Food, Nutrition, Metabolism

Food & Nutrition

The chemical composition of your body is roughly equivalent to the proportions of the same elements and molecules in the food that you eat.

you are what you eat

to maintain “yourself” you must continually replenish these nutrients

A nutrient is any component of the food that we eat that our body needs to function properly

the food that we eat must do 2 things:

1. serve as building blocks, ie. nutrients used to maintain and build tissues

2. release energy when metabolized in cells

   breaking bonds releases energy

   we break down large organic molecules to release their energy and make ATP

   food

   \[
   \begin{align*}
   \text{matter} & \quad \text{(building blocks)} \\
   \text{energy} & \quad \text{(metabolism, ATP)}
   \end{align*}
   \]

Essential vs Nonessential Nutrients

some of these nutrients are individual atoms or elements

some of these nutrients are molecules that we need but that our body is unable to make for itself

There is a short lists of specific elements or atoms that the body requires to function

These elements are usually eaten in the form of large complex organic molecules

eg. proteins, carbos, lipids, etc

In the body these molecules are digested and
separated into small molecules and individual atoms
the body then uses these building blocks to construct most of the molecules that make up our bodies
most of the molecules that make up our bodies are made in our own cells
but a few molecules we need cannot be made
‡ they are essential molecules that we must get in our diets to survive
45 –50 different nutrients (atoms and a few molecules) are essential nutrients
‡ can’t make them ourselves
‡ must be in food
atoms:

<table>
<thead>
<tr>
<th>macronutrients</th>
<th>micronutrients</th>
</tr>
</thead>
<tbody>
<tr>
<td>C 18.5%</td>
<td>Cr, Co</td>
</tr>
<tr>
<td>H 9.5%</td>
<td>Cu, F</td>
</tr>
<tr>
<td>O 65%</td>
<td>Mo, Se</td>
</tr>
<tr>
<td>N 3.2%</td>
<td>Si, Sn (tin)</td>
</tr>
<tr>
<td>P 1.0%</td>
<td>Zn, V</td>
</tr>
<tr>
<td>Ca 1.5%</td>
<td></td>
</tr>
</tbody>
</table>

molecules:
O₂ (oxygen gas)
vitamins
8 amino acids
2 fatty acids

2. energy

we break down organ foods (sugars, lipids, etc) to extract energy
chemical bond energy: break bonds ‡ release energy
most cells prefer glucose but can also use lipids, proteins, etc
some cells can only use glucose

glucose + O₂ ‡ CO₂ + H₂O + ATP(energy)
most foods are a combination of essential and nonessential nutrients that we use as building blocks and as energy
as a general rule the foods we eat contain the essential nutrients and energy
sources in roughly similar amounts as they are found in the body

∴ we are what we eat!

but if our diets aren’t carefully selected:

∴ can get too little or too much of a particular nutrient

eg. deficiencies may cause diseases

eg. excesses may be toxic

∴ can bet too much or too little energy need ~ 2000 Cal/day

∴ may contain various additives that could be beneficial, neutral or toxic to body

**Metabolism**

Digestion breaks down complex organic molecules into their component parts:

∴ glucose, glycerol, fatty acids, amino acids, nucleotides

metabolism focuses on what happens to these substances inside the body cells

metabolism = sum of all chemical reactions that occur in the body

anabolism = synthesis; requires energy

catabolism = decomposition; releases energy

**Metabolic Pathways**

Metabolism in most cells is a collection of groups of enzymes forming a metabolic pathway

**Health Risks associated with body weight**

1. Health Risks of Underweight

1\textsuperscript{st} to die during famine

more at risk when tests require fasting

in greater danger when fighting a wasting disease like cancer

∴ many people with cancer die not from cancer but
Anatomy & Physiology: Nutrition & Metabolism, Ziser Lecture Notes, 2005

from malnutrition

underweight women more likely to be infertile

pregnancy may result in unhealthy infant

2. Health Risks of Overweight

obesity has been declared a “disease” because so many health risks are associated with it:

- diabetes
- cardiovascular disease
- hypertension
- sleep apnea
- osteoarthritis
- abdominal hernias
- some cancers
- varicose veins
- gout
- gall bladder disease
- liver malfunction
- arthritis
- flat feet
- respiratory problems
- complications in surgery and pregnancy
- greater rate of accidents

obesity related illnesses cost $39 Billion/yr (1986)

Some Examples:

1. Cardiovascular Disease
   strong relationship
   central obesity is as important risk factor as high blood cholesterol, hypertension and smoking

2. Diabetes
   Adult Onset (Noninsulin dependent) diebetes is 3x's more likely to develop in obese than nonobese person
   Central body fat cells appear to be larger and more insulin resistant than lower body fat cells

3. Cancer
   risk of cancer increases with body fat
   not sure why – may be correlated with greater levels of some hormones
   eg. estrogen in women