’t be digested with water

Shells of crabs, oysters, lobsters, etc.

* + - * + Cellulose

Wood

Roughage

* + - * + Fiber

Roughage

Colon cancer prevention/reduction

Termites ecological role

* + - Lipids – Fats& Oils
			* Non-polar (non-soluble)
			* Greasy
			* Source of energy
			* Energy for a rainy day
				+ Fats

Long-term energy storage and insulation

Most efficient way of storing energy

* + - * + Sterols

Regulates growth and development

* + - * + Phospholipids

Form membranes that enclose cells

* + - * Also act as hormones
				+ Glycerol: “head” region
				+ Fatty acid “tail”
				+ Triglycerides
				+ Fats have much more energy than carbohydrates
			* Saturated vs. Unsaturated
				+ Saturated made with more hydrogen
				+ Unsaturated made with less hydrogen

Makes double bonds instead of single bonds

Reason unsaturated are normally liquid

* + - * Cholesterol
				+ Important component of most cell membranes
				+ Can attach to blood vessel walls
				+ Liver produces 90% of cholesterol
				+ Sex-hormones

Estrogen influences mood and memory

Testosterone influences muscle growth

* + - * PSA!!
				+ Sugar is sugar
				+ Carbs are sugar
				+ Fats become sugar
				+ Oils become sugar
		- Amino Acids/ Proteins
			* Chemicals that put body together
			* Structural
				+ Hair
				+ Nails
			* Protective
				+ Fight invading microorganisms
			* Regulatory
				+ Control cell activity
			* Contractile
				+ Heart and muscles
			* Transport
				+ Carry molecules around your body
			* Complete proteins contain all 8 essential amino acids
				+ Those eight can’t be made by the body
				+ Incomplete proteins don’t have all eight essential amino acids
			* Primary structure
				+ Sequence of amino acids
				+ Peptide bonds
				+ Proteins are influenced by their 3-D shape
			* Proteins are essential
				+ Growth
				+ Repair
				+ Replacement
			* Enzymes are proteins that initiate and speed up chemical reactions
				+ Natural catalysts
				+ Function by their shape
				+ Always end in “ase”

Lactase breaks down lactose

* + - * + Renewable, they work more than once
			* “Misspelled” Proteins
				+ Incorrect amino acid sequence
				+ Active site disruptions
				+ Phenylketonuria
		- Nucleic acids – DNA
			* Store the info on how to build and run the body
			* Deoxyribonucleic acid
			* Ribonucleic acid
				+ Both play central roles in protein production.
			* The info in DNA is determined by the sequence of bases
				+ Adenine, guanine, cytosine, and thymine
				+ Base pairing

A-T

C-G

Complimentary Strand? CCCCTTAGGAACC

GGGGAATCCTTGG

* Chapter 3: Cells
	+ Learning Objectives
		- Describe what a cell is
		- Structure and function
		- Several ways molecules move across membranes
		- How cells are connected and how they communicate
		- Nine important landmarks in cells
	+ Cell Theory
		- All living organisms are made up of one or more cells
		- All cells arise from other pre-existing cells
		- All cells are alive
	+ Cells
		- Robert Hooke, a British scientist, mid 1600’s
		- A cells is a 3-D structure like a fluid-filled balloon
		- Nearly all cells contain DNA
		- 2 types of cells
			* Prokaryote
				+ No nucleus
				+ Bacteria/archaea
				+ No organelles
				+ DNA tiny & looped
			* Eukaryote
				+ Nucleus
				+ Protists, fungi, plants animals
				+ Lots and varied organelles
				+ DNA lots – threads
		- Parts of Cell
			* Cell membrane
				+ Gatekeepers
				+ Two layers of lipids with a variety of pores, molecules and channels
				+ They perform several critical functions
				+ 4 primary types of membrane proteins

Receptor

Bind to external chems to regulate processes

Recognition

Provide fingerprint for cell

Transport

Passageway for molecules

Reaction

* + - * + Problems with membrane?

Cystic fibrosis

* + - * Nucleus
				+ Cell’s genetic control center
				+ Largest and most prominent organelle
				+ Two primary functions

Genetic control center

Storehouse for hereditary info

* + - * Mitochondria
				+ Converts food to energy and stores it for cellular use.
				+ ATP: Adetisontriphosphate

The only form of energy a cell can use

Can’t get it, the mitochondrion have to make it

Made from sugar and O2

Byproducts: CO2  and H2 O

Called cellular respiration

* + - * + Has its own set of DNA
			* Lysosomes
				+ Cell’s garbage disposals
				+ Round membrane-enclosed, acid filled
			* Endomembrane system
				+ Rough endoplasmic reticulum, smooth ER and golgi apparatus
				+ Smooth ER

Creates lipids and detoxifies

* + - * + Rough ER

Creates proteins via ribosomes

Packages proteins for use in the cell

* + - * + Golgi apparatus

Packages proteins and lipids for use outside the cell

* + - * Cell wall
				+ Provides additional protection
			* Chloroplast
				+ Photosynthesis
				+ Thylakoids in chloroplast helps photosynthesis
* Chapter 4
	+ The process of creating energy
		- Photosynthesis
			* Plants take in H2O and CO2 and sun light
			* Produces glucose and O2
		- Cellular respiration
			* Takes in Glucose and O2
			* Creates ATP, CO2 and H2O
		- C3 (Type of photosynthesis)
			* Efficient with light
			* Inefficient with water
			* Rainforest plants
			* Uses a lot of water for larger leaves to catch a little sun
			* Most edible plants are C3 plants
		- C4 (different photosynthesis)
			* Inefficient with light
			* Efficient with water
			* Desert plants
			* Hardly any leaves but stores water
			* Runs more photosynthesis at night to lose less water
		- Fermentation
			* Same process as alcohol production
			* In animals, fermentation produce Lactic Acid
				+ Makes your muscles sore
				+ Overworked cells say “Hey, dumbass, slow down!”
				+ Far less efficient; uses more sugar than cellular respiration

Cellular Respiration = C6H12O6 🡪 36 ATP

Fermentation = C6H12O6 🡪 2 ATP

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PG 33-34 in lab book needs to be completed before lab on Tuesday

Test in two weeks from today. September 22