sexual relationships/encounters, brought about by physical maturity combined with emotional immaturity
- skull or brain malformations

Distinctive facial features may include:

- small head (microcephaly)
- small eyes with folds in the skin near the nose (epicanthal folds) and short horizontal eye openings (palpebral fissures)
- underdevelopment of the upper lip with flat philtrum (ridges extending vertically between the upper lip and nose)
- small jaw (micrognathia)

FAS/FAE is a lifelong condition that, depending on its severity, significantly affects the individual's ability to function productively. Early diagnosis and intervention with support and education services may improve outcomes in educational, social, and employment settings.

See also **Addiction/addictive personality; Alcohol dependence and abuse; Apgar score; Intellectual disability.**

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Fight/flight reaction

The fight/flight reaction, also called the fight-or-flight response, is the body's emergency response to danger. It is triggered by fear and prepares the body to defend itself or avoid the danger—quick action or quick escape. The fight/flight reaction is both a physiological and an emotional adaptation for the survival of humans and other animals.

The fight/flight reaction is an evolutionary adaptation for protecting against bodily harm and promoting survival. As soon as danger is perceived by the senses, the body redirects its energy from conscious thought and routine bodily functions to automatic functioning that invigorates physical performance so that the muscles of the body can strike, lift, or run with abnormally strong force. The fight/flight reaction triggers major changes throughout the body:

- tensing of the muscles
- a rapidly beating, pounding heart
- rapid, shallow breathing
- sweating
- dry mouth
- constriction of the throat so that the voice rises in pitch
- possibly shaking, dizziness, or nausea

In his 1872 treatise, *The Expression of the Emotions in Man and Animals*, Charles Darwin (1809–82) hypothesized that the fight/flight reaction is a survival adaptation in humans and other animals and that the similarities of emotional expressions, such as fight/flight, among all groups of people suggests that humans all evolved from a common ancestor. In the 1880s, the American psychologist William James (1842–1910) also described the fight/flight reaction as an emotion. Since the 1950s, the fight/flight reaction has been recognized as a physiological response.

Sometimes stimuli other than danger can trigger the fight/flight reaction. Possible triggers include being startled, memory of a frightening or traumatic experience, or even an intensely pleasurable stimulus.

Physiology

The fight/flight reaction is under the control of the sympathetic nervous system, which mobilizes the body for fight or flight. The sympathetic nervous system is one of the two branches of the autonomic nervous system that controls bodily functions—such as respiration and digestion—that are outside conscious control. The other branch of the autonomic nervous system, the parasympathetic system, slows down bodily functions to conserve energy—the rest-and-digest mode.

Based on sensory input and processing, as well as memories of previous experiences, the brain decides whether a threat exists. If it perceives a threat, the brain circuitry shifts from the prefrontal cortex—the seat of conscious thought—to the more primitive limbic system, since conscious thought would slow down the response. The fight/flight reaction is activated by the amygdalae—basal ganglia in each cerebral hemisphere—and the hypothalamus at the base of the brain. The thalamus signals the amygdalae that there is a threat, and the amygdalae and the hypothalamus responds. The amygdalae also appear to be involved in both learning fear and overcoming fear. The hypothalamus signals two other hormone-releasing endocrine glands—the pituitary in the brain and the adrenal glands. The adrenals sit on top of each kidney and are part of the autonomic nervous system. The adrenal glands secrete adrenaline (epinephrine), which is the primary fight/flight hormone. Adrenaline activates the sympathetic nervous system and damps down the activity of the parasympathetic nervous system. The adrenals also secrete norepinephrine (noradrenaline), a stress hormone and neurotransmitter in the sympathetic system. The hypothalamus signals the pituitary gland to release adrenocorticotropic hormone (ACTH), which causes the adrenal glands to secrete the stress hormone cortisol. Cortisol supplies the body with bursts of energy, improves memory, and suppresses inflammation for the short term.

This activation of the sympathetic nervous system in response to the three stress hormones (adrenaline, norepinephrine, and cortisol) results in immediate and dramatic physiological changes:

- increased heart rate (pulse)
- dilation of the blood vessels leading to the heart and the large muscles of the arms and legs to increase the volume of blood pumped and raise blood pressure
- diversion of blood supply away from the cerebral cortex (which may cause fainting, a survival mechanism for some animals)
- increased breathing rate and shallower breathing to supply the body with more oxygen
- release of glucose from the liver and energy supplies from fat to increase blood sugar and supply a rush of energy
- tensing of the muscles to prepare them for action
- increased sweating from a rise in body temperature
- dilation of the pupils for better vision
- the erection of body hairs causing so-called goose bumps
- slowing of the digestive and urinary systems and a reduction in salivation, swallowing, and other functions to preserve energy
- dry mouth from the reduction of saliva and mucous
- reduced hunger
- reduced pain sensitivity
- activation of immune system responses

If the brain determines that the fight/flight reaction is inappropriate, the freeze response is initiated. Heart rate and breathing slow, and the body shuts down in a final effort to survive. Stage fright is an example of the freeze response.

Once the danger has passed, the fight/flight stress response is turned off, and the body recovers and returns to equilibrium. The parasympathetic nervous system takes over, releasing acetylcholine, a neurotransmitter that activates nicotinic and muscarinic receptors in cells and muscles throughout the body to shift it to a rest-and-digest mode. This shift lowers metabolism, heart rate, and blood pressure; boosts the immune response; and activates cellular repair.

