Effectors

Peripheral tissue at the outer end of an efferent neural path (one leading away from the central nervous system).

An effecter acts in special ways in response to a nerve impulse. In humans, effectors may either be muscles, which contract in response to neural stimuli, or glands, which produce secretions. The muscles are generally divided into two groupings: somatic effectors, which are the body’s striated muscles (such as those found in the arm and back), and autonomic effectors, which are smooth muscles (such as the iris of the eye).

Both types of effectors are linked to the gray matter of the spinal cord, but each system originates in a different portion of it. The somatic effectors, which are responsible for powerful motor movements, are linked to the ventral horn cell, a large neuron in the ventral portion of the gray matter. The autonomic effectors receive impulses from the lateral part of the gray matter. The smooth muscles that are supplied by these effectors maintain the tone of blood vessels walls, thus helping to regulate blood pressure. Glandular secretions controlled by autonomic effectors include external secretions, such as sweat, and internal ones, such as the hormone epinephrine secreted by the adrenal medulla of the brain.

Some nerve fibers that connect with autonomic effectors also pass through the ventral roots of the spinal nerves by way of a ganglion located outside the spinal cord and are then distributed to smooth muscles and glands.

Further Reading

Ego

In psychoanalytic theory, the part of human personality that combines innate biological impulses (id) or drives with reality to produce appropriate behavior.

Sigmund Freud believed that human personality has three components: the id, the ego and the superego.

In his scheme, the id urges immediate action on such basic needs as eating, drinking, and eliminating wastes without regard to consequences. The ego is that portion of the personality that imposes realistic limitations on such behavior. It decides whether id-motivated behavior is appropriate, given the prevailing social and environmental conditions.

While the id operates on the “pleasure principle,” the ego uses the “reality principle” to determine whether to satisfy or delay fulfilling the id’s demands. The ego considers the consequences of actions to modify the powerful drives of the id. A person’s own concept of what is acceptable determines the ego’s decisions. The ego also must “negotiate” with the superego (conscience) in the often bitter battle between the id’s drives and a person’s own sense of right and wrong. Repression and anxiety may result when the ego consistently overrides the id’s extreme demands.

Further Reading

Electra complex

See Oedipus complex

Electrical stimulation of the brain (ESB)

A procedure which involves the introduction of a weak electrical current into specific locations in the brain by using multiple microelectrodes to apply short pulses of electrical currents intended to mimic the natural flow of impulses through the neural pathways.

Electrical stimulation of the brain (ESB) is useful in a variety of situations, including neurosurgical operations and experimental research. In neurosurgery, this procedure may be used to assist physicians in determin-
ing which brain tissue should be removed. Because the patient must remain awake during the procedure, only a local anesthetic is administered. Focal epilepsy has been surgically treated by using electrical brain stimulation in conscious patients to determine the epileptic focus.

In experimental research, ESB does not control complex behavior patterns such as depression, but it can be employed quite successfully to control individual functions. Therefore, this procedure has proven useful in studying the relationships among various areas and structures of the brain and the activities they control. It has been found, for example, that stimulation of the visual cortex produces visual sensations, such as bursts of light or color (blind people have seen spots of light as a result of ESB). Similarly, stimulation of the auditory cortex results in aural sensation, while stimulating areas associated with motor control produces arm, leg, or other body movements. Stimulation of areas of the brain linked to association can induce memories of scenes or events.

In addition to research and experimental uses, electrical brain stimulation has been successfully used for some therapeutic purposes. Brain stem and cerebellar stimulation have aided in some movement disorders; peroneal nerve stimulation has been used to treat drop-foot in stroke victims; and transcutaneous nerve, dorsal-column, and deep-brain stimulation have proven useful in the relief of chronic severe pain.

Electrical brain stimulation has aided in mapping connections between different regions of the brain in animals, and has been used to induce many different types of behavior in animals, including eating, drinking, aggression, hoarding, and both sexual and maternal behavior. While hypothalamic stimulation is associated with such emotional responses as attack and defense, stimulation of the reticular formation in the brain stem can induce sleep. ESB has also confirmed the existence of a “reward center” in animals, whereby animals can be taught to stimulate their own brains mechanically by pressing a lever when such stimulation results in a pleasant sensation.

---

**Electroconvulsive therapy (ECT)**

The application of a mild electric current to the brain to produce an epileptic-like seizure as a means of treating certain psychological disorders, primarily severe depression.

Electroconvulsive therapy, also known as ECT and electroshock therapy, was developed in the 1930s when various observations led physicians to conclude that epileptic seizures might prevent or relieve the symptoms of schizophrenia. After experiments with insulin and other potentially seizure-inducing drugs, Italian physicians pioneered the use of an electric current to create seizures in schizophrenic patients.

ECT was routinely used to treat schizophrenia, depression, and, in some cases, mania. It eventually became a source of controversy due to misuse and negative side effects. ECT was used indiscriminately and was often prescribed for treating disorders on which it had no real effect, such as alcohol dependence, and was used for punitive reasons. Patients typically experienced confusion and loss of memory after treatments, and even those whose condition improved eventually relapsed. Other side effects of ECT include speech defects, physical injury from the force of the convulsions, and cardiac arrest. Use of electroconvulsive therapy declined after 1960 with the introduction of antidepressant and antipsychotic drugs.

ECT is still used today but with less frequency and with modifications that have made the procedure safer and less unpleasant. Anesthetics and muscle relaxants are usually administered to prevent bone fractures or other injuries from muscle spasms. Patients receive approximately 4 to 10 treatments administered over a period of about two weeks. Confusion and memory loss are minimized by the common practice of applying the current only to the non-dominant brain hemisphere, usually the right-brain hemisphere. Nevertheless, some memory loss still occurs; anterograde memory (the ability to learn new material) returns relatively rapidly following treatment, but retrograde memory (the ability to remember past events) is more strongly affected. There is a marked memory deficit one week after treatment which gradually improves over the next six or seven months. In many cases, however, subtle memory losses persist even beyond this point, and can be serious and debilitating for some patients.

About 100,000 people in the United States receive electroconvulsive therapy annually. ECT can only be administered with the informed consent of the patient and is used primarily for severely depressed patients who have not responded to antidepressant medications or whose suicidal impulses make it dangerous to wait until such medications can take effect. ECT is also administered to patients with bipolar disorder. Contrary to the theories of those who first pioneered its use, ECT is not an effective treatment for schizophrenia unless the patient is also suffering from depression. The rate of relapse after administration of ECT can be greatly diminished when it is accompanied by other forms of treatment.

Researchers are still not sure exactly how electroconvulsive therapy works, although it is known that the