

# MIND YOUR OWN BODY

Vol. II Powering life

No. 4 You are what you eat

## POWERING LIFE



## You are what you eat

**To stay alive, your body constantly remakes itself. An internal factory converts food nutrients to body fuel and building blocks.**

**E**verything you do—from sleeping to straining your brain on a test to running a fifty-yard dash—requires energy your body burns fuel to make. And while making and using energy, it continually

wears out its parts. Your incredible body machine transforms three pounds of food a day into chemical **nutrients** to burn as fuel or make into replacement parts—a process called **digestion**. For fuel it process-

es **carbohydrates** and **fat**. To build cells it uses **water, minerals,** and **proteins**.

Digestion of the food you eat begins in the mouth. When you chew you physically break your food into smaller pieces and chemically mix it with the digestive juice **saliva**.

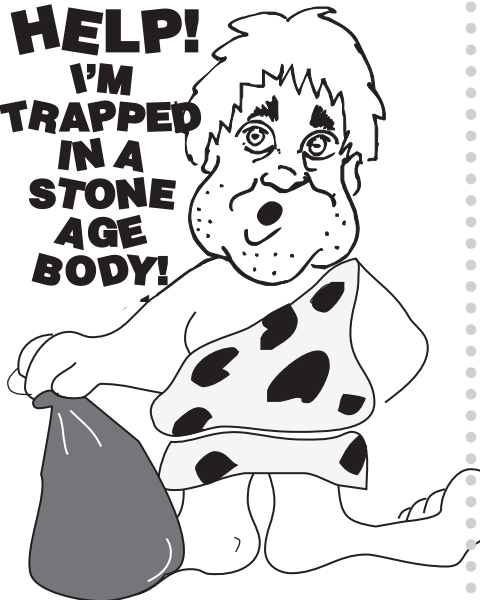
After a voluntary swallow, the **involuntary muscles** of the **esophagus** take over pushing the food to the **stomach** in a process called **peristalsis**.

In the stomach strong, **hydrochloric acid** breaks down food into a liquid mush. When the different foods are ready, they are pushed on to the **small intestine**. Carbohydrates leave the stomach first in one to two hours, protein in three to four hours. Fats stay longest in the stomach—five to six hours.

In the small intestine, food is broken down further by **enzymes**—special chemicals—created by the **liver** and **pancreas**. Lining the 21-foot **small intestine** are tiny finger-like **villi** filled with **capillaries** where the blood stops in to pick up digested nutrients to take to other parts of the body.

The **large intestine** or **colon** finishes digestion. Friendly **bacteria** in the colon break down what they can of remaining hard-to-digest plant **fiber**. Lots of water is added along the way during digestion. Instead of sending it all back out as waste, the body reabsorbs most of it on its nine-foot journey through the colon. The waste that leaves your colon is about half undigestible fiber and half worn-out bacteria.

**HELP!  
I'M  
TRAPPED  
IN A  
STONE  
AGE  
BODY!**



Until recently—and still today in many parts of the world—using every last bit of food meant the difference between survival and starvation. Hunter-gatherers might feast on a plentiful stash of nuts or the meat from a large animal one week, only to go hungry the next. Agriculture helped the "feast or famine" situation, but storms or insects could still destroy a farmer's entire crop. Worse yet were widespread disasters—droughts like those that still cause suffering in Africa or plant diseases like the 1840's potato blight that started a mass-migration of Irish to America.

To help it survive these conditions the body learned that saving every bit of food was a life and death matter. This efficient system lives on in us today, but backfires in our plentiful times. For example, contrary to what many people think, the waste that leaves our bodies is exactly that—used-up bacteria and undigestible fiber. Our bodies hold on to everything else—to construct new cells, to fuel life, or to store as fat, just in case of famine. But when famine doesn't come, fat cells accumulate.

Losing weight too quickly kicks in Stone Age defenses again. Your body thinks that, sure enough, the famine it predicted has happened, so it burns less of your stored energy—fat cells. That's why crash diets don't work as well as moderate diets. By cutting back just a little, you slowly dip into the fat reserves, but not so fast that your body pushes the panic button.

**2/You are what you eat**

# NEWS YOU CAN USE!

## Your energy budget

**You have a choice about how you acquire fuel and spend or save your body's energy. The amount of fuel you need depends on how much energy you use.**

**T**he energy food contains is measured in calories. One calorie is the amount of heat energy needed to raise one gram of water one degree Celsius.

Just staying alive requires about 1600 calories a day. Children, teenage girls, active women, and inactive men need about 2200 calories. About 2800 is right for teenage boys and active men.

Where you "earn" those calories matters too. Food is made up of varying amounts of nutrients: the building blocks, proteins and min-

erals; the energy makers, carbohydrates—fuel for now—and fats—fuel for later; water, which makes up 60% of our bodies; fiber, the clean-up crew, which pushes digestion along. Vitamins in food help your energy-burning, body-building chemistry along.

