Organic Synthesis

# Alpha Amino Acids

* Amino acids contain both amino functional group (-NH2) and carboxylic acid functional group (-COOH)
* Alpha amino acids are those in which both of these functional groups are attached to the same carbon atom (-C(COOH)NH2)
* Alpha amino acids are building blocks of proteins or polypeptides
* Polypeptides are those which contain many alpha amino acids
* Dipeptides (contain 2 alpha amino acids), Tripeptides (3) and more exist
* Polypeptides are formed from bonds between -NH2 functional group of one alpha amino acid and -OH group in another ⇒ -NH2 loses 1 H and the -OH group is lost to form H­2O and a bond
* In the **solid** and **aqueous** form of an alpha amino acid, they occur in a zwitterion form
  + Contains a positive and negative terminal (not to be confused with partial charges of a polar molecule) and overall neutral
  + Weakly acidic -COOH group releases H+ ion and is accepted by weakly basic -NH2 functional group
    - Remaining groups are: -COO- and -N+H3
  + Formation of zwitterion explains why all alpha amino acids are crystalline solids with relatively high melting points ⇒ Zwitterions can form very strong ionic bonds with each other
  + Alpha amino acids are fairly soluble in water
  + Zwitterions are capable of behaving as acids (proton donors) or bases (proton acceptors) ⇒ Ka depends on pH of surrounding solution
  + Zwitterions can also act as buffers and are amphoteric
* Carboxylic acids have acidic properties
* Hydrolysis:
  + Carboxylic acid + H2O ⇔ ethanoate ion + hydronium ion
* Carboxylic acids are typically weak acids

# Fats and Oils

* Triglycerides ⇒ fats and oils (type of ester)
* Triglycerides contain fatty acid molecules attached to a main ester group
* Vegetable oils are unsuitable for cooking because they remain a liquid when heated
  + Unsaturated fats from plants also tend to spoil quicker (due to more reactive double bounds, capable of addition reactions)
  + Hydrogenation is solution ⇒ converts unsaturated liquid vegetable oils into more versatile solid products (ex. shortening, margarine)
    - Addition reaction where H atoms add to some double bonds in triglyceride carbon chains
    - Reduces degree of unsaturation and produces solid fat
    - Hydrogenation can produce an undesirable side reaction which converts some cis double bonds in triglyceride carbon chain into trans form
      * Trans isomers are unsaturated, but their linear geometry increases dispersion forces and allows molecules to pack more efficiently than cis form
        + Trans fats solidify more readily than cis ⇒ poses a risk to cardiovascular system

# Zwitterions

* α-amino acids exist as a dipolar ion in aqueous and solid solutions
* Carboxylic acid group loses proton, NH2 group accepts proton
* pH and charge is neutral, zwitterion is capable of ionic bonding
* Therefore, α-amino acids are crystalline solids with high bps, due to ionic bonding
* Zwitterion forms cationic form (accepted proton) in low pH, as there are an excess of protons
* Forms anionic form (released proton) in high pH

# Ester Hydrolysis

* Na+ and O- atom goes to oate salt, H goes to alcohol

# Saponification