Chemistry 1010

The Chemistry of Food:

Proteins and Water

Protein

What is protein primarily used for?

1) building material for tissues

skin, muscle, hair, fingernails, etc




2) to make enzymes – control chemical reactions

break down disaccharides
produce hormones
replicate DNA
control cellular respiration
etc

How much protein do you need?

0.8 g protein per kg body weight

Do most Americans get enough protein?

yes – usually one to two times the required amount

What kinds of people need extra protein?

growing children

pregnant and nursing women

people with physical trauma (accident, surgery, disease)

athletes undergoing endurance training

What happens if you eat more protein than you need?

it is broken down and excreted

can't be stored

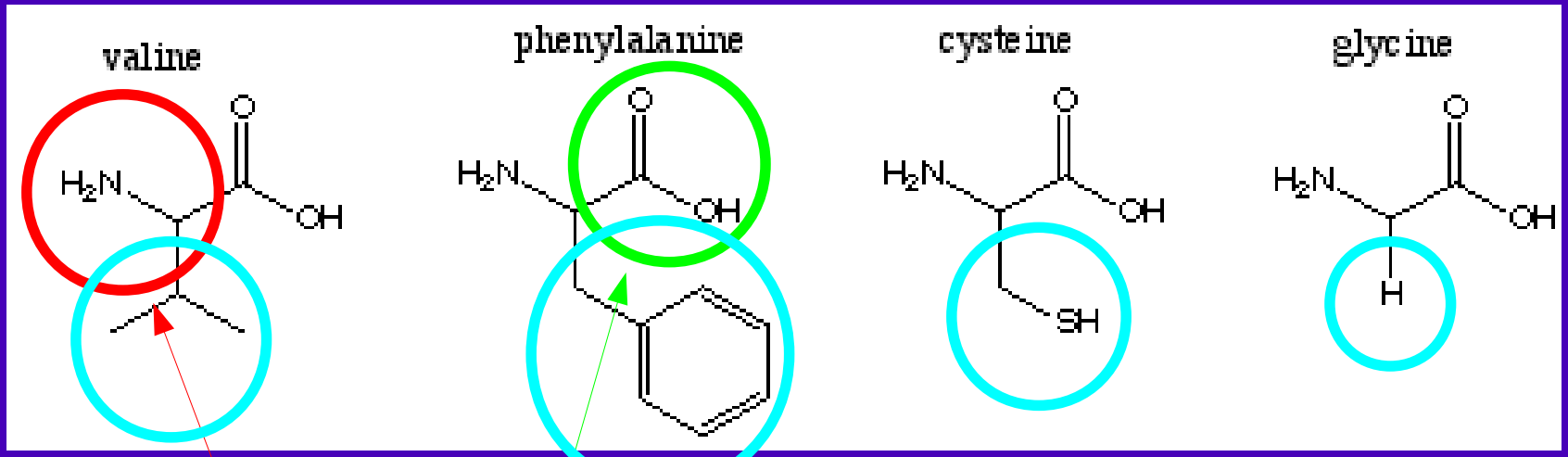
causes strain on liver and kidneys

What kinds of foods contain protein?

meat – beef, poultry, pork, fish
dairy products – milk, cheese, yogurt eggs
grains, nuts, seeds, and beans




What are proteins made of? **amino acids**



amine

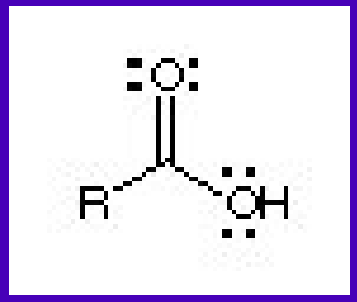
carboxylic acid

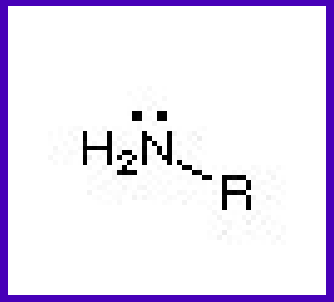
R group (different for each amino acid)

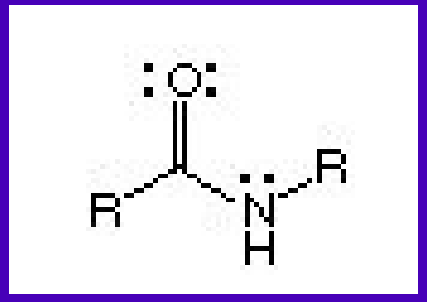
There are 20 common amino acids.

