

PEPTIDES AND POLYPEPTIDES:

→ Definitions and Concepts:

- **A residue:** each amino acid in a (poly)peptide
- **Dipeptide, tripeptide, tetrapeptide, etc.**
- **Oligopeptide (Peptide):** a short chain of 20-30 amino acids
- **Polypeptide:** a longer peptide with no particular structure
- **Protein:** one or more polypeptide chains with an organized 3D structures
- **Dalton:** the atomic mass unit

NOTE:

- The average molecular weight of an amino acid residue is about 110
- The molecular weights of most proteins are between 5500 and 220,000

Calculate how many amino acids

$$5500 / 110 = 50 \text{ amino acids}$$

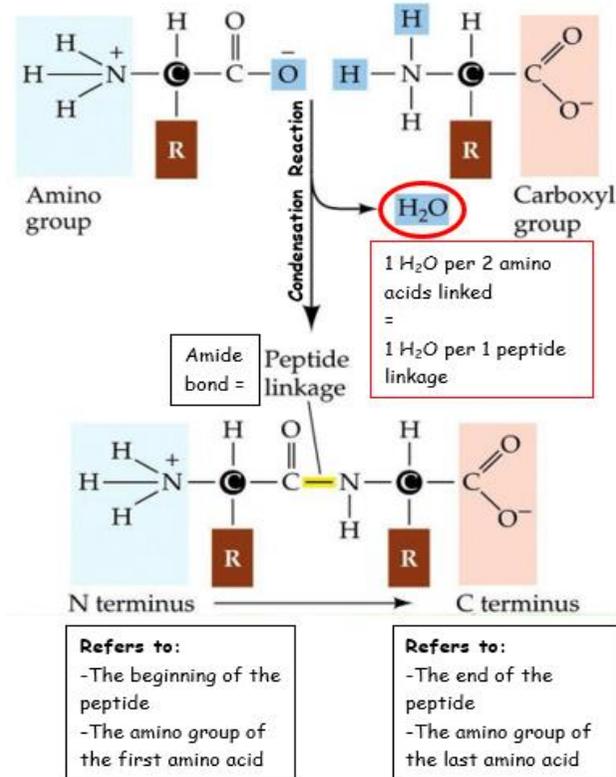
$$220000 / 110 = 2000 \text{ amino acids}$$

Thus, number of amino acids in most proteins ranges from 50 to 2000 amino acid

- We refer to the mass of a polypeptide in units of Daltons: i.e.

A 10,000-MW protein has a mass of 10,000 Daltons (Da) or 10 kilodaltons (kDa)

FORMATION OF THE PEPTIDE BOND:



Q: Calculate the number of water molecules produced by the linkage of 28 amino acid

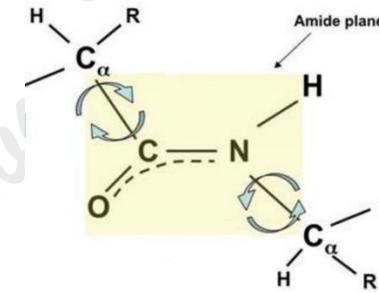
A: 28 - 1 = 27 water molecule

*Features of the Peptide Bond:

- Resonance structure makes peptide bond:
 - Zigzag structure
 - Double bond = Planar, Charged, Rigid, Un-rotatable
- Hydrogen bonding, except for proline

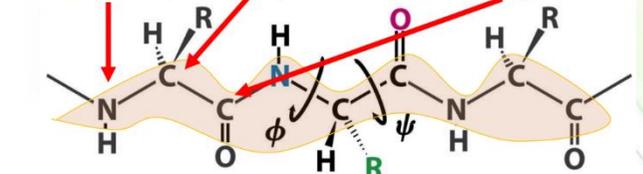
NOTE:

Rotation can occur but not at the peptide bond.

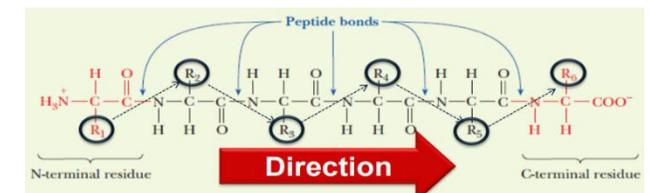


GENERAL STRUCTURE OF A PEPTIDE:

α-amide N, the α-C, and the α carbonyl C atom



→ The shadowed area = The backbone



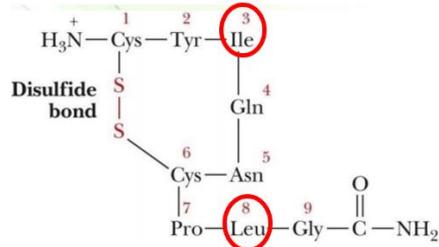
R Groups are in trans configuration
WHY??

