INE | INSTITUTE OF NUTRITIONAL ENDOCRINOLOGY

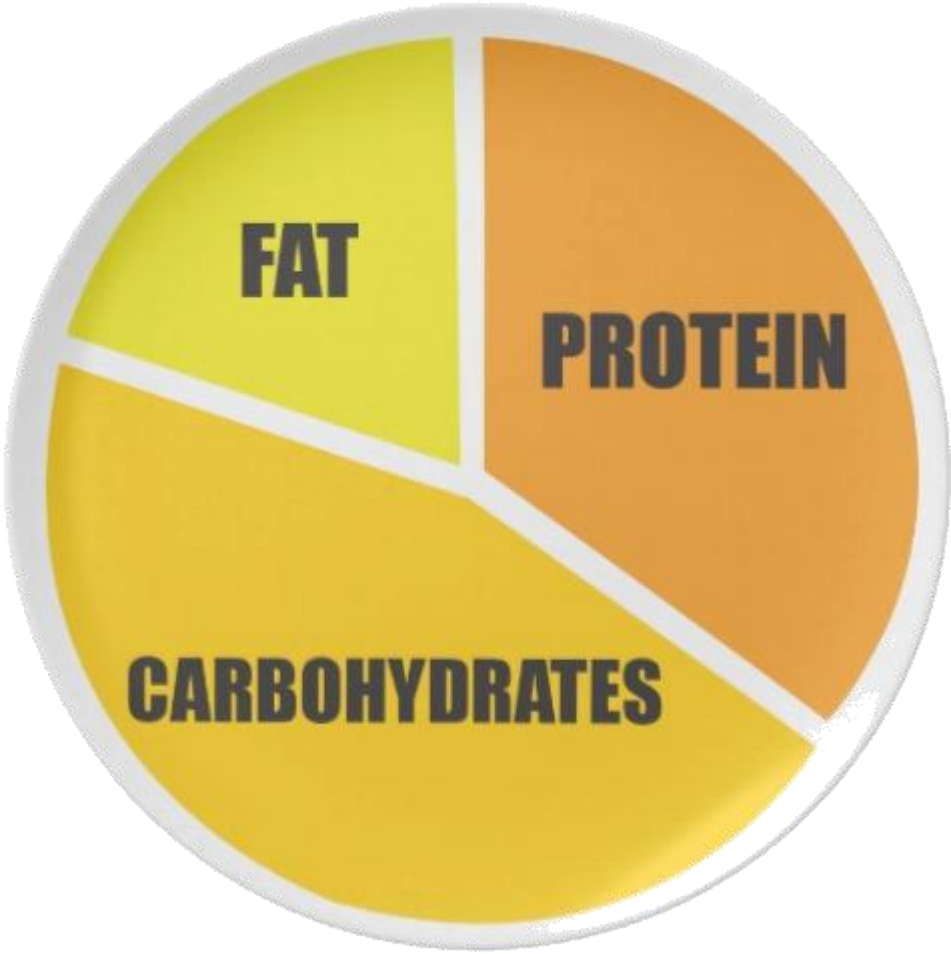
Macronutrients: Protein Structure and Function

