AMINO ACIDs

Amino acids
- Non polar
  - Aliphatic
    - Glycine [Gly] Amical → R = H → derived from acetic acid
    - Alanine [Ala] → R = CH_3
    - Valine [Val] → R = $-CH(CH_3)_2$
    - Leucine [Leu] → R = $-CH_2CH(CH_3)_2$
    - Isoleucine [Ile] → R = $CH_3-CH_2-CH(CH_3)$
    - → essential, branched amino acids (from diet, the body can't synthesize)
    - Methionine [Met] → R = $CH_2CH_2-S-CH_3$ → SAM is derived from it (Thio ether; S-Adenosyl-D-methionine; methyl donor)
    - Proline [Pro] → R = (Nα, Cα, CH_2, CH_2, CH_2 2nd amine) → rigid; the only cyclic amino
  - Aromatic
    - Phenylalanine [Phe] → R = $-CH_2-C_6H_5$
    - Tryptophan [Trp] → R = $-CH_2-C_8H_6N$ [Indole] → the largest amino acid
- Positively charged
  - Lysine [Lys] → R = $(CH_2)_4NH_2$ (primary amino; can be protonated $(+)$)
  - Arginine [Arg] → R = $(CH_2)_3-NH-C(=NH)-NH_2$ (can be protonated; guanidinium)
  - Histidine [His] → R = CH_2 + [Imidazole] (Nδ, Nε) → Histamine is derived from it; Aromatic side chain
- Negatively charged
  - Glutamic acid [Glutamate] [Glu] (5 carbon molecule) → R = $-CH_2-CH_2-COOH$ (can be deprotonated) → acidic side $[COO^-]$
  - Aspartic acid [Aspartate] [Asp] → R = $-CH_2COOH$ → acidic side $[COO^-]$
- Polar
  - Serine [Ser] → R = CH_2OH
  - Threonine [Thr] → R = $CH_3-CH(OH)-$ → branched → hydroxyl aliphatic → more hydrophilic → more reactive
  - Cysteine [Cys] → R = $-CH_2SH$ (Thiol carbohydrate) → Thiol is reactive; it has essential role in folding
  - Glutamine [Gln] → R = $CH_2-CH_2-CONH_2$ → derivative of Glutamic acid
  - Asparagine [Asn] → R = CH_2-CONH_2 (Carboxamide) → derivative of Aspartic acid
  - Tyrosine [Tyr] → R = $CH_2-C_6H_4-OH$ → hydroxyl aromatic; reactive

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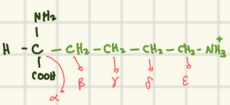
- Designation of carbon in side chains; we refer to them in Greek letters as
- If the carbon is terminal we refer to it as ω [omega]



- α Nitrogen [C_α] is the primary source for many nitrogeneous compounds
  - Hormones
  - Neurotransmitters
  - Biologically active peptides
- Amino acid pool can form
  - Mainly proteins
  - glucose, glycogen
  - steroids, fatty acid, ketone bodies
  - CO_2

- Tyrosine [Tyr]
  - Chatechol amine neurotransmitters
    - Dopamine
    - Norepinephrine
    - Epinephrine [Flight or fight response]
    - → The pathway: Tyr → DopA → Dopamine → Norepinephrine → Epinephrine
  - Melanin
    - Eumelanin [skin color]
    - pheomelanin [hair color]
  - Thyroxine [Hormone]
- Tryptophan [Trp]
  - Serotonin neurotransmitter → SSRI (Selective Serotonin Reuptake Inhibitor) it controls emotion, appetite etc..
  - Melatonin
    - secreted from Pineal Gland
    - Day-Night cycle [In the night Calorimeter, it increases signaling the body to sleep, relax]
      - Elderly people have less Melatonin, therefore, they sleep less.
- Histidine → Histamine
  - acts as neurotransmitter
  - causes allergic symptoms [Major causes for Asthma]
- Arginine → Nitric oxide [NO, N=O]
  - Vasodilation
  - Inhibition platlet adhesion
  - Anti inflammatory

- Lysine —hydroxylation→ Hydroxylysine → Part of collagen structure
- Proline —hydroxylation→ Hydroxyproline → Part of collagen structure; modified After protein synthesis

- Glutamine
  - GABA [γ aminocarbutyric acid] → inhibitory neurotransmitter
    - anti anxiety, relaxing
    - anti-convulsive [seizures]
  - carboxylation → γ carboxyglutamat [Gla] → residue of blood proteins are Carboxylated, Essential for blood clotting [coagulation]
    - Vitamin K is essential for this process
  - Monosodium Glutamate [MSG]
    - food enhancer; Asian food
    - Can cause physiological reaction [Chinese restaurant syndrome]
      - head aches
      - dizziness
      - Chills