Chapter 1 Basic Physiology

Being Over-Fat

Did you know that **excess body-fat** can lead to a multitude of health problems? For one thing, **excess body-fat** can precipitate **hypertension** thus **increasing the risk of stroke**. Fat gain can also increase the **likelihood of diabetes** in genetically susceptible people and, thus, bring on its associated ills. Excess body-fat (especially in the central abdominal area of the body) also increases the risk of **heart disease** by worsening **atherosclerosis**. Other physical conditions associated with over-fatness include **abdominal hernias**, **some cancers**, **varicose veins**, **gout**, **gallbladder disease**, **arthritis**, **respiratory problems**, **liver malfunction**, **complications in pregnancy and surgery**, **flat feet** and even a **high accident rate**.

Social, Economic and Psychological Effects

Here's something else to consider. No one who is fat in America escapes the **social** and **economic handicaps**. Research has shown that over-fat people are **less sought after for romance, less often hired**, and **less often admitted to college**. They pay **higher insurance premiums** and they pay **more for clothing**. Psychologically, too, a body size that embarrasses a person **diminishes self-esteem**.

Goal Setting and Keeping Score

That's the bad news. The **good news** is most people are <u>not</u> **obese**. Nonetheless, most people desire to lose some degree of body-fat. Therefore, the extent of our over-fatness -- and the amount we wish to lose -- **must be determined.** This way **goals** can be set and **progress** monitored. Once your goals are established, you should record your progress in your daily **Exercise and Nutrition Journal.**

Throw Away Your Scale

Here's the best advice you'll ever hear in regard to weight-management -- "**THROW AWAY YOUR SCALE**." The focus (obsession) on **weight** is the very reason why most people fail. It's mis-guided and dangerous.

The focus on weight began back in the **1950's** when the definition of **appropriate weight** was simple. Your weight was compared against the **"ideal weight"** tables developed by the **Metropolitan Life Insurance Company**. If your actual weight was **twenty percent (20%)** or more above the table weight, then, you were considered **obese**. If it was **ten percent (10 %)** under, you were **underweight**. Today, however, the term **ideal weight** is **irrelevant**.

Beware: Some medical doctors still use the Metropolitan Life Tables.

It's Body-Composition That Matters

The original weight-table standards were designed for **insurance purposes** -- not as guides for **nutrition** and **fitness**. These tables never considered **body-composition.** Most world-class body-builders (usually less than 8% body-fat) would be categorized **"obese"** by the original weight-tables.

The way to measure and determine one's fat to lean muscle proportion is to determine **body-fat percentage**. The **body-fat percentage** is the percentage of an individual's weight that is **fat**.

Body-Fat Vs. Lean Mass

It is **lean mass** that plays the **key role** in any type of weight-management program. Whether you're interested in **fat-loss** or **muscle gain**, lean mass requires certain conditions in order to make a change in **body-composition**.

It's imperative to understand that the **lean mass** of an individual is **directly related** to **metabolism**. More about this later.

Can I Touch a Calorie?

Here's another confusing issue. **Calories.** Some think calories are something you remove or add to the diet. It's as if a calorie is an entity all in and of itself. This is **false**.

A calorie is a **unit of measure.** It's used to designate the body's **energy requirements**. The word calorie relates to **"combustion"** or, to **produce energy**. By definition, a calorie is: **The amount of heat required to raise the temperature of 1 gram of water 1 degree Celsius**.

Combustion of Proteins, Fats and Carbs

Generally speaking, **proteins**, **fats** and **carbohydrates** provide different rates of combustion. **Fat** is one of the most efficient, compact sources of energy in all the foods you eat. **One gram** of **fat** when burned in the body will yield **9 calories**. **Proteins** and **carbohydrates** are not as efficient. The rate of combustion for both of these fuel sources is **4 calories per gram**. Thus we have a **9-4-4** ratio of values applied to the main elements of a menu.

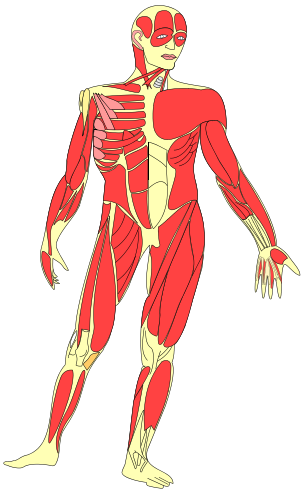
Conversion Rates

The conversion numbers **9-4-4** are used to convert a given amount of food (1 gram) into calories. Thus 100 grams of protein (x 4) is worth 400 calories. 10 grams of fat (x 9) is worth 90 calories, and 200 grams of carbohydrates (x 4) is equal to 800 calories.