Dr. Ritamarie Loscalzo

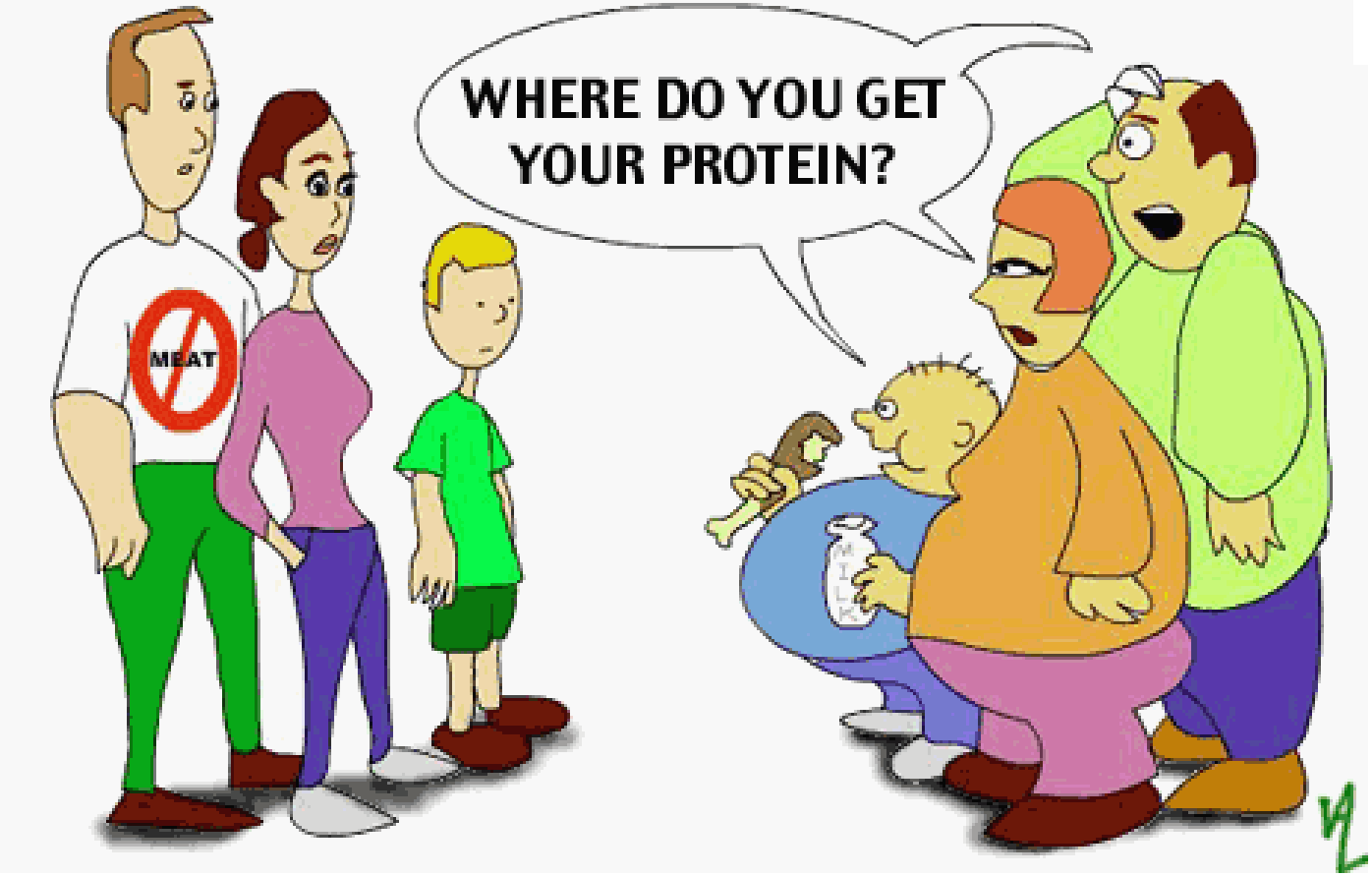
Medical Disclaimer: The information in this presentation is not intended to replace a one-on-one relationship with a qualified health care professional, and is not intended as medical advice. It is intended as a sharing of knowledge and information from the research and experience of Dr. Ritamarie Loscalzo, drritamarie.com, and the experts who have contributed. We encourage you to make your own health care decisions based upon your research and in partnership with a qualified health care professional.

