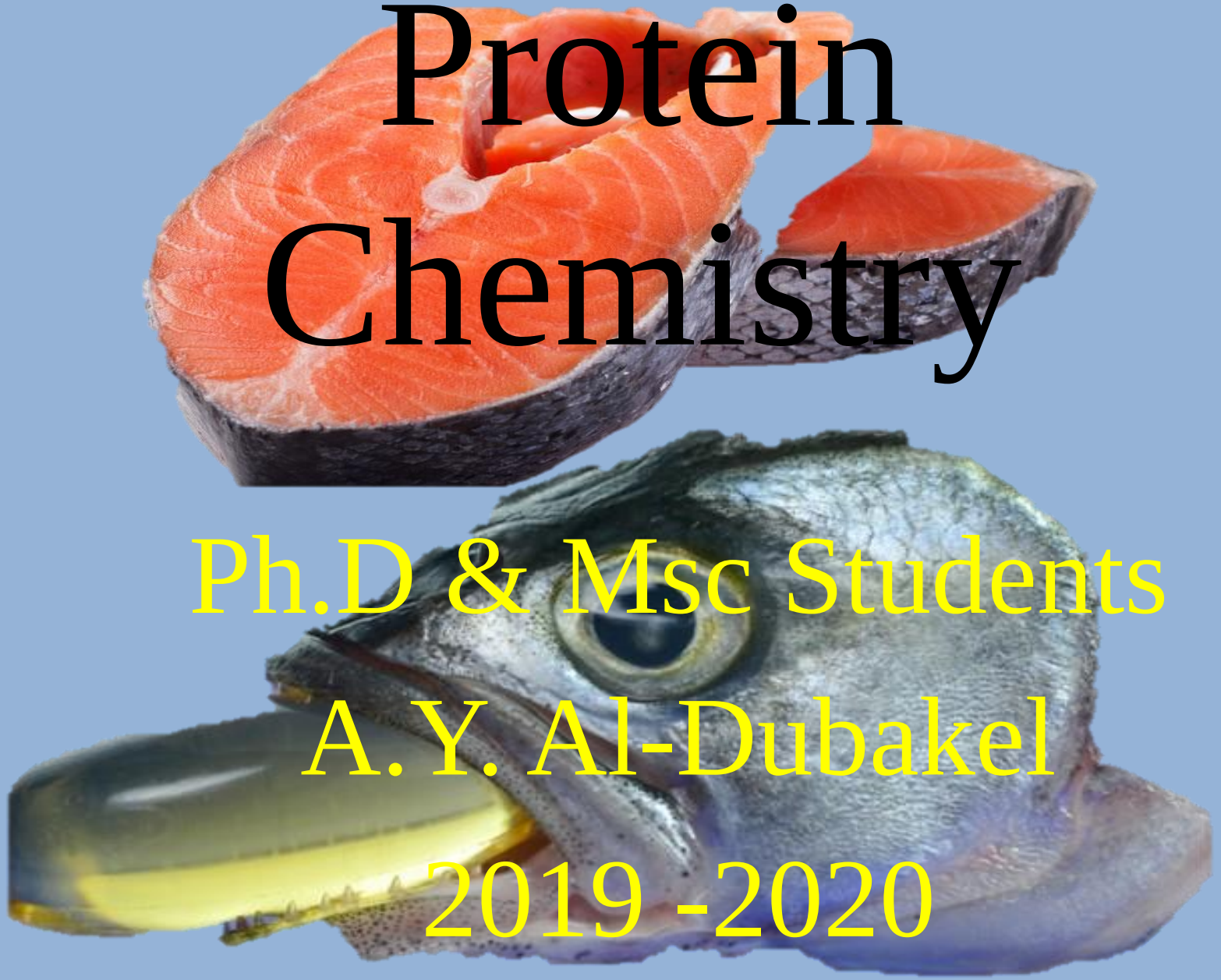
Protein Chemistry



Ph.D & Msc Students

