I. Carbon, Carbon in the Sky – Are you swinging low or high?

1. Gaps in the leaf epidermis = "stomata" = CO_2 in for fixation (inorganic becomes organic)
2. Organic Compounds = one or more elements covalently bonded to C
   a. mostly C, H & O (w/ P(nucleic acids), N, S(proteins))
   b. Can form chains & rings of various sizes, yielding various functions & hence shapes & sizes depending on:
      i. Bondings
      ii. Side chains
      iii. Functional groups
         1. Hydroxyl -OH
         2. Aldehyde HCO
         3. Ketone C=O
         4. Carboxyl (acid) O=C-OH
         5. Amine $-NH_2$
         6. Phosphate $-PO_4^{-2}$
         7. Methyl groups $-CH_3$
   c. Four simple/basic types of C compounds (monomers)
      i. Simple sugars (carbohydrates)
      ii. Fatty acids (lipids/fats/oils/waxes)
      iii. Amino acids (protein/enzymes)
      iv. Nucleotides (nucleic acids & ATP)
   d. Five classes of Rx (enzyme driven)
      i. Functional group transfer (e.g. – phosphorylation)

ii. Electron transfer (Reduction = gain of electrons and/or **H**; Oxidation = loss of electrons and/or **H**)
iii. Rearrangement
iv. Condensation (dehydration synthesis)
v. Cleavage (hydrolysis)

e. Present day conditions only allow for synthesis of carbohydrates, lipids, proteins & nucleic acids within cells

3. Carbohydrates
   a. Usually a ratio of 1C:2H:1O (carbon water)
   b. Most abundant
   c. Structural components
   d. Energy storage/transfer
   e. 3 classes mono-; di- (oligo-) & polysaccharides (different chemical tests for each)
      i. Monosaccharide
         1. aldehyde or ketone with more than two hydroxyl groups a polar molecule
         2. Sweet
         3. Tendency to form rings within cells or body fluids
         4. Main energy source & monomer is Glucose (6-C)
         5. Others: Vitamin C & Glycerol, based on sugar monomers
      ii. Oligosaccharides

1. Disaccharide is most common (maltose, lactose, sucrose)
2. Make excellent protein, etc. side chains
3. Imp. cell markers (for defense, regulation and recognition)

iii. Polysaccharides

1. Complex carbohydrates
2. Energy storage
3. Structural purposes
4. Indicated by iodine
5. Starch, cellulose, glycogen, chitin
6. Spiral amylose
7. Side-chains (amylopectin)
8. Different bonding patterns between monomers → distinct properties

II. Lipids (C,H,O in no apparent ratio)

f. Non-polar (hydrophobic) non-water soluble; soluble in nonpolar substances (membranes)

g. 3 fatty acids (long chains/ tails, ends in carboxylic acid, synthesized with glycerol (3–C alcohol))

h. Stored energy, structural material and cell products

i. Saturated (C-C) and unsaturated (C=C, C≡C)

j. Triglycerides (3 fatty acids and a glycerol)

i. Most abundant lipid; insulation padding, conduction
ii. Produce twice as much energy as complex carbohydrates

k. Phospholipids (underlain by glycerol and phosphate-nitrate polar head)
i. Hydrophilic head
ii. Hydrophobic tails

l. Sterols (four fused C/fatty acid rings with no tails)

m. Cholesterol, vitamin D, steroids, bile salts

n. Waxes

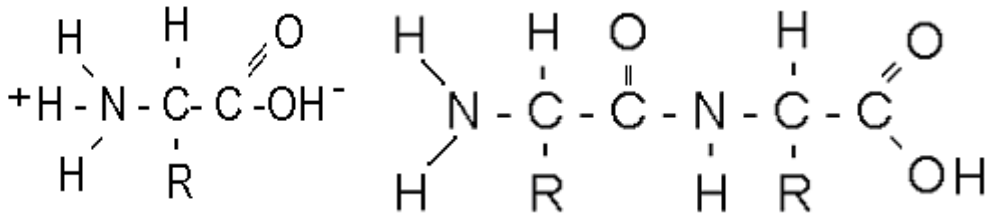
o. Cutin (most of the cuticle of above ground plant)

III. Proteins C,H,O,N,**S**

A. Extremely diverse

B. Enzymatic; structured; transporter; nutrient; regulatory; immunological

C. Monomer: amino acids (20 different kinds) all have the form



LEVELS OF PROTEIN STRUCTURE

A. 1° Structure: linear arrangements of AA, prescribed by DNA (gene→splitting)

B. 2° Structure: via H-bonds & R-group interactions of 1° structure

1. α-helix + β-pleated sheets and hydrophobic/hydrophilic interactions arrange the 1° structure 3 dimensionally

C. 3° R-group interactions along with hydrophobic and hydrophilic interactions create folded **polypeptide** (globin)

D. 4° - 2 or more polypeptides joined to form structurally functional protein (hemoglobin) globular or fibrous

E. Proteins are generally pH and Temperature specific. They can also be denatured (changes their 3^0 structure) = non-functional proteinaceous mass.

IV. Nucleic Acids (C,H,O,N,**P**)

A. Hereditary info; controls cellular metabolism (DNA->RNA->Protein)

B. Nucleotide monomers

i. sides/backbone = 5C sugar & phosphate group @ 5’

ii. ‘rungs’ = nitrogen bases (A,T(U),C,G w/ complementary base pairing; the sequence determines the gene)

C. DNA –

i. double helix; located in the nucleus or nucleoid region; hereditary info., makes RNA

ii. Sugar = deoxyribose
iii. bases
Purines – Ade**nine**(A), Gua**nine**(G);
Pyrimidines – Thymine(T),
Cytosine(C)

D. RNA
i. generally single stranded; located in nucleus and cytoplasm; produces proteins; *can* act enzymatically
ii. Sugar = Ribose
iii. bases – Uracil(U) replaces T (hence A bonds to U in RNA)
iv. the basic component of ATP (Energy currency of the cell)