Primary Macronutrients

- ✓Water
- ✓Fat
- ✓**Protein**
- ✓Carbohydrate



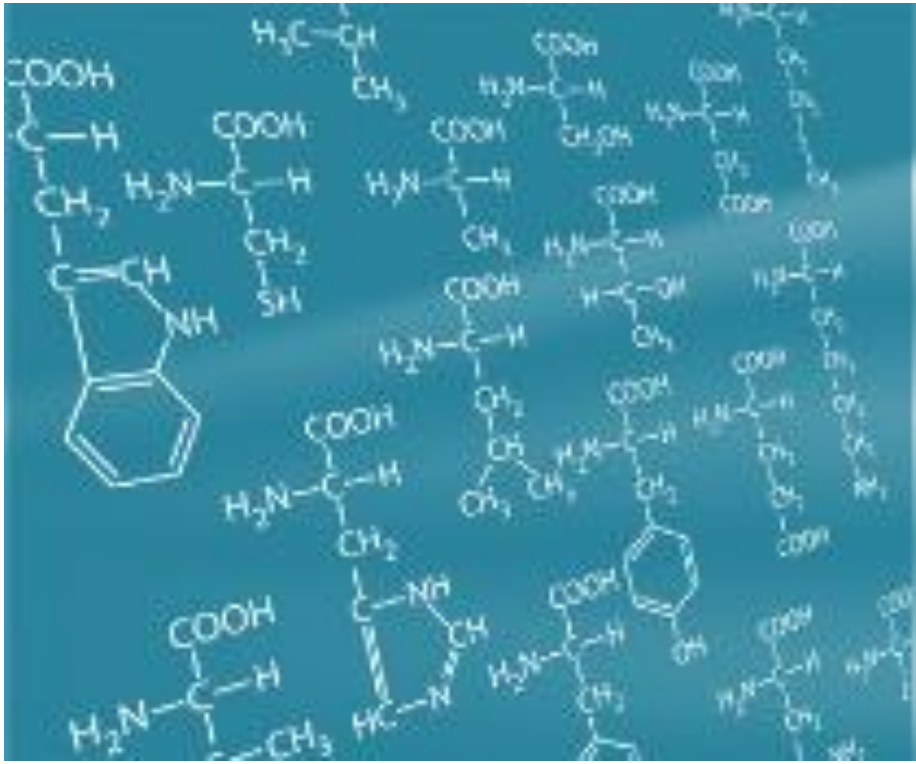
The Myth of Not Enough Protein



From HappyCow.net

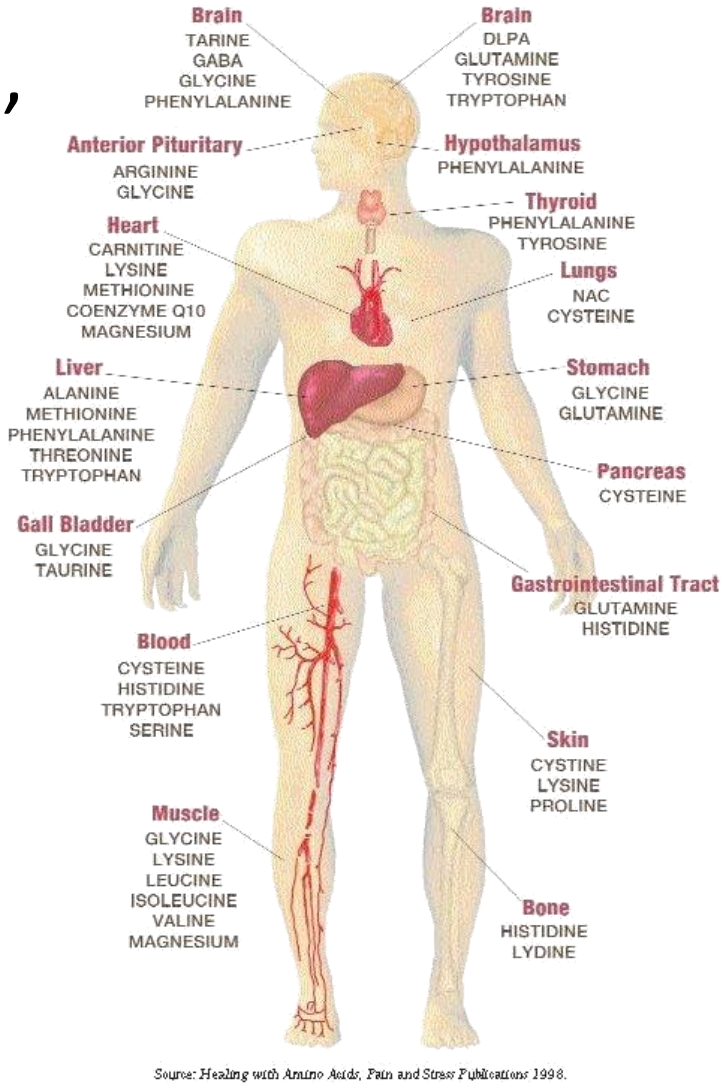
What You'll Learn:

- ✓ What protein is
- ✓ How to resolve the protein dilemma of too much vs. too little
- ✓ How to determine if you are low in protein
- ✓ Food sources of protein
- ✓ Protein powder vs. whole food proteins
- ✓ How and when to consume protein powders