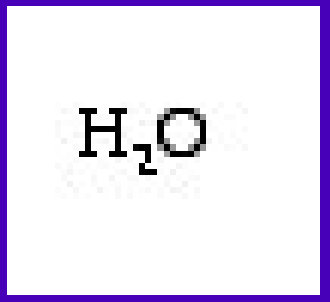
How are amino acids joined to make a protein?

carboxylic acid + amine → amide + water

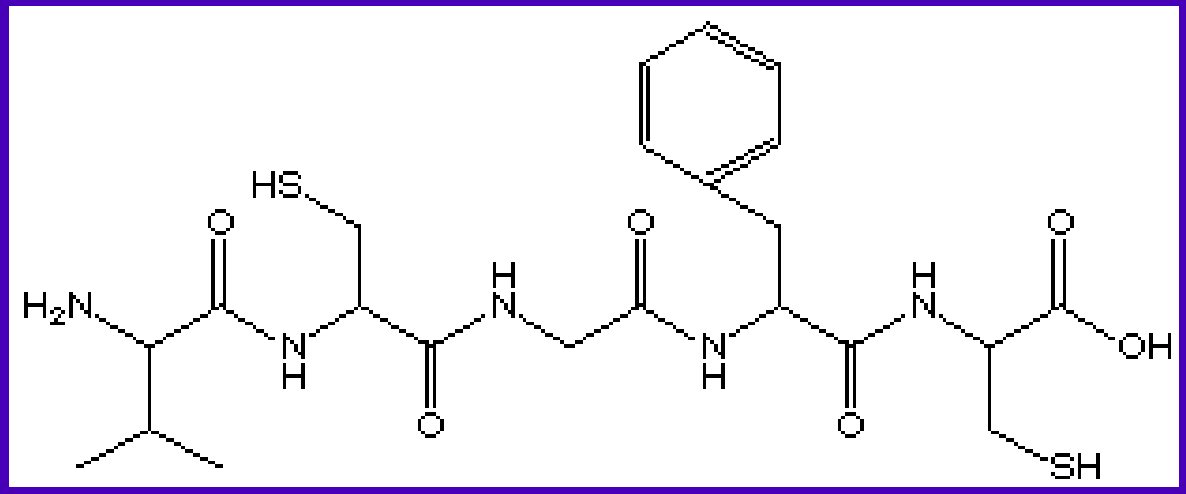








What amino acids made up this protein?



valine-cysteine-glycine-phenylalanine-cysteine

The sequence of amino acids determines the structure and function of the protein.

What determines the sequence of amino acids in each protein?

DNA

All genetic variation is caused by slight differences in the proteins made by your cells.




How does the protein you eat get turned into the proteins you need?

1) You eat protein.

2) During digestion, it is broken down into amino acids.

3) Amino acids are carried by blood to cells.

4) Cells make protein as directed by DNA.

Protein malnutrition may be caused by:

1 – not getting enough protein

protein malnutrition is very serious in developing countries

2 – not getting all of the essential amino acids

Essential amino acids: those that can't be made by your body must come from your diet

Complete proteins: contain all of the essential amino acids in sufficient amounts

animal proteins (meat, milk, eggs)

Incomplete proteins: lacking in one or more essential amino acids

plant proteins (grains, beans, nuts, seeds)

Complementary proteins: **putting together two incomplete proteins that make up for each other's lack**

corn

high in methionine
low in lysine

+

beans

low in methionine
high in lysine

=

complete protein

soy beans
rice

lentils
pita bread

peanut butter
sandwich

Water

We don't usually think about water as a nutrient, but it is an important part of our diet.

you will die from lack of water before any other nutrient

Why is water important in your body?

over half of your body weight is water

25% of bones
70% of heart
75% of muscles
85% of brain
main component of fluids
blood, tears, sweat, saliva, gastric juices, urine, mucus, lymph

What does water do?

water dissolves and transports nutrients

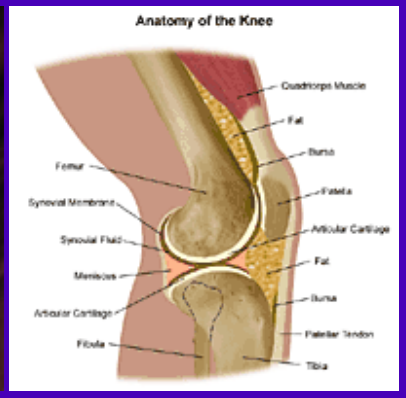
water dilutes toxins and flushes them out of the body

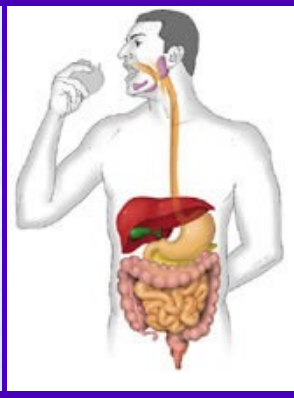
water helps regulate temperature

water lubricates joints and moistens lungs

water makes skin stretchable and flexible

water helps move food through your digestive system





What is it called when you don't get enough water?

dehydration

When is this likely to happen?

any time you're not taking in as much water as you lose

working or playing
in the sun

weight loss pills

when you have the flu

fasting

What are the symptoms of dehydration?

thirst (often disguised as hunger)
headache
feeling light-headed
feeling tired
forgetfulness
dark urine
nausea
weakness
chills
disorientation
stop sweating

Dehydration can progress to heat exhaustion and heat stroke.