Steric hindrance between the functional groups attached to the C_α atoms will be greater in the **cis configuration**, thus the **trans configuration** is favored.

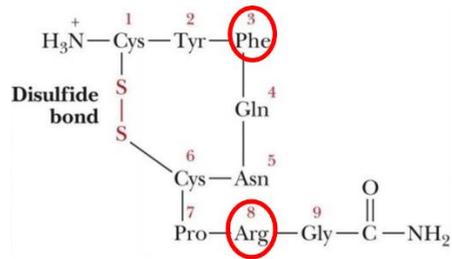
Except for proline

WHY?? ▼

◇ Oxytocin:



◇ Vasopressin:



NOTE:

Oxytocin and Vasopressin are unique among other peptides due to the presence of NH₂ at the C-terminus

-Found in different glands

-Functions of Oxytocin:

•Regulates contraction of uterine muscle (labor contraction)

[The production of this hormone in labor increases, along with the expression of its receptors]

•Regulates mood; increasing happiness

-Functions of Vasopressin (Anti-Diuretic Hormone ADH):

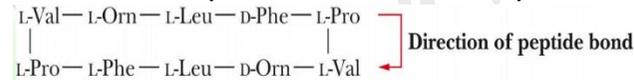
- Regulates contraction of smooth muscle, specifically at the urinary bladder
- Increases water retention
- Increases blood pressure

*Gramicidin S and Tyrocidine A:

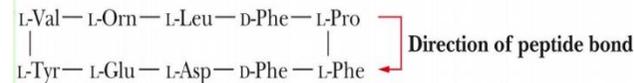
[Decapeptides]

-They are cyclic, formed by peptide bonds
-Produced by the bacterium Bacillus brevis and act as antibiotics

[Not Found/Synthesized in our Body]



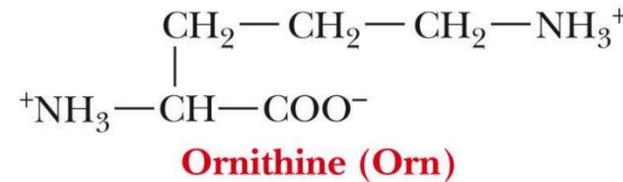
Gramicidin S



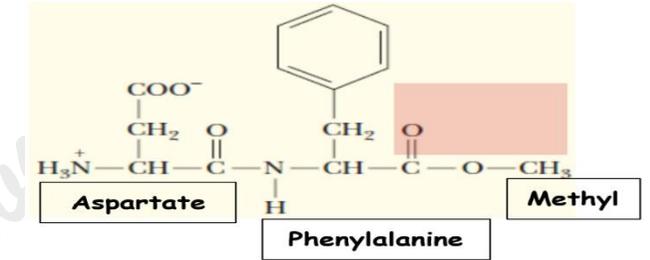
Tyrocidine A

NOTE:

- Both contain D- and L-amino acids
- Both contain the amino acid ornithine (Orn), which does not occur in proteins



*Aspartame (L-Aspartyl-L-phenylalanine):
[a Dipeptide]



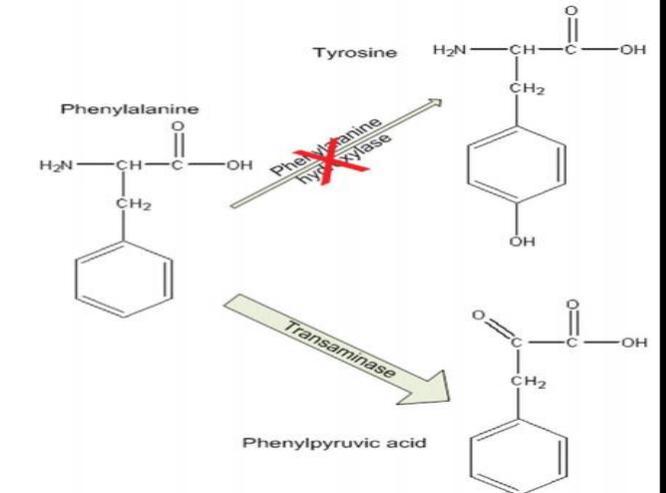
-It is a methyl ester

-It is 200 times sweeter than sugar, thus; used as an artificial sweetener

-If a D-amino acid is substituted for either amino acid or for both of them, the resulting derivative is bitter rather than sweet

◇ Phenylketonuria (PKU):

-PKU is a hereditary "inborn error of metabolism" caused by defective enzyme, phenylalanine hydroxylase



-It causes accumulation of phenylpyruvate, which causes mental retardation.

-Sources of phenylalanine such as aspartame must be limited.

-A substitute for aspartame, known as alitame, contains alanine rather than phenylalanine

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