Food	Grams	Calories
Fat	10	90
Carbohydrate	10	40
Protein	10	40

A Brief Overview of Metabolism

Your **metabolism** is the **total amount of energy required by all your bodily functions** for **one day**. It's imperative to understand that in order to make a positive change (whether fat-loss or a muscle-gain), your body requires a certain **metabolic (expenditure)** and **caloric (consumption) combination** in order for that change to occur.

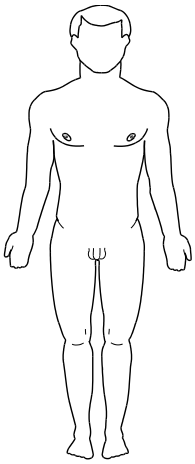


Energy Out

Two activites occur in the human body that contribute to energy expenditure. One activity is the fueling of the **basal metabolism.** The second is the fueling of its **voluntary activities**.

Basal Metabolism

The **basal metabolism** supports your bodily functions that occur without conscious awareness. This includes the **heartbeat**, **breathing**, **maintenance of body temperature** and the **sending of nerve** and **hormonal messages to direct these activities**. They are the **basal processes** that **maintain life**.



The amount of energy required to maintain these functions is called the **basal metabolic rate (BMR)**. The basal metabolic rate is the **minimum amount of calories** needed to sustain the vital functions of the body during a **relaxed**, **reclined** and **waking state**. BMR is **proportional** to the **body size**, **lean mass** and **surface area** of an individual. The BMR is surprisingly fast. A person whose total energy needs are **2,000** calories a day, spends as many as **1,200** to **1,400** of them to support basal metabolism.

You cannot directly change your BMR, today. You can, however, change the second component - **voluntary activities** - and spend more calories **today**. By increasing your daily voluntary activities day after day, it will ultimately change your BMR.

Voluntary Activities

In order to make **favorable changes** in your body, one of your primary goals is to increase your **Basal Metabolic Rate**. You can **increase** your **BMR** by making **exercise** a **daily habit**. This will **increase** your **body-composition** toward **lean**. Lean tissue is more **metabolically active** than fat, so, your **basal energy output** also will increase.

The **amount** of energy you spend in exercise depends on your **personal lifestyle** and **exercise preferences**. For example, the **larger the muscle groups** you use in your activity, and the **more time you consistently invest**, the **more calories** you spend.

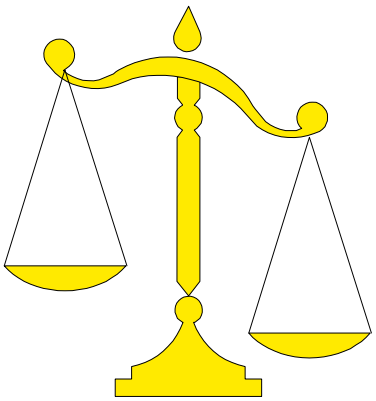
Voluntary activity of exercise is the **most immediate change** you can make to help **increase daily caloric expenditure**. Whether you are interested in **fat-loss** or **muscle gain**, increasing energy expenditure through consistent daily aerobic exercise will ensure that weight-loss is due to **fat-loss** rather than muscle tissue.

Now that you understand the **two basic expenditures** of **metabolism**; **basal metabolic rate** and **voluntary exercise expenditure**; let's explore the necessary conditions for change to occur.

Positive Energy Balance

Regardless of popular theories behind behavior and metabolism, people in the real world **gain** and **lose body-fat**. How does this happen? It occurs due to an **unbalanced energy budget**. That is, by eating (consuming) either **more** or **less food energy than they spend**. There is an **energy balance** when the **caloric intake equals** the **caloric expenditure**.

The primary cause of excessive body-fat and obesity is an **energy imbalance** in the body.



Let's examine a **positive energy balance**. A positive energy balance occurs when the input of calories (food) **exceeds the expenditure**, (you eat more than you spend). For every **3,500 calories** of excess food consumed -- that the body does not burn for energy -- **one pound of fat** is stored in the body.

Improper diet, **overeating**, **hormone disturbances**, **physical inactivity** and even **extensive dieting** may create a **positive energy balance** which leads to **weight gain**.

Positive Energy Balance Can Be Good

A positive energy balance is not always bad. In fact, for those interested in increasing their **weight/lean muscle mass**, a **positive energy balance** is **essential**. They must consume more calories than the **basal metabolism** requires. This positive energy balance, **coupled with correct exercise**, will stimulate and accommodate **new tissue growth**.

An increase in lean mass will occur as long as there is enough weight training to substantiate the growth of lean muscle tissue during a positive energy balance.

Negative Energy Balance

Here's how you'll lose body-fat through a negative energy balance. When the **caloric expenditure exceeds** the **caloric intake**, a **negative energy balance occurs**. You burn more calories than you consume. The most effective way of producing this deficit is through **proper nutrition** and **exercise**. More specifically, a **personalized nutrition plan** to meet your body's needs and an **effective exercise plan** designed to achieve **your goals**. Correctly setting up these two variables can ensure that **metabolism** will be enhanced and any weight-loss is due to **fat-loss** -- not the loss of lean muscle.

