Nutrition

Why we eat

Animals need to eat. Eating provides food and nutrients for the body. The body converts these materials into glucose that is stored in the liver. Glucose is sent to all the cells of the body. The cells of the body oxidize the glucose using cellular respiration. This provides energy for each of the cells. So we eat in order to provide nutrients for our cells and our body.

Organisms can be classified by their method of nutrition

Autotrophic organisms

Autotrophic organisms can make their own organic nutrients by using the process of photosynthesis. They require only inorganic nutrients. Inorganic nutrients include ions of elements such as magnesium (Mg$^{++}$). These ions are generally known as minerals.

Heterotrophic organisms

Heterotrophic organisms cannot make their own organic nutrients. They require their organic nutrients in pre-formed (ready-made) condition. They also require inorganic nutrients (minerals). Because they ingest large molecules, heterotrophic organisms require a digestive system to digest these large molecules into their component subunits.

Plants obtain their nutrients by absorption through the roots

The minerals that a plant needs are absorbed by the roots. The roots also serve to anchor the plant in the soil. There are two types of root systems. These are known as the taproot system and the fibrous system. A taproot plant has a single large root that generally extends straight into the ground. Examples are carrot and dandelion. Fibrous roots extend in various directions in the soil. It is not obvious which one is the predominant root. Grass plants have fibrous roots.

The root anchors the plant in the soil. Each root has root hairs that are specialized cells used for absorption. Some roots are used for food. Examples include carrots and turnips.

Plant nutrients are all minerals. They are summarized by remembering the name "C HOPKNS, CaFe Mg." Imagine Mr. Hopkns is manager of the cafeteria. This is his nameplate. Note that the letter "I" is missing—this is because plants do not require iodine. Each symbol stands for a mineral required by plants.
Table 8-2. Nutrients required by plants.

<table>
<thead>
<tr>
<th>Element</th>
<th>Name</th>
<th>Source*</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Carbon</td>
<td>Air</td>
</tr>
<tr>
<td>H</td>
<td>Hydrogen</td>
<td>Water</td>
</tr>
<tr>
<td>O</td>
<td>Oxygen</td>
<td>Air</td>
</tr>
<tr>
<td>P</td>
<td>Phosphorus</td>
<td>Fertilizer</td>
</tr>
<tr>
<td>K</td>
<td>Potassium</td>
<td>Fertilizer</td>
</tr>
<tr>
<td>N</td>
<td>Nitrogen</td>
<td>Fertilizer</td>
</tr>
<tr>
<td>S</td>
<td>Sulfur</td>
<td>Fertilizer</td>
</tr>
<tr>
<td>Ca</td>
<td>Calcium</td>
<td>Fertilizer</td>
</tr>
<tr>
<td>Fe</td>
<td>Iron</td>
<td>Soil</td>
</tr>
<tr>
<td>Mg</td>
<td>Magnesium</td>
<td>Soil</td>
</tr>
</tbody>
</table>

*Other than C, H and O, the remaining minerals that a plant needs are dissolved in the water that is absorbed by the roots.

Nutrition of heterotrophic organisms

Fungi

Fungi are heterotrophic organisms. They are different from plants, especially in their lack of ability to produce their own food. They do not have chlorophyll so they cannot perform photosynthesis. They must use chemical digestion.

Saprophytic organisms live on dead organic matter. Fungi can be found growing on rotted logs or stumps.

Parasitic organisms live on living organic matter. There are various types of parasitic fungi, including the yeast Candida albicans, a common human pathogen.

Animals

Animals are heterotrophic organisms. They cannot make their own food so they have to eat other organisms. Animals are classified according to the types of organisms they eat.

- Herbivores—eat plants. Herbivores, such as cows, have flat teeth to grind plants.
- Carnivores—eat meat of other animals. Carnivores, such as cats, have sharp teeth to tear meat.
- Omnivores—eat both plants and animals. Omnivores, such as humans, have a mixture of sharp teeth to tear meat and flat teeth to grind plants.
Humans require bulk nutrients in large amounts

Carbohydrates and fats

Carbohydrates and fats contain large amounts of carbon and hydrogen that can be oxidized for energy. They are not good for building protoplasm because they do not contain nitrogen. Not all carbohydrates are digestible. Animals cannot digest cell walls of plants. These structures provide fiber, which is also known as roughage.

Water

Water is the basis for body transport and regulation. Humans and animals require clean drinking water to maintain their proper body equilibrium. Humans cannot drink ocean water because the high salt concentration in the ocean has a dehydrating effect on the body and will make thirst worse.

Proteins

Protein molecules contain nitrogen, which is essential for building body proteins. After proteins are digested, the resulting amino acids are used by the body to build structures and to make enzymes. Proteins are found in muscles, blood, and other structures. They maintain and repair body tissues. Both plants and animals contain proteins. Vegetarians, who do not eat meat, can obtain sufficient protein using only plant material for food.

“Essential” amino acids

There are about 20 amino acids. The ones that are known as “essential” amino acids must be found in the diet because the human body cannot produce them. There are about 10 essential amino acids. There are many references for these amino acids and they do not all agree. Some sources say there are only nine and some say even eight. The essential amino acids are as follows:

CYS – cysteine
GLY – glycine
HIS – histidine
LEU – leucine
LYS – lysine
MET – methionine
PHE – phenylalanine
THR – threonine
TRY – tryptophan
VAL – valine
List of “non-essential” amino acids. These amino acids are necessary but the body can make them.

ALA – alanine
ARG – arginine
ASN – asparagine
ASP – aspartic acid
GLN – glutamine
GLU – glutamic acid
ILE – isoleucine
PRO – proline
SER – serine
TYR – tyrosine

Vitamins are necessary for proper body function. Many are necessary components of enzymes. They are vital (“vitamin” is derived from “vital”) because the body cannot make them.

A – vitamin A is used for color and night vision
B₁ – (thiamine) – enzyme function
B₂ – (riboflavin) – enzyme function (found in FAD)
B₃ – (niacin) – also called nicotinamide – found in NAD and NADP
B₆ – (pyridoxine) – enzyme function
B₁₂ – (cyanocobalamin) – enzyme function
C – vitamin C is important in collagen development
D – bone formation
E – vitamin E is sometimes known as the “antisterility factor”
K – blood clotting, electron transport

Minerals are ions of various elements that the body requires for proper functioning.
Ca – calcium is required for bones, teeth and muscle function
Fe – iron is necessary for hemoglobin and enzyme function
Mg – magnesium is necessary for ATP hydrolysis
Plants use magnesium in chlorophyll for electron transfer
P – phosphorus is necessary for ATP and bones
Na, K – sodium and potassium maintain body fluids and nerve transmissions
Co – cobalt is required as a component for vitamin B₁₂
I – iodine is part of thyroxin, involved in thyroid function