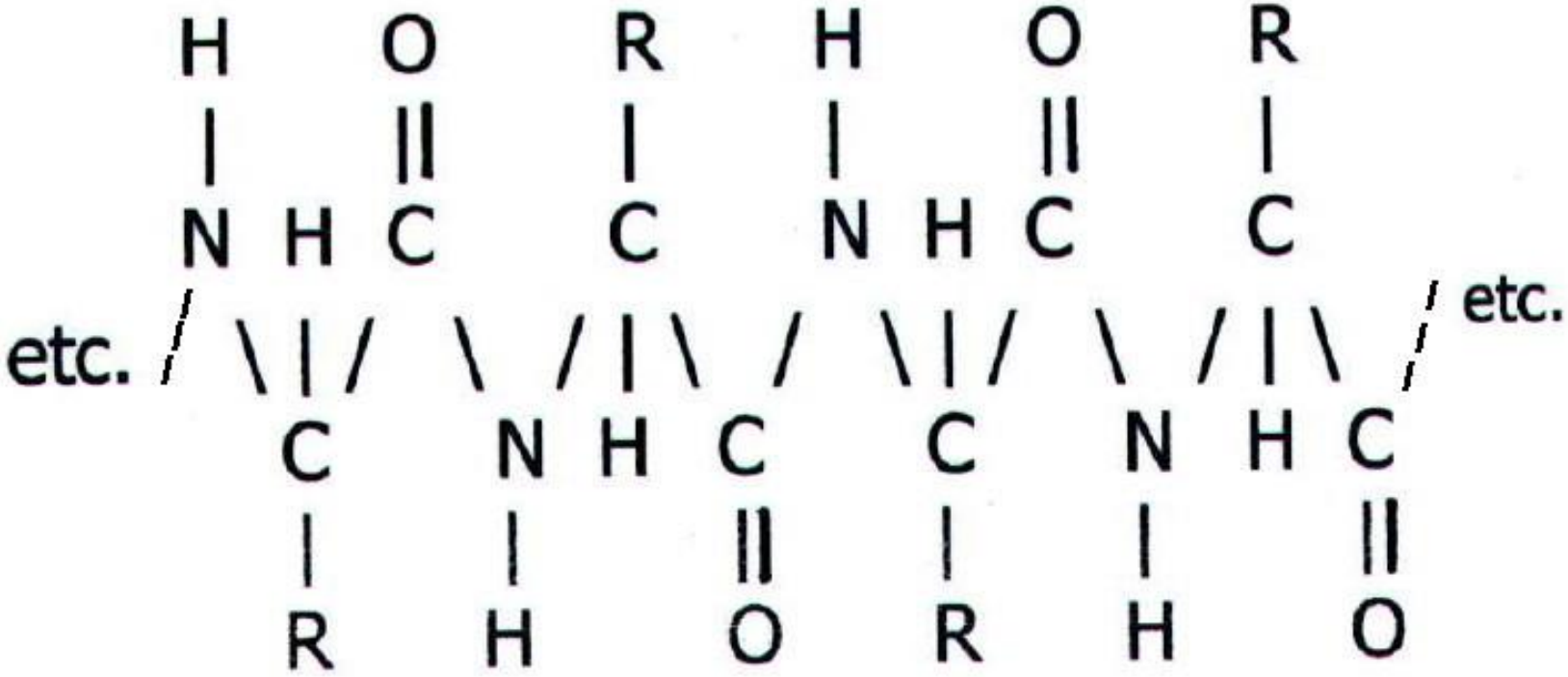


Function Of Protein

- ✓ Structure: muscles, ligaments, tendons, hair, skin, and nails
- ✓ Enzymes
- ✓ Hormones
- ✓ Transport proteins
- ✓ Energy intermediates
- ✓ Growth and repair
- ✓ Neurotransmitters
- ✓ pH Balance

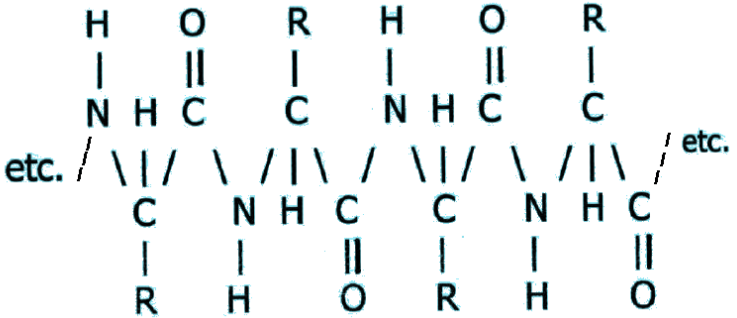


Protein Structure



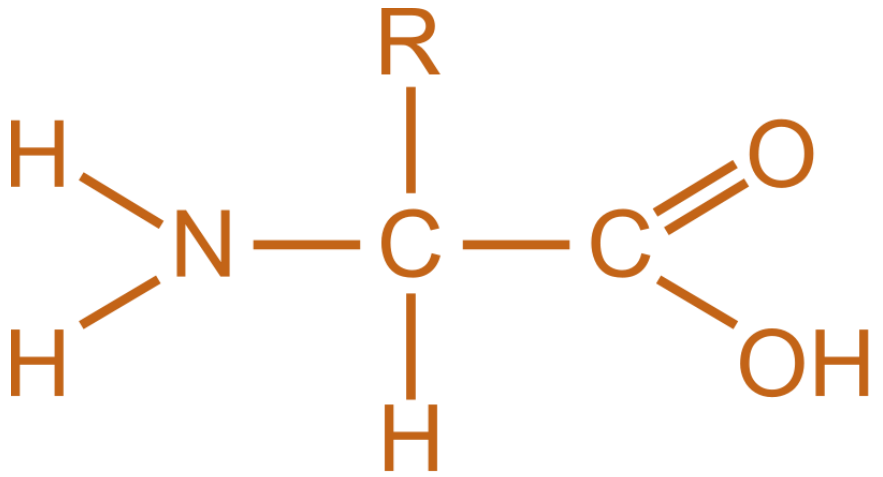
What is Protein?

- ✓ Vital components of body tissues, enzymes, and immune cells, accounting for 20% of body weight.
- ✓ Combination of different amino acids linked together in unique combinations containing carbon, oxygen, hydrogen, nitrogen, and sometimes sulfur.
- ✓ Deficiencies in essential amino acids causes the body to have to break down muscle proteins.

