Essential Amino Acids

1. Histidine
2. Leucine
3. Isoleucine
4. Lysine
5. Methionine
6. Phenylalanine
7. Threonine
8. Tryptophan
9. Valine

11 Non-Essential Amino Acids

1. alanine
2. asparagines
3. cysteine
4. glutamine
5. proline
6. tyrosine
7. arginine
8. aspartic acid
9. glutamic acid
10. glycine
11. serine
Metabolism – fate of amino acids

A. Protein turnover
   1. Amino acid pool
   2. Endogenous
   3. Exogenous

B. Nitrogen balance
   1. Negative
   2. Positive

C. Make protein

D. Make non essential amino acids

E. Make other compounds

F. Using amino acids for energy

G. Deamination

H. Making fat
Protein Synthesis

Each of us unique due to protein structures. Genetic information transmitted at conception in our DNA (deoxyribonucleic acid)

RNA = ribonucleic acid

**Messenger RNA**
Delivers DNA pattern to ribosome.

**Transfer RNA**
Collects and transfers amino acids to ribosome.
Food Sources of Protein

Animal Foods
- Meat
- Poultry
- Fish
- Dairy Products

Plant Foods
* Grains
* Legumes
* Nuts
* Vegetables (small amt)
* Fruits (very small amt)

Complete
- Most animal foods.
- Few grains: soy, amaranth, quinoa

Incomplete
- Plants foods.
- Gelatin

Protein Quality
Complementary proteins
Limiting amino acid
Mutual supplementation
PROTEIN QUALITY
Depends upon:
   1. Amino acid composition
   2. Protein digestibility

**Reference protein**: the essential amino acid requirements of preschool-age children.

**PDCAAS** - (Protein-digestibility-corrected amino acid score)

<table>
<thead>
<tr>
<th>Protein</th>
<th>PDCAAS</th>
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<tbody>
<tr>
<td>Casein</td>
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<tr>
<td>Egg white</td>
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<tr>
<td>Soybean</td>
<td>.99</td>
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<td>Beef</td>
<td>.92</td>
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<tr>
<td>Kidney bean</td>
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<td>Pinto beans</td>
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<td>Rolled oats</td>
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<tr>
<td>Lentils</td>
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<tr>
<td>Whole wheat</td>
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</table>
Too little Protein

1. PEM
2. PCM
3. Kwashiorkor
4. Marasmus

Too much Protein

1. Contributes to obesity – heart disease
2. Stresses kidneys
3. Stresses liver
4. Higher water needs
5. Increased calcium loss - osteoporosis
Protein Recommendations (2002)

10-35% of total kcalories
or
0.8 g/kg body weight
or
.36 g/lb. Body weight

Needs vary with age/activity
a. infants < 6mos:  9.1g/kg
b. infants 7-12 mos: 1.5g/kg
c. child 1-3 yo: 1.1g/kg
d. adults 14-18 yo: .85g/kg
e. pregnancy 1.1g/kg or +25g/ day
   lactation 1.1g/kg or +25 g/ day
f. athletes 1-1.5g/kg
   power train 1.2-1.7g/kg
   endurance 1.2-1.4g/kg
g. illness/stress increases needs
PROTEIN SOURCES

Meat - 7 g / ounce
Milk - 8 g / cup
Starch - 3 g / serving
Vegetable - 2 g / serving
Fruit - very little
VEGETARIAN DIETS

Lactovegetarian

Ovovegetarian

Lacto-ovo-vegetarian

Pollo vegetarian

Vegan
Soy Products

a. Tofu = bean curd
   • silky - desserts, very delicate, soft.
   • soft   - dip, sauces.
   • firm - holds shape
b. Tempeh: fermented soybean cake.
c. Soy nuts: whole soybeans
d. Miso: salty, fermented soybean paste
e. Soy sauce:
f. Soybeans: frozen, canned, dry
   Green ‘sweet beans’.
   • Black soybeans
   • Yellow “field” beans
g. Soy milk
h. Soy oil
i. Soy flour
j. Soy sprouts: sprouted soybeans.
k. TVP: Texturized vegetable protein
Protein equivalents:

½ c soybeans
2 ½ T. peanut butter (50% fat)
1/3 cup peanuts (49% fat)
2/3 cup split peas (1% fat)
¾ cup blackeye peas (1%)
½ cup cashews (54% fat)
2/3 cup walnuts (64% fat)
1 cup pecans (71% fat)
1/3 cup sesame seeds (49% fat)
½ cup sunflower seeds (47% fat)

1 ½ oz cheddar cheese (33% fat)
Nutrients of Concern for Vegans

- Vitamin B 12
- Vitamin D
- Calcium
- Iron
- Zinc