A. Y. Al-Dubakel

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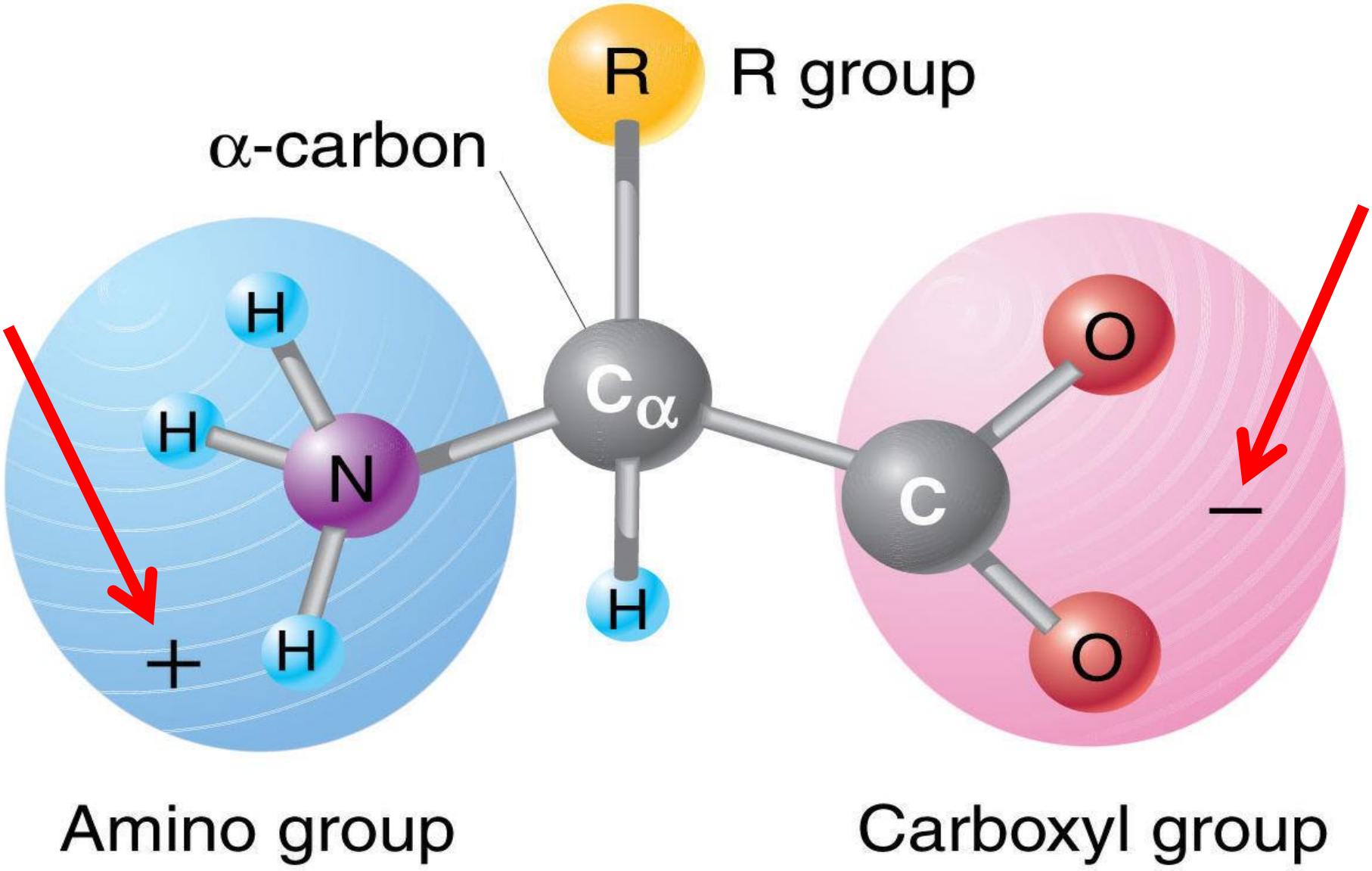
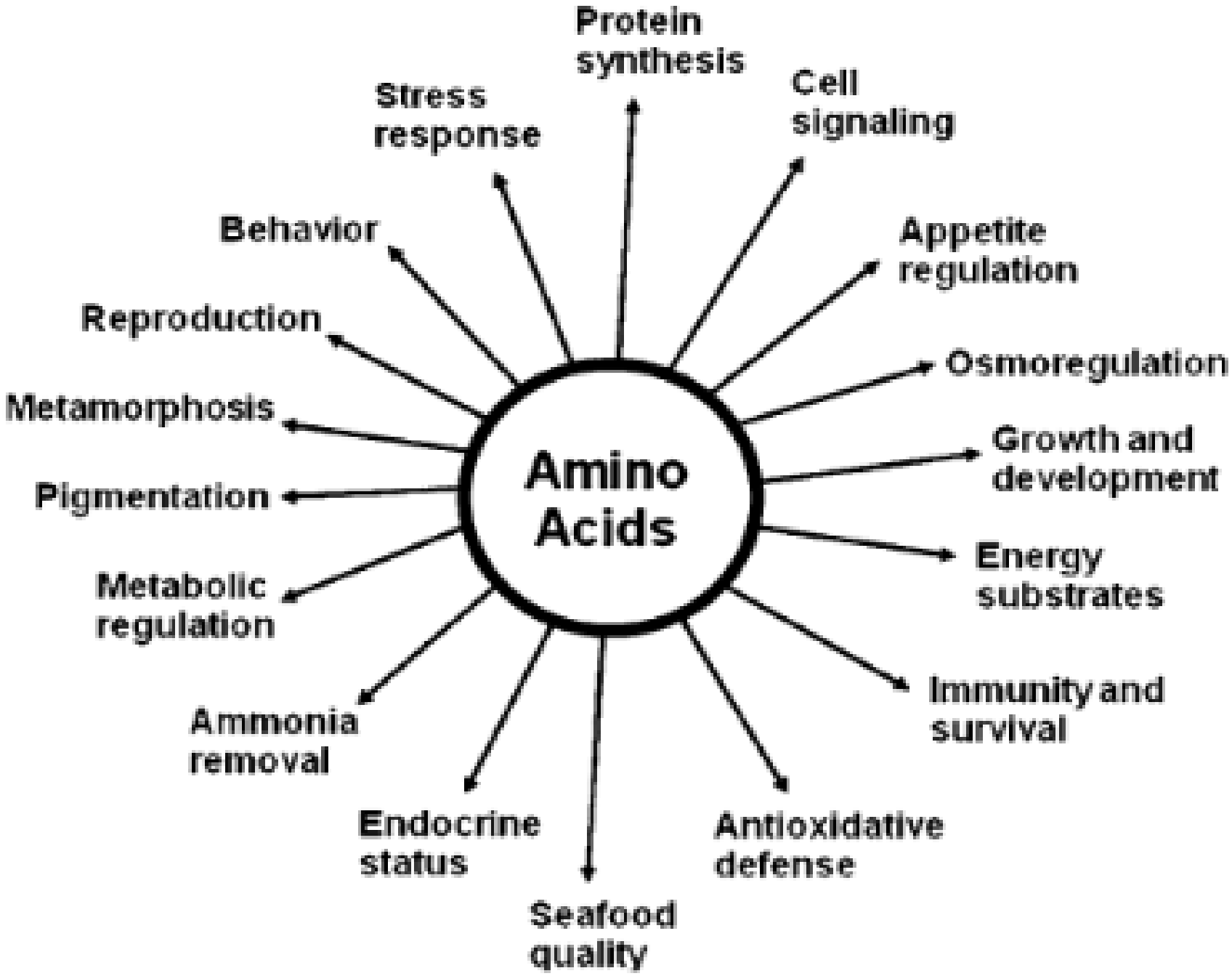
Lecture 2