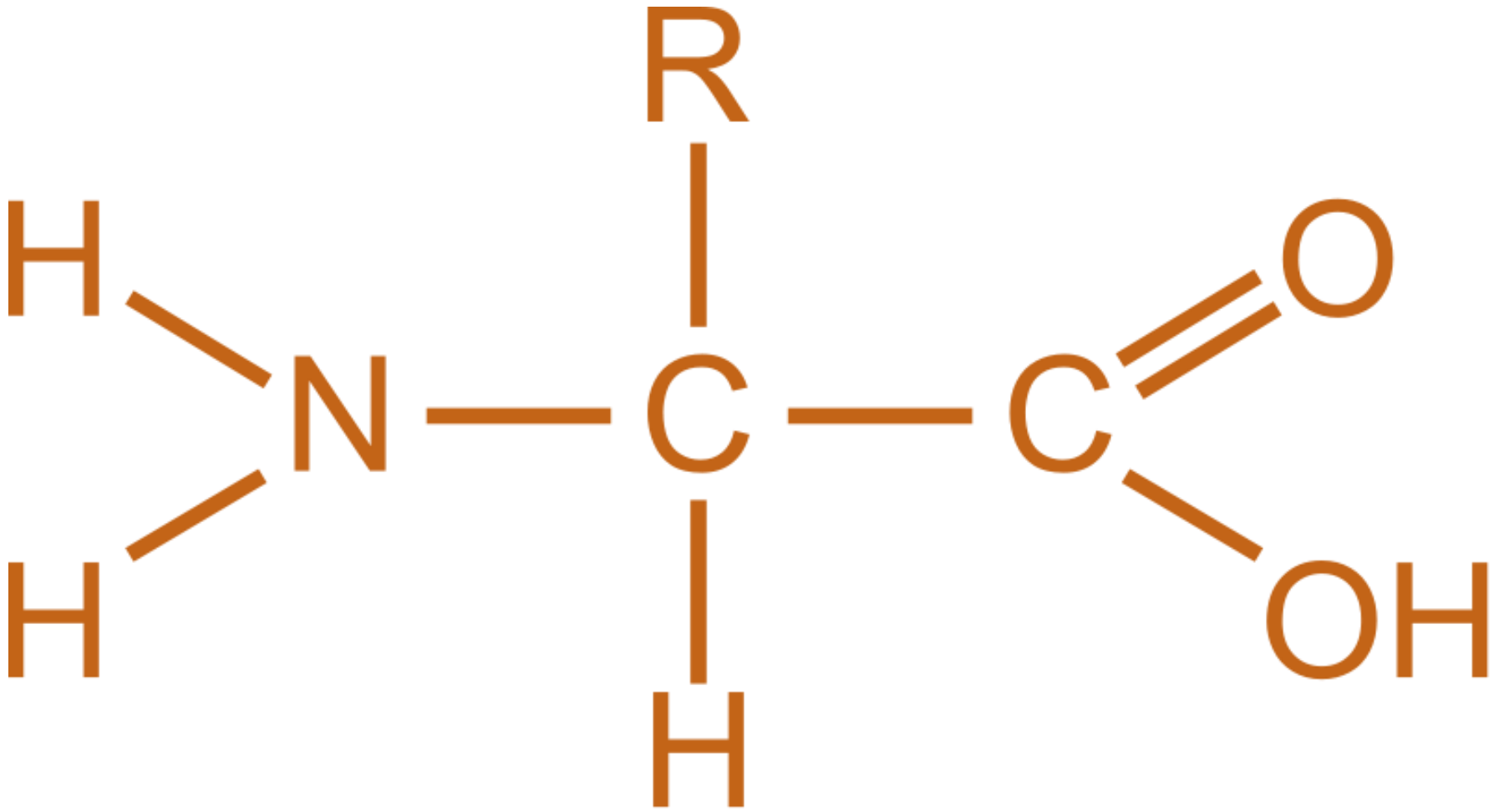


What Are Amino Acids??

- ✓ Biologically important organic compounds
- ✓ **Amine** (-NH2) group
- ✓ **Carboxylic acid** (-COOH) group
- ✓ **Side-chain** specific to each amino acid
- ✓ **Key elements**
  - ➢ Carbon
  - ➢ Hydrogen
  - ➢ Oxygen
  - ➢ Nitrogen

