UNIT 4

Preparation

Prerequisite Concepts

This unit builds on your knowledge of the structure and function of animal cells (Unit 3 Preparation), the cell membrane (Unit 3 Preparation), and cellular respiration (Chapter 5).

Human Systems

Each of the cells of the human body is a living unit that performs a specific function. Cells of the same type interact both structurally and functionally to form specialized tissues, such as those that line your stomach. One or more tissues interact to form more complex structures known as organs, such as your stomach. Several organs—for example, your stomach, small and large intestines, liver, and pancreas—are linked either physically or functionally as organ systems, such as the digestive system.

Figure P4.1 Organ systems of the human body

Digestive system
- breaks down food into chemical components that are small enough to enter circulation
- eliminates undigested food

Respiratory system
- delivers oxygen to blood
- removes carbon dioxide from cells
- helps to control blood pH

Circulatory system
- transports blood, nutrients, gases, and metabolic wastes
- defends body against disease
- helps to control temperature, fluid balance, and pH balance

Lymphatic and immune systems
- help to control fluid balance
- defend against disease
- absorb fats (lymphatic)

Excretory system
- removes metabolic wastes
- helps to control fluid balance
- helps to control pH balance

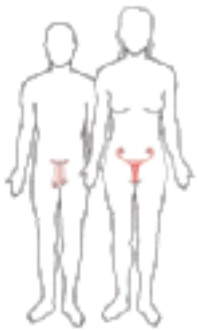
Muscular system
- maintains posture
- moves body and organs
- produces heat

Integumentary system
- protects body from infection
- receives sensory input
- helps to control body temperature
- synthesizes vitamin D

Skeletal system
- provides framework for muscles to attach to, making movement possible
- produces blood cells
- stores minerals
- protects soft organs

Nervous system
- detects, interprets, and responds to stimuli from outside and within body
- with endocrine system, coordinates all organ-system functions

Endocrine system
- produces hormones
- helps to coordinate organ systems
- responds to stress
- helps to regulate fluid and pH balance
- helps to regulate metabolism



Reproductive system
- produces gametes (sperm or ova)
- transports gametes
- produces sex hormones
- nourishes, nurtures, and gives birth to offspring in females

The first six organ systems shown and summarized in Figure P4.1 are the subject of this unit. You will study other organ systems in your next biology course.

Homeostasis and Negative Feedback

Whether you are resting or working out, your body temperature will stay near a set point of 37 °C. The pH of your blood will stay near 7.4. Your blood glucose level will stay around 100 mg/mL. Regardless of external conditions, the internal environment of your body remains stable or relatively constant. The tendency of the body to maintain a relatively constant internal environment is known as *homeostasis*.

Body systems maintain homeostasis through a mechanism that has three components: a *sensor*, which detects a change in the internal environment; an *effector*, which brings internal conditions back into a normal range; and a *control centre*, which activates the effector based on information received from the sensor.

The main homeostatic mechanism that works in the body to keep a variable, such as body temperature, stable is *negative feedback*. Figure P4.2A compares negative feedback to the way a seesaw moves. A seesaw is level when the forces acting on it are balanced. If a change occurs to disrupt this balance, the seesaw can be made level again by applying a force to reverse the change.

In terms of negative feedback, a sensor detects a change that disrupts a balanced state and signals a control centre. The control centre then activates an effector, which reverses the change and restores the balanced state. Figure P4.2B shows how this idea applies to the control of body temperature.

Prerequisite Concepts

This unit provides opportunities to practice and further develop your skills in the use of the microscope and in the illustrating of scientific drawings.

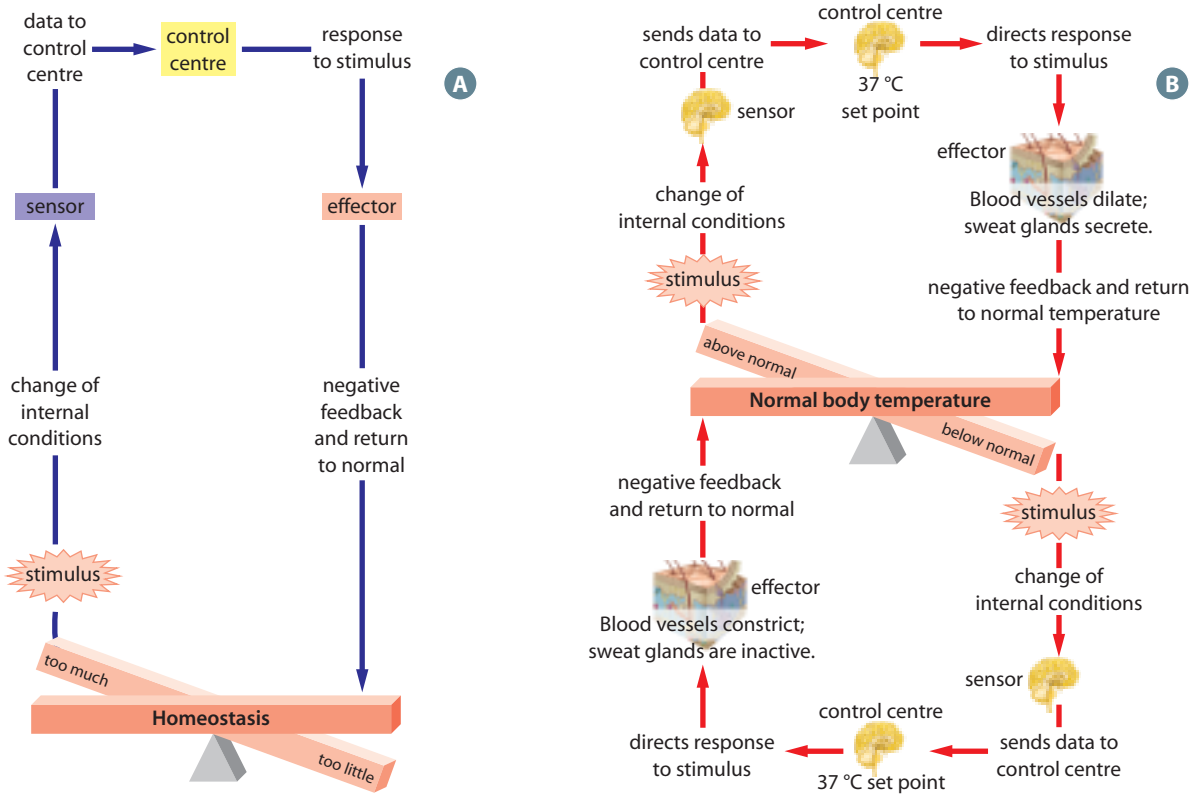


Figure P4.2 Negative feedback in general **(A)** and in a biological example—maintenance of body temperature **(B)**.