It All Starts With Food

The **highest priority** of **nutrition** is **metabolism**. Every individual requires a **specific amount of food** to meet their **metabolic needs**. The **amount of calories** is **dependent** upon the **change** of **body-composition** you desire.

To achieve **fat-loss**, a **negative energy balance** must be present for weight-loss to occur. However, the negative energy balance must **not** fall below the requirements of the **basal metabolic rate**. When the basal metabolism receives all of the necessary fuel requirements, it can function efficiently enough to **burn** the **unneeded fat stores.**

When calories are eliminated or reduced to a level **below** what is required by the **basal metabolic rate**, the diet will have an **adverse effect** on the individual's body-composition and health.

Don't Burn Lean Muscle Tissue

The body's **first choice** for fuel is stored **glycogen** (blood sugar). After the glycogen has been depleted, the body must obtain more glucose to keep its **nervous system** operating. At this point, the underfed body will turn to **protein**, its own lean muscle mass, to feed its **basal metabolic rate**.

Many dieters believe the body will burn **fat** as its **alternative source of energy**. This is wrong. At this stage, fat stores are of no use to the nervous system.

Here's why. The **nervous system** and **brain** are the central controllers in the body. They can only use glucose (blood sugar) as fuel, and it is **imperative that they find fuel**. The **muscles** and **organs** may use fat as fuel, but the nervous system cannot. Also, **the body possesses no enzymes that can convert fat to glucose**. The body does, however, have **enzymes** that convert **protein to glucose**.

So, if fuel is not available, the body converts its own **muscle mass into glucose** to feed its **nervous system** and **metabolism**. In fact, if the body were to continue to consume its lean tissue unchecked, with no other fuel sources, death would ensue within a few weeks. After all, not only skeletal muscle, but also the liver, heart muscle, lung tissue, blood cells -- all vital tissues - are being **burned as fuel**.

The Wrong Way

Herein lies the problem with most conventional weight-loss programs. They are **faulty in design** for the very reasons just explained. Conventional diets **lower** the

caloric intake <u>below</u> the **basal metabolic rate** to create a negative energy balance. This method will incur weight-loss, but it will be a result of muscle or lean mass loss (protein).

It's important to realize that when the calories drop below the minimal amount of energy required (BMR) to feed the nervous system, the body **perceives starvation**. When this occurs, not only does the body burn muscle to fuel its energy requirements, but while doing so, it is actually slowing down its metabolism. By ridding itself of **muscle**, **the body is essentially ridding itself of metabolism**.

This is where the fat storage occurs during dieting. While shedding muscle under this **perceived state of starvation**, the body will store whatever it can as **body-fat** to **protect itself**. It also will respond to the threat of starvation by increasing the fat-depositing **enzymes** which will in turn **store more fat**.

The long term effects of dieting (especially without physical activity) will produce a **negative effect** on body-composition. A person who lowers calories below his or her BMR and loses muscle mass through dieting, will lower his or her metabolism. (Remember metabolism is directly proportional to the amount of lean muscle mass).

Lowered Metabolism

By **lowering the metabolism**, the body now requires **fewer calories**. If the calorie consumption **increases**, the individual will gain back more **fat** than **lean muscle mass** (especially without physical activity). Each time a person loses weight and regains it while remaining inactive, the metabolism will require fewer calories. If a person eats the same amount as they did before the last diet, he or she will not maintain (because they lost the lean muscle mass) but will, instead, **gain weight**.

This explains the **yo-yo dieting effect**. Each round of dieting, without physical activity, is followed by a **rebound** of weight to a higher level than before. The body-fat content increases and caloric needs fall after each round, making the next round of weight-loss more difficult.

There's Only One Way

Remember, **metabolism** will define what our bodies will be -- or become. The **basal metabolic rate** is the minimum amount of energy required to fuel our basic physiological functions. Any decrease in calories below this BMR will result in a **decrease** in **lean muscle tissue**. A decrease in muscle tissue **slows** the **metabolic expenditure**, which leads to an eventual **increase in body-fat** to protect the body from perceived starvation.

In order to make a favorable change in your current **body-composition**, the **appropriate conditions** must be **consistently maintained** for the desired change to occur. For weight/muscle gain, the body must experience a **positive energy balance**. By consuming more calories than the current BMR requires, an effective weight/strength training program will stimulate the desired growth.

For **weight/fat-loss** to occur, an individual must consume enough calories to maintain and support their BMR and create a **negative energy balance** by increasing voluntary **aerobic activity**. **It's that simple.** Remember, all desired changes in body composition rely upon the **metabolism** to **build muscle** or **burn fat**.