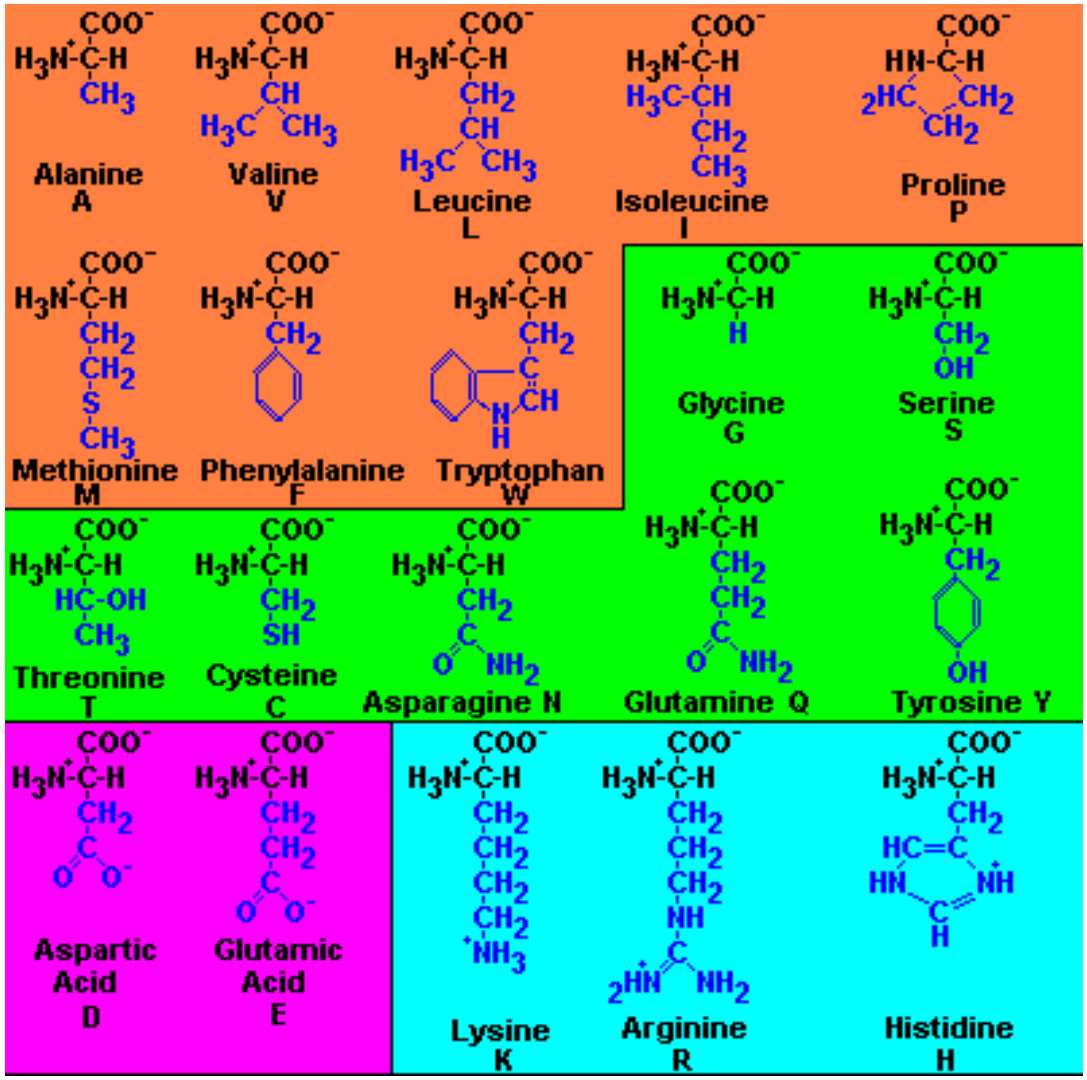


Amino Acid Structure



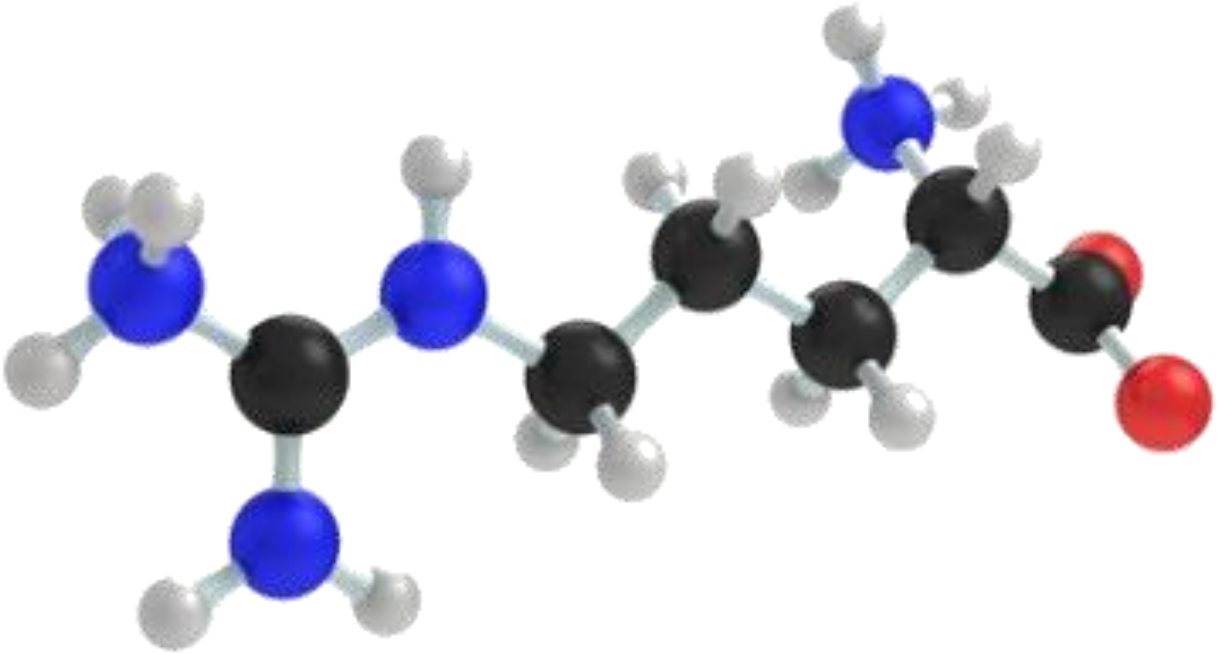
9 Essential Amino Acids

- ✓ Leucine
- ✓ Isoleucine
- ✓ Valine
- ✓ Lysine
- ✓ Methionine
- ✓ Tryptophan
- ✓ Phenylalanine