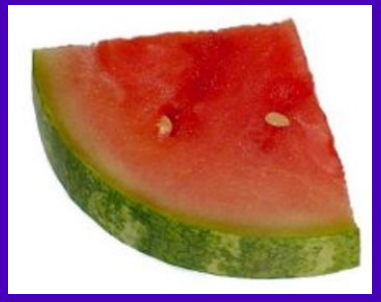
Loss of as little as 2% water can affect athletic performance.

How much water do you need each day?

8 – 10 glasses per day

1 oz of water for every pound of body weight (1 glass of water = 8 oz)

many foods also contain lots of water



when you're ill and don't feel like drinking, try taking small sips of water or eating ice chips

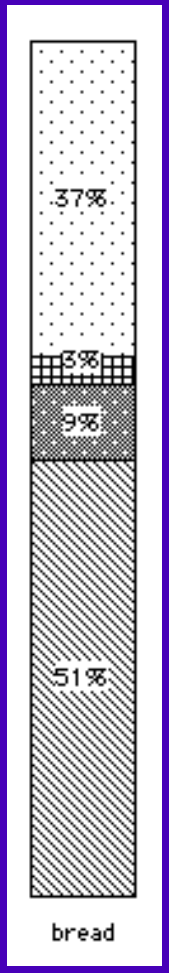
Why are coffee, ice tea and caffeinated sodas a poor choice?

caffeine is a diuretic – signals the kidneys to produce more urine

Summing up the macronutrients

What percentage of each of the macronutrients is found in the following foods?

bread



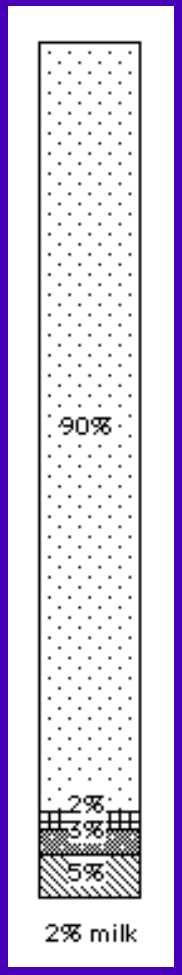
37% water

3% fat

9% protein

51% carbohydrates

milk



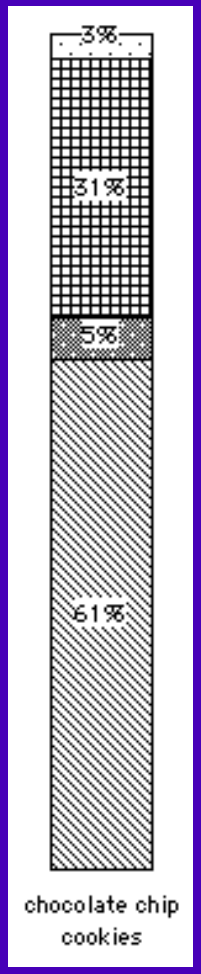
90% water

2% fat

3% protein

5% carbohydrates

chocolate chip cookies



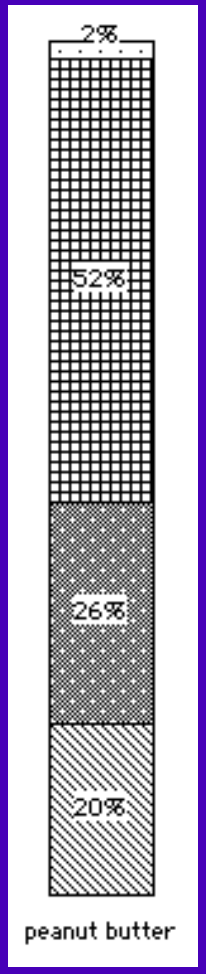
3% water

31% fat

5% protein

61% carbohydrates

peanut butter



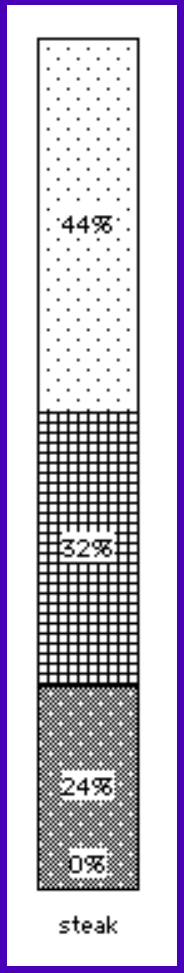
2% water

52% fat

26% protein

20% carbohydrates

steak



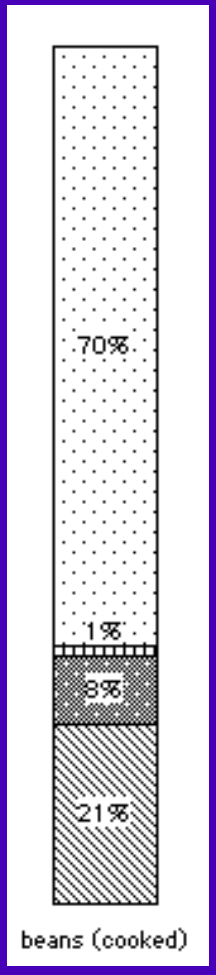
44% water

32% fat

24% protein

0% carbohydrates

beans (cooked)



70% water

8% fat

21% protein

1% carbohydrates