



Organic Chemistry Lecture 4 - Biochemistry/Lab Techniques

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Lipids

Fatty acids: long carbon chains with carboxylic acid at the end

-> Can be saturated or unsaturated depending on whether there's double bonds

-> Are amphipathic and nonpolar

Stored in body as *triglycerides* in adipose cells when connected to glycerol via *esterification*

Can be broken down in body thru *lipolysis* or in lab thru *saponification* (by adding NaOH)

When metabolized, cut up into 2-carbon chunks which are converted to Acetyl CoA

Proteins

Amino acids: have an amine at one end, a carboxylic acid at the other end, joined at the alpha carbon

Peptide bonds are connections between the amine and the carboxylic acid (amides)

20 different possible side chains coming off alpha carbon = ten amino acids

10 amino acids are essential (can't be produced by body)

When titrated with base, will have the following occur:

1) Starts off with carboxylic acid having proton, amine having extra proton (+)

-> at this point, is positively charged

2) Carboxylic acid loses proton, 1st half equivalence point + 1st equivalence point

-> at this point, is a zwitterion or has both + and - charge

3) Amine loses proton, 2nd half equivalence point + 2nd equivalence point

-> at this point, is negatively charged

pH at 1st equivalence point is the *isoelectric point*

-> Basic amino acids have isoelectric point > pH 7, acidic have < pH 7, neutral have = pH 7

Carbohydrates

Hexoses: glucose has an aldehyde, fructose has a ketone

-> Aldoses vs. ketoses

D vs. L: if 2nd carbon from bottom has OH to the left, it's L; if to the right, it's D

Glucose can form 6 membered ring (pyranose), with *anomeric carbon* to the right of the O

-> OH points down: alpha, OH points up: beta

Fructose can form 5 membered ring (furanose), same thing with anomeric carbon

Glucose can react with alcohols to form *glycosides* (OH replaced with OR)

Sucrose: glucose + fructose, 1-1 linkage

Maltose: glucose + glucose, 1-4 alpha linkage

Lactose: glucose + galactose, 1-4 beta linkage

Cellulose: glucose + glucose + ..., 1-4 beta linkage

Amylose (starch): glucose + glucose + ..., 1-4 alpha linkage



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Amylopectin: glucose + glucose + ..., 1-4 alpha linkage (branched 1-6)

Glycogen: glucose + glucose + ..., 1-4 alpha linkage (branched 1-6)

Lab Techniques

NMR

Caused when hydrogen nuclei are resonated by magnetic field

Right = upfield = high mag field strength, left = downfield = low mag field strength

Different connectivities of hydrogen will have different peaks (more electrons around hydrogens = more mag field strength required = upfield)

Splitting results from hydrogens being affected by non chemically equivalent hydrogens attached to adjacent carbons; number of splits = number of neighboring hydrogens + 1

IR

Infrared light causes bonds to vibrate at specific frequencies

Wavenumber = $1/\text{wavelength}$, units are cm^{-1}

O-H: big peak around 3300

N-H: small peak around 3300

Saturated C-H: 2800-3000

C-triple-N: 2200

C=O: 1710

Fingerprint region: between 600-1400 cm^{-1} , tells you what specific compounds are like

UV Spectroscopy

Conjugated double bonds increase absorption wavelength by 30-40 nm each

Mass Spectrometry

Break down molecule into ions, run thru magnet and see where they land

Mass to charge ratio differs between different molecules

Chromatography

Separating components of mixture by passing thru a substance that is attracted differently to different parts of the mixture

Can be solid substance, liquid mixture or liquid substance, gas mixture

Distillation: separating compounds with different boiling points



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Extraction

Things are differently soluble in different pH environments, can dissolve and remove separately

- 1) Add strong acid to dissolve amines (bases)
- 2) Add weak base to dissolve carboxylic acids (strong acids)
- 3) Add strong base to dissolve alcohols (weak acids)
- 4) Rest of mixture contains the rest of the stuff