- ✓ Threonine
- ✓ Histidine



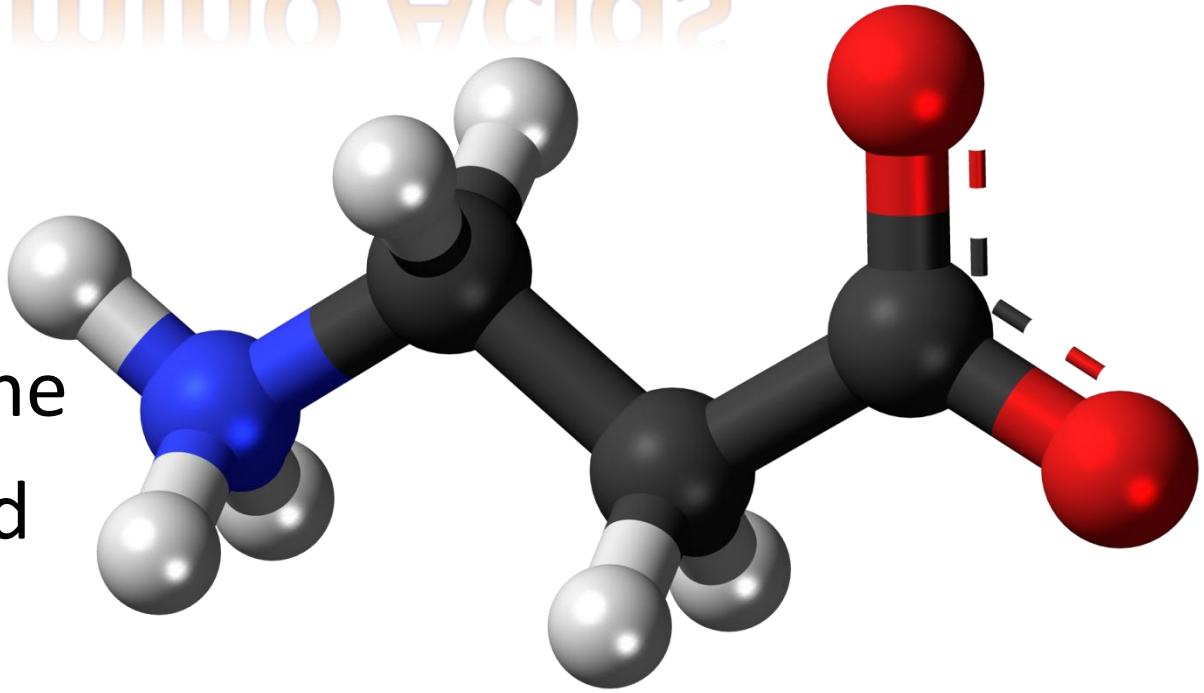
Conditionally Essential Amino Acids

- ✓ Arginine
- ✓ Asparagine
- ✓ Glutamine
- ✓ Glycine
- ✓ Proline
- ✓ Serine
- ✓ Tyrosine
- ✓ Cysteine



