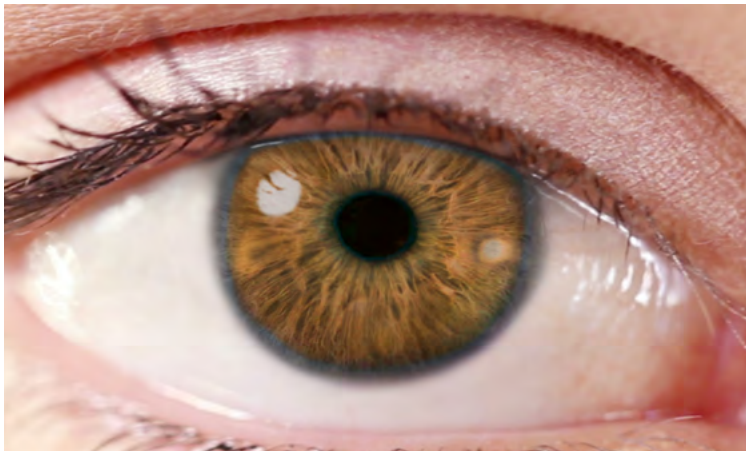
Chapter 12

The Nervous System



12.2 Homeostasis

Whether you are swimming in icy waters or hiking through scorching heat, your body temperature stays close to 37°C (98.6°F). This consistency in body temperature is an example of **homeostasis**, the maintenance of a relatively stable internal environment. Homeostasis is a characteristic of all living organisms, and a huge amount of the body's activity goes toward maintaining it.

As just another example of homeostasis, your cells need a certain amount of oxygen to function. Your lungs and heart maintain a normal level of activity to supply this oxygen. If your activity level increases—say, because you run to catch a bus—your cells use up more oxygen. What happens? Your body responds by breathing harder to take in more oxygen and by increasing your heart rate to move that oxygen to your cells. Once your activity level returns to normal and your oxygen use decreases, your breathing and heart rate slow again.

(a) (b)

FIGURE 12.2

Your body responds to changing conditions in ways that help maintain homeostasis. (a) When you're cold, you shiver to warm up. (b) When you're hot, you sweat to cool down.

To go back to body temperature, when it's cold outside, you feel cold and pile on more clothes, or wrap your arms around your body to reduce heat loss. In addition, less blood is sent to your limbs and extremities, which lose heat faster than the core of your body. (This explains why your fingers and toes often feel most cold when you're cold.) You may also shiver to generate heat (Figure 12.2). On the other hand, when it's hot outside, you take off your clothes, look for shade, and sweat to cool off. Also, more blood goes to the extremities and to the face, which are good at shedding heat. (This explains why your face turns red when you're hot.)

Controlling body temperature is an example of *feedback regulation*. In feedback regulation, changes in one variable affect a second variable, and changes in the second variable in turn affect the first variable. We say the variables are related in a *feedback loop*. In this example, changes in body temperature trigger specific responses that in turn affect body temperature.

Homeostasis is often maintained by a type of feedback regulation called *negative feedback*. In negative feedback, a stimulus causes a response that counters the stimulus. So, if body temperature decreases, the response will cause body temperature to increase back to normal. On the other hand, if body temperature increases, the response will cause body temperature to decrease back to normal.

Oxygen supply and body temperature are only two of the many variables the body carefully regulates. The amount of water in the body, the concentration of nutrients and waste products in the blood, the concentrations of important ions inside and outside cells, and blood pH—these and many other variables are carefully regulated. When all this regulation is working well, we say that the body is maintaining homeostasis.

READING CHECK

Your activity level increases, and your cells begin to use more oxygen. Then, you begin to breathe harder and take in more oxygen. Your heart rate also increases to help move that oxygen to your cells. Is this an example of negative feedback? Why or why not?

CHECK YOUR ANSWER

Negative feedback describes a situation in which a stimulus causes a response that counters the stimulus. In this example, the stimulus is that your cells begin to use more oxygen, so that oxygen levels in your tissues decrease. The response is that you breathe harder and your heart beats faster, transporting more oxygen to your tissues and increasing oxygen levels there. In other words, this response (increased oxygen) counters the stimulus (decreased oxygen), so yes, this is an example of negative feedback.

You can read more about homeostasis at this website:

https://www.livescience.com/65938-homeostasis.html