Adverse effects

The fight/flight reaction evolved to protect humans and other animals from predators and promote survival, and its short-term activation has no ill effects. However, most people in modern society have little to fear from wild animals. Instead, the fight/flight reaction can be initiated by stresses of everyday life, such as the following:

- exams
- frustrations at work
- job loss
- loss of a home or moving to a new home
- a fight with a partner
- divorce
- bereavement
- general dissatisfaction or unhappiness

Some researchers believe that fast-moving modern society, with its constant barrage of information and frantic stress, puts the sympathetic nervous system into a constant state of overdrive, in which fight/flight reactions are continually activated. There are a myriad of stresses that can trigger and maintain the fight/flight reaction. Prolonged excessive stress may damage the system, causing symptoms of hyperarousal, such as insomnia, irritability, anxiety, and jumpiness. Without abrupt actions that release the flight/flight response, hyperactivation of the sympathetic nervous system can turn into a panic attack. Post-traumatic stress disorder (PTSD) is a condition in which the fight/flight reaction has been altered or damaged, so that it is activated when there is no danger.

KEY TERMS

Adrenal glands—The endocrine glands located on top of the kidneys that secrete several stress hormones, including adrenaline, norepinephrine, and cortisol.

Adrenaline (epinephrine)—A neurotransmitter and the primary fight/flight hormone that is secreted by the adrenal medulla to stimulate the heart and raise blood pressure.

Adrenocorticotropic hormone (ACTH)—A protein produced by the pituitary gland that stimulates the adrenal glands during the fight/flight reaction.

Amygdala; pl. amygdalae—The almond-shaped basal ganglia in each cerebral hemisphere; part of the limbic system that is activated in stressful situations, such as the fight/flight reaction, and that triggers fear.

Cortisol—A corticosteroid hormone produced by the adrenal gland in the fight/flight reaction.

Hypothalamus—Part of the diencephalon beneath the thalamus on each side of the brain that controls the autonomic nervous system and regulates hormone production by the adjacent pituitary gland.

Limbic system—Brain structures, including the hypothalamus, hippocampus, and amygdalae, that are involved in mood, emotion, and motivation and are responsible for the fight/flight reaction.

Norepinephrine—A neurotransmitter, adrenal hormone, and the precursor of epinephrine.

Parasympathetic nervous system—The rest-and-digest division of the autonomic nervous system that lowers heart rate and blood pressure and stimulates digestion, among many other functions.

Pituitary gland—A small endocrine organ in the brain that is associated with various hormones that control and regulate other endocrine organs and affect most basic bodily functions, including growth and development and the fight/flight reaction.

Post-traumatic stress disorder (PTSD)—Ongoing fight/flight responses in the absence of a threat.

Sympathetic nervous system—The fight-or-flight division of the autonomic nervous system that increases heart rate, blood pressure, and respiration, among other functions, in active or stressful situations.

Thalamus—The largest portion of the diencephalon, which relays impulses, especially sensory impulses, to and from the cerebral cortex.

Over the long term, hyperactivation of the fight/flight reaction can cause or worsen health problems and contribute to the following:

- nervousness or worry
- decreased brain function, including poor concentration, indecision, and memory problems
- irritability and anger
- sleep disturbances
- mental health problems, including depression and anxiety disorders
- increased or decreased appetite
- weight gain
- increased use of caffeine, alcohol, tobacco, or drugs
- lack of energy
- fatigue
- headaches
- acne and other skin problems
- muscle aches and tension, especially in the neck, shoulders, and back
- stomach and intestinal problems
- increased heart rate
- high blood pressure
- increased blood cholesterol
- heart disease and stroke
- decreased immunity
- higher risk of bone density loss
- increased risk of diabetes from extra glucose released by the liver
- cancer
- irregular or painful menstrual periods in women
- lower sperm production and reduced sexual desire in men

See also **Post-traumatic stress disorder (PTSD); Stress.**

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American Psychological Association, 750 First St. NE, Washington, DC, 20002-4242, (202) 336-5500, (800) 374-2721, http://www.apa.org.

Mental Health America, 2000 N. Beauregard St., 6th Fl., Alexandria, VA, 22311, (703) 684-7722, (800) 969-6642, Fax: 1(703) 684-5968, http://www.mentalhealthamerica.net.

Figure-ground perception

Figure-ground perception refers to the ability to differentiate visually between an object and its background.

A person's ability to separate an object from its surrounding visual field is referred to as figure-ground perception. The object that a person focuses on is called the figure; everything else is referred to as background, or simply ground.

Psychologists have created different kinds of stimuli in order to study how people separate figure from ground. In some cases, these stimuli involve simple ambiguous figures such as the famous face-vase (called the Rubin vase) figure that can be interpreted either as two faces looking at one another in profile or as a vase, depending on what aspect a person focuses on. In order to see both percepts, the visual system has to shift figure and ground; this is called a figure-ground reversal. The visual system apparently uses a variety of cues to choose between figure and ground. Often, the smaller stimulus is deemed figure, the larger background. Shape is a determinant as well, so objects that are convex tend to be interpreted as figures. Movement is another cue, as is color. A solid color is more likely to be perceived as background, while multiple colors seem to indicate figure. Edge can also be a cue, because the perception of figural edge helps to define the background. There is no single defining cue or feature; the perceptual system and the brain take in the available information and use it to make judgments differentiating figure from ground.

Figure and ground are used extensively in artistic compositions. They may also be used for non-visual stimuli, for example, to distinguish melody from harmony in a complex musical composition. Figure-ground relationships are subjective and determined by the perceptions and biases of the observer.

***See also* Binocular depth cues; Color vision; Depth perception; Gestalt principles of organization.**

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Fine motor skills

Fine motor skills are the ability to make smooth, controlled movements using the small muscles in the fingers, hand, and wrist.

Fine motor skills involve deliberate and controlled movements requiring both muscle development and maturation of the central nervous system.