Non-Essential Amino Acids

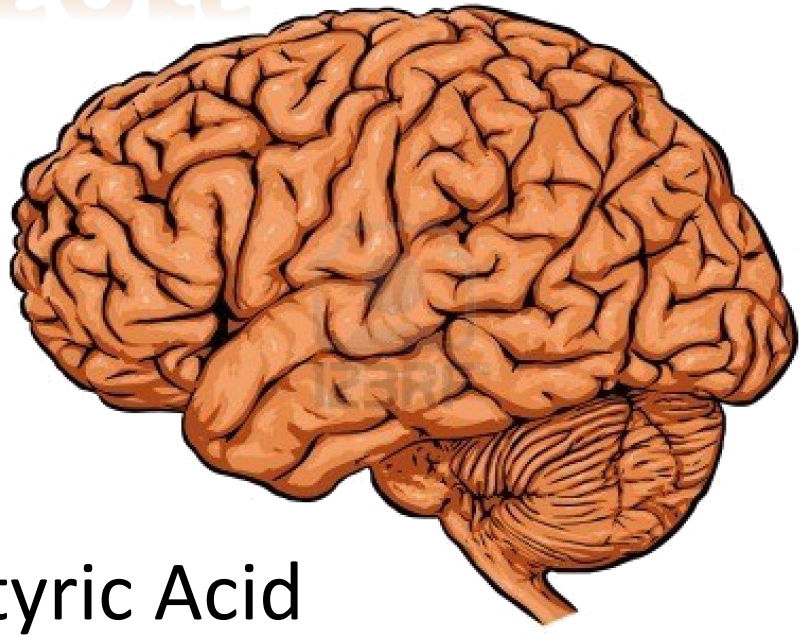
- ✓ Alanine
- ✓ Aspartic Acid
- ✓ Selenocysteine
- ✓ Glutamic Acid



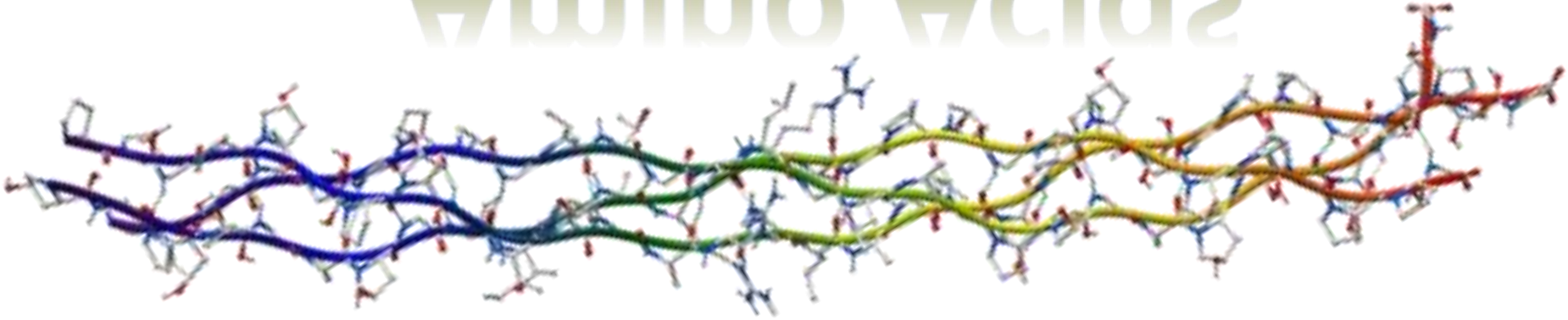
*** Need an abundant supply of essential Amino Acids plus alpha-ketoglutarate and vitamin B6 to synthesize*

Amino Acids That Are Neurotransmitter Precursors

- ✓ Phenylalanine
- ✓ Tyrosine
- ✓ Tryptophan
- ✓ Glutamic Acid
- ✓ GABA – Gamma Amino Butyric Acid



Collagen Related Amino Acids



- Proline
- Hydroxyproline
- Glycine
- Arginine

Sulfur Containing Amino Acids

- ✓ Methionine
- ✓ Cysteine
- ✓ Homocysteine
- ✓ Cystathionine
- ✓ Taurine

Energy Producing Amino Acids

- ✓ Isoleucine
- ✓ Leucine
- ✓ Valine

Branched Chain Amino Acids – *35% of muscle protein and 50% of dietary amino acids*

- ✓ Histidine – *high with muscle breakdown, low in RA*
- ✓ Lysine – *collagen cross linkages*
- ✓ Threonine – *low levels lead to hypoglycemia*

The Protein Dilemma

Too Little Protein

- ✓ Low energy
- ✓ Poor immune function
- ✓ Hormone imbalance
- ✓ Depression
- ✓ Muscle weakness
- ✓ Weak brittle nails
- ✓ Hair thinning or falling out
- ✓ Poor recovery from injury
- ✓ Inability to increase muscle bulk or strength with weights

Too Much Protein

- ✓ Kidney stress leading to low back pain
- ✓ Bone loss
- ✓ Decreased appetite
- ✓ Nausea
- ✓ Acidic urine and saliva
- ✓ Dehydration
- ✓ Constipation
- ✓ Increased risk of cancer and heart disease