

# BSCS Biology An Ecological Approach

## Chapter 17 The Human Animal: Coordination

*Physical fitness is not only one of the most important keys to a healthy body; it is the basis of dynamic and creative intellectual activity.*

*-John F. Kennedy*

### Introduction

In order for the human body to be involved in any activity with movement, several systems must work in **coordination**. There are specialized cells and systems involved including muscles, nerves, and the skeleton. The human **brain** may be compared to a command center as all of this coordination is controlled by the **nervous system**.

### Muscles

Muscles are responsible for all manner of movement in the body. There are three types of muscle groups. They are:

**Skeletal muscles** which are attached to and move bones. They are **voluntary**.

**Smooth muscles** which are found in the walls of the stomach and digestive organs.

Smooth muscles are **involuntary**.

**Cardiac muscle** which is found only in the heart and is also involuntary.

Muscle **contraction** is made possible through a complex series of interactions initiated by nerve impulses. Chemical changes involving the **ATP – ADP** cycle and the release of energy are ongoing and heat is a by product.

### Movement and Exercise

Movement in **vertebrates** (animals with backbones) is possible because of the **coordination** of muscles, the **skeleton**, and the **nervous system**. As we grow, our **cartilage** is replaced by bone in a hardening process. Strong bones provide a framework for support and movement. Muscles cannot push bones; they pull them (**flexors**) so other muscles must pull them back (**extensors**). Fitness is a term applied to healthy muscle and cardiac systems. **Muscle tone** is an indicator of fitness. **Cardiac fitness** is a result of proper nutrition and exercise.

### The Nervous System

An organism's muscular movements are coordinated by the **nervous system**. The body receives external **stimuli** through **receptors** such as the **eyes** and **skin**. These signals are transmitted by individual nerve cells (**neurons**) combined with groups of cells (**nerves**). Each neuron consists of a **cell body**, an **axon** (transmits signals or nerve impulses away from the cell body) and **dendrites** (transmits towards the cell body). Neurons are connected by synapses. The central nervous system is comprised of the brain and spinal cord while the peripheral nervous system is made up of the sensory and motor neurons. The human brain consists of several specialized parts:

- The **cerebrum (right and left lobes)** is responsible for personality, consciousness, learning, and memory. Each lobe has different functions and the right lobe controls the left side of the body and vice versa.
- The **cerebellum** coordinates all bodily movement through the muscles.
- The **brain stem** regulates the unconscious activities such as heart rate, breathing, and other involuntary bodily functions and actions.

## **The Endocrine System**

This system consists of a series of **ductless glands** which provide for maintaining body balance and control. It consists of a group of chemical-producing glands which release **hormones** directly into the bloodstream. These hormones have a specific effect on the **target organs**. For example, **adrenalin** from the **adrenal glands** causes the heart to speed up. The following are all part of this system: the **pineal gland, hypothalamus, pituitary gland, parathyroid glands, thyroid gland, thymus gland, adrenal glands, pancreas, ovaries** (female) and **testes** (male). The **hypothalamus** is the master gland because its hormones help to control the other glands.

## **Stress, Drugs, and our Bodies**

**Stress** is the body's physiological reaction to adverse conditions. Lack of sleep, lifestyle, working conditions, extreme weather, and abuse all contribute to stress. The **stressors** are those external factors in the environment that cause stress. For example, too many "fight or flight" situations can lead to stress. Some individuals turn to various **psychoactive drugs** in an attempt to shortcut dealing with stress. This can lead to drug dependence or **addiction** as well as a **tolerance** to the effects of the drug requiring increasing amounts and usage. Drug addiction can also lead to higher **risk** for such diseases as AIDS because of impaired decision-making.