Your body can turn one form of fuel to another. Like a wise investor, your body will spend its regular energy income—the carbohydrates you eat—before it uses up its savings—the fat it has stored. If you eat more carbohydrates than it needs, it

## The Food Guide

### Pyramid

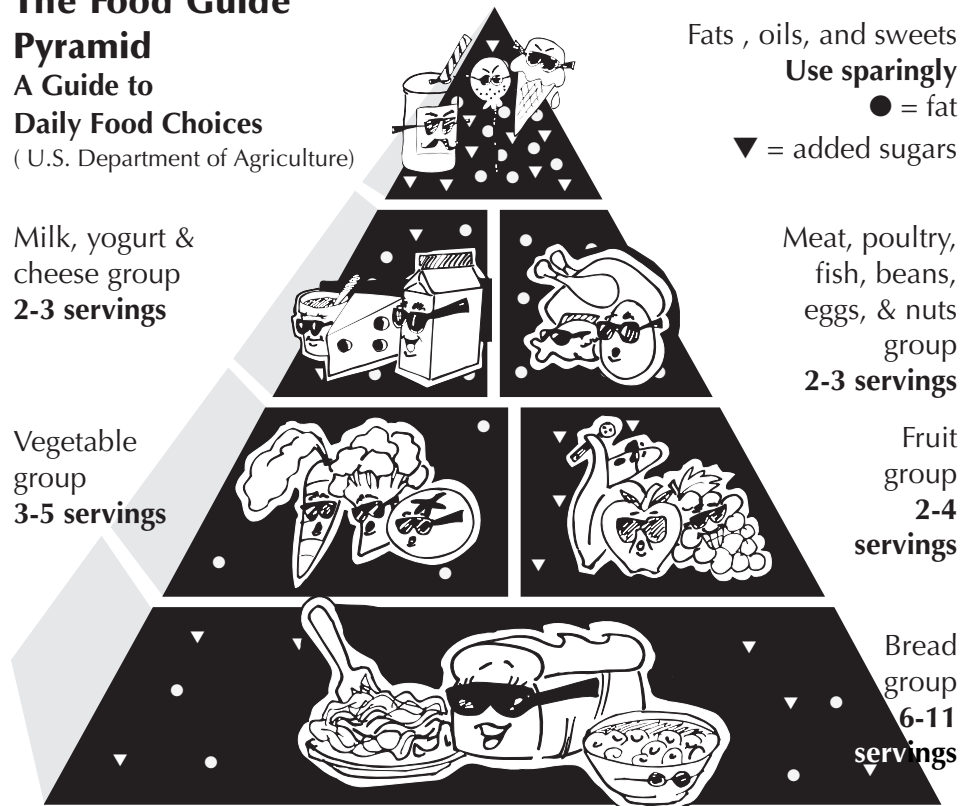
#### A Guide to Daily Food Choices

(U.S. Department of Agriculture)

Milk, yogurt & cheese group  
**2-3 servings**

Vegetable group  
**3-5 servings**

Bread group  
**6-11 servings**





# AMAZING

## Did you know?

- The average person eats about three pounds of food per day or 1,095 pounds—more than a half ton—of groceries a year.
- Your mouth makes about a half quart of saliva daily. Your whole body secretes more than seven quarts of assorted digestive juices every day.
- Food must be dissolved in saliva before you can taste it.
- Children are born with taste buds all over their mouths. By adulthood most of them disappear, leaving just 3000, mostly on their tongues.
- Food's peristaltic trip from mouth to stomach takes seven seconds.
- The small intestine is about 21 feet long.
- The digestive system is really one long tube from mouth to anus. It changes in size and shape along the way depending on the job each part does. Food takes two days to make the whole journey through your body.
- The liver weighs three to four pounds in an adult, making it the largest internal organ in the body.

# ANATOMY

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# EUREKA!



Medical discoveries—like all scientific discoveries—result from a combination of observation, hunches, learning from mistakes, building on the work of others, tireless work, and plain old luck. A good example is the story of the discovery of **vitamins**—the nutrients that regulate the chemical processes that turn other nutrients into energy or flesh and bone.

Long before the word “vitamin” appeared, sharp observers in the 1700s noticed that sailors who ate lemons on long voyages avoided the disease **scurvy**. Without realizing it, they had discovered that scurvy is caused by a shortage of **vitamin C (ascorbic acid)**, needed to heal wounds and build skin, bones, and tendons. The body can’t store or manufacture vitamin C, so it must be replenished by eating fresh fruits.

In the 1800s **beri-beri**, a disease common in rice-eating areas, was prevented by using unpolished instead of polished rice. In 1911 Polish chemist Casimir Funk discovered that the chemical missing from polished rice was **thiamine (vitamin B<sub>1</sub>)**—an amine or nitrogen-containing compound—and named it “vit-

amine” for “vital amine.” A few years earlier British biochemist Frederick Hopkins had shown that foods contained “accessory factors” as well as carbohydrates, protein, fat, minerals, and water. “Vitamins” came to refer to all of these chemicals. Scientists discovered other vitamins and diseases related to them.

The story of how **pernicious anemia** was traced to a lack of **Vitamin B<sub>12</sub>** is a good example of luck, skill, and teamwork all working together. In 1926 Dr. George Whipple discovered that dogs who were **anemic**—low in red blood cells—from bleeding, recovered when fed large quantities of liver. After hearing this, Dr. George Minot successfully cured his patients with pernicious anemia by feeding them liver extract. Years later, researchers identified the ingredient in liver that cured pernicious anemia was the chemical now known as Vitamin B<sub>12</sub>. The lucky part? Looking back, doctors today agree that Dr. Whipple’s dogs had anemia caused by lack of **iron**, which eating liver replenished. Just by coincidence liver also contains the B<sub>12</sub> that cures pernicious anemia, a completely different disease.