Week 13 Lecture 0

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1 Administrative drivel

- Exam grades are not in yet
- we're throwing out the senses, since we won't be worried about this till we're in our 50s
- So, we'll proceed to nutrition and digestion
- next week we'll cover ecosystem processes and human impact

2 Nutrition

- Why do we eat?
  - We must acquire from the enviornment the energy and building blocks to run our activities
  - Building blocks
    - Things that don't provide energy
    - provide molecules for building structures, protiens, etc
  - calories (energy)
    - Plants can turn light into chemical energy, but we have to get our energy through calories in food
    - the principle form of chemical energy for humans is glucose
    - The energy we get ultimately comes from plants, who get it from the sun
- Nutrients – the things we need to survivie
  - Macronutrients – need lots
    - carbohydrates
      - bulk of the mass of plants
    - lipids
    - protiens
      - Heavy meat intake leads to weight gain, and cardiovascular disease with potential shortened life
  - Micronutrients – need small amounts
    - vitamins
    - minerals
- macronutrients:
  - **Protiens**
    - Amino acids, polypeptides

    - Importantly, they get turned into digestive enzymes
    - Recycle into your own proteins
        - break apart ingested proteins into individdual amino acids
        - Assemble amino acids into proteins at the ribosomes
    - Some are built into nucleic acids
        - recall that both hamino acids are nucleic acides are N-based (nitrogen based)
    - Minor source of energy
        - turned into glucose
        - They aren't usually stored, and get urinated out
        - So, a steady supply is needed
        - when protiens are broken down, there are left over nitrogens in the form of amonia, which is toxic, which needs to be evacuated in the urine
- **Carbohydrates**
    - Sugars, starches, glycogen
        - Glycogen is the animal material form of starch
        - most of which is found in the liver
        - also a long chain molecule of glucoses
    - Main source of energy
        - starches and other polysaccharides get broken down to sugar
        - sugar (esp. glucose) burned to make ATP
        - carried in the blood to almost all of the cells
    - plants build the starches during the day with excess glucose, so they have energy at night when they don't have the sun
- **Lipids**
    - Fatty acids, triglycerides, cholesterol
    - build cell membranes
    - secondary source of energy
        - much more enrgy-dense than carbohydrates
        - used as a storage molecule
        - have a lot more energy than carbs per pound

- Energy
    - All macro nutrients can be used for ATP productionn
    - **METABOLISM** == convert food into energy or building blocks
    - $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + 36ATP$ – respiration (inverse of photosynthesis)
    - ATP "density"
        - Glucose = about 34 ATP per glucose molecule
            - 6 carbons
        - Fatty acides = about 34 ATP per 4 carbons of the FA (fatty acid)
            - Chain length can be between 6-22 carbons and up
            - fatty acids only come in even numbers of carbon

- Calorie density:
    - 4 Calories / gram
    - 9 Calories / gram
    - so, it's much more weight efficient to store exess energy as fat
    - e.g. bird migration is powered by lipids to save weight
    - $\underline{C}$al == 1000 $\underline{c}$al
    - 1 calorie = $5 - 8 \times 10^{19}$ ATP molecules
    - So, 1g carbs = 4 Cal = 4000 cal = 200-320 sextillion ATPs

- Energy Balance
    - If average energetic demand equals energetic input, all consumed energy is used for body funcntioning
    - if *input exceed demand*, suprlus energy is stored as **glycogen** or **triglyceride** if not used within hours or days
    - Obesity – one of the leading global causes of preventable eath
        - 2.5 million/year
        - Effects: heat disease, diabetes, arthritis, stroke, dimentia
    - if *demand exceeds input*, stored glycogen and triglycerides are mobilized
    - **Malnutrition** :
        - Without sufficient calorie intake, body consumes fat resereves, then protein reserves