Amino acid classification




Protein synthesis
Stress response
Cell signaling
Behavior
Appetite regulation
Reproduction
Osmoregulation
Metamorphosis
Growth and development
Amino Acids
Pigmentation
Energy substrates
Metabolic regulation
Immunity and survival
Ammonia removal
Endocrine status
Antioxidative defense
Seafood quality

Amino Acids

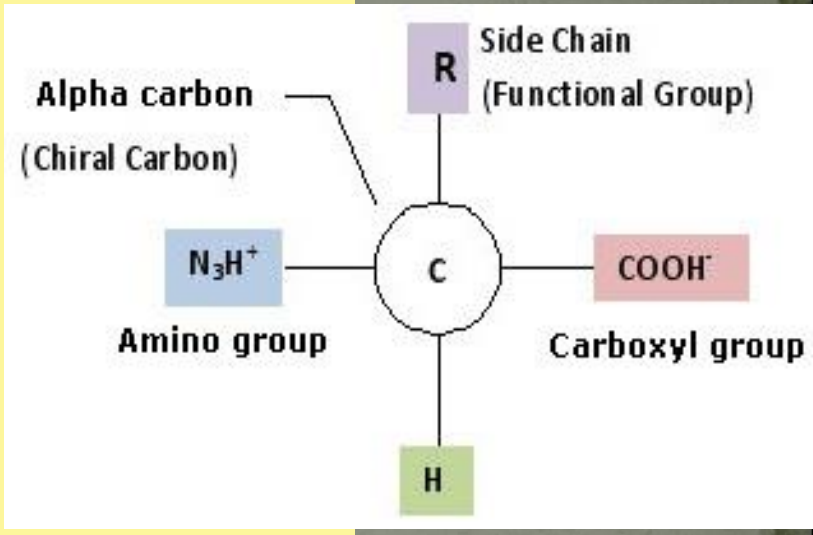
- There are over 300 “500” “700” types of amino acids that have been discovered in nature. Almost all of them are α-amino acids. More than 100 amino acids occur in nature, particularly in plants.
- 20 important amino acids are crucial for life as they contain peptides and proteins

classification of Amino Acids

- Amino acids can be classified in 4 ways:
  1. Based on **structure**
  2. Based on **side chain characters**
  3. Based on **nutritional requirements**
  4. Based on **metabolic fate**

1)Based on Chemical structure

- Mono amino mono carboxylic acids
  Ex-Glycine,valine,theronine,leucine, isoluceine
- Mono amino dicarboxylic acids
  Ex- Aspartic acid, glutamic acid
- Diamino mono carboxylic amino acid Ex- arginine,lysine
- Sulphur containing acid
  Ex- cystine, methionine
- Aromatic and heterocyclic Amino acid
  Ex -Phenylalanine, tyrosisne, tryptophan,histidine, proline



2)Classification based on side chain characters

A) Amino acids with a non-polar side-chain :

e.g.: Alanine, Valine, Leucine, Isoleucine,

B) Amino acids with a polar but uncharged side-chain:

e.g. Serine, Threonine, Tyrosine, Cysteine, Asparagine and Glutamine.

C) Amino acids with a charged side-chain

a) Amino acids with a positively charged side- chain:

The basic amino acids- Lysine, Arginine and Histidine

b) Amino acids with a negatively charged side- chain:

The acidic amino acids- Glutamic acid and Aspartic acid

They are hydrophilic in nature.

Having a tendency to mix with, dissolve in, or be wetted by water.

•**Isoelectronic point, pI.** The **isoelectronic point** or **isoionic point** is the pH at which the amino acid does not migrate in an electric field.

•This means it is the pH at which the amino acid is neutral, *i.e.* the zwitterion form is dominant.

•The pI is given by the average of the pK_as that involve the zwitterion, *i.e.* that give the boundaries to its existence.

•There are 3 cases to consider....**neutral side chains**

These amino acids are characterised by two pK_as : pK_a1 and pK_a2 for the carboxylic acid and the amine respectively.

The isoelectronic point will be halfway between, or the average of, these two pK_as, *i.e.* **$pI = 1/2 (pK_{a1} + pKa_2)$**. This is most readily appreciated when you realise that at very acidic pH (below pK_a1) the amino acid will have an overall +ve charge and at very basic pH (above pK_a2) the amino acid will have an overall -ve charge. For the simplest amino acid, glycine, pKa1= 2.34 and pK_a2 = 9.6, pI = 5.97.

3)Based on nutritional requirements

- Essential amino acids
- Non essential amino acids
- Semi essential amino acids