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