

A

ABDOMINAL CAVITY The hollow space that contains the abdominal viscera. The **abdominal wall** refers to the layers of muscle between the skin and the abdominal cavity.

ABDOMINAL INJURIES The abdominal muscles, most commonly the *rectus abdominis*, may incur a strain as a result of direct trauma such as sudden twisting or hyperextension of the spine. Complications arise when the epigastric artery or intramuscular blood vessels are damaged, leading to hematoma formation. If hollow viscera are damaged, their contents can leak into the abdominal cavity and cause severe hemorrhage, peritonitis and shock. Baseball catchers wear torso protection from compressive forces to prevent contusions of the abdominal wall.

See also HERNIA; SOLAR PLEXUS CONTUSION.

ABDOMINAL OBESITY Upper-body obesity. Android-type obesity. It is associated with visceral fat storage, including an increase in intra-abdominal fat (mesenteric and omentum fat).

Evidence from research on twins has suggested there may be specific genetic determinants of central abdominal fat, independent of overall obesity.

According to the American Heart Association, a person is considered to be upper-body (android) obese when the waist-to-hip ratio is greater than 0.95 (men) and greater than 0.88 (women). The **waist-to-hip ratio** is the ratio of waist girth to hip girth. The waist girth is measured at the narrowest point during relaxed standing (without 'pulling in the stomach'). The hip girth (over the buttocks) is measured at the widest point. In men, waist-to-hip ratio correlates with increasing fatness, because of the tendency to store excess fat in the abdominal region. In women, waist-to-hip ratio correlates poorly with fatness, because of the heterogeneity of fat storage in women. The proportion of intra-abdominal fat progressively increases with age.

Women tend to be lower-body (gynoid-type) obese and men tend to be upper-body (android-type) obese, but there are many men who are lower-body obese and women who are upper-body obese. It is not clearly understood why some people are upper-body obese and some people are lower-body obese. Fat distribution is partly determined by the regional activity of the enzyme lipoprotein lipase. Females possess larger amounts of lipoprotein lipase. The areas of greatest lipoprotein lipase are (female) hip, thigh and breast; and (male) intra-abdominal. There are age-related variations in lipoprotein lipase and this plays a role in the development of upper-body obesity in middle-aged females. In women, compared to men, the enzyme is markedly more active in the femoral fat regions. In pre-menopausal women, this activity is greater in femoral fat than in breast or abdominal fat. Women with upper-body obesity have much higher levels of male hormones, such as testosterone, compared to women with lower-body obesity.

Abdominal obesity is a more serious risk factor than total body obesity for cardiovascular disease, diabetes, hypertension, hypertriglyceridemia (excessive fat in the blood) and low HDL cholesterol.

Obese subjects with visceral fat accumulation more frequently demonstrate impairment of glucose and lipid metabolism than those with subcutaneous fat accumulation. Visceral fat obesity is present in almost 90% of obese patients with ischemic heart disease. Even in nonobese subjects, visceral fat accumulation is correlated with glucose intolerance, hyperlipidemia and hypertension. 40% of nonobese subjects with coronary artery disease have increased visceral fat. Intra-abdominal fat has been shown to have high activities of both lipogenesis and lipolysis. Its accumulation can therefore induce high levels of free fatty acids, a product of lipolysis, in portal circulation. Excess free fatty acids may cause the enhancement of lipid synthesis and gluconeogenesis, as well as insulin resistance, resulting in

B

BABINSKI REFLEX Plantar grasp reflex. Foot grasp reflex. A primitive reflex that is present at birth and persists through the first year of life. It is elicited by applying slight pressure to the outer margin of the sole of the foot. As a result, the toes of the foot flex and adduct as if to grasp. This reflex enhances body awareness and strengthens the foot muscles. It is due to incomplete myelination of the nervous system. Failure of this reflex to integrate properly interferes with balance in walking and standing. It is often seen in conjunction with the positive supporting reflex (increased extensor tone that results in toe walking).

It is an important neurological test for spinal cord damage because it gives an easily detectable abnormal response if the spinal cord has been injured. If there is damage to the lateral corticospinal tract, there will be extension and abduction of the toes instead.

BABKIN REFLEX *See* PALMAR MANDIBULAR REFLEX.

BACTERIA A group of single-cell microorganisms, some of which produce poisonous substances called toxins that lead to ill health in humans. They contain only one chromosome and lack many organelles found in human cells.

BAINBRIDGE REFLEX *See* ATRIAL REFLEX.

BAKER'S CYST *See* POPLITEAL CYST.

BALANCE i) An instrument that is used in weighing. ii) A condition of partial or complete equilibrium or adjustment. iii) A term that refers to the control processes that maintain body parts in the specific alignments necessary to achieve different kinds of mobility and stability. Postural control involves keeping or returning the body's center of mass over its base of support. Balance in young children is heavily influenced by vision, whereas

adults rely more on tactile and kinesthetic input. Sensory systems (vestibular, kinesthetic, tactile and visual) interact with environmental variables to enable balance. **Static balance** involves maintaining one's equilibrium while the center of gravity remains stationary. Activities that include static balance include balancing on one foot. **Dynamic balance** involves maintaining one's equilibrium as the center of gravity shifts. Activities that require dynamic balance include walking along a narrow beam. There is low correlation between different tests of static and dynamic balance. A test of vestibular function is to seat a person on a stool and spin them rapidly. 20 seconds of spinning normally results in 9 to 11 seconds of nystagmus (rapid eye movements), an automatic midbrain response. A longer or shorter duration of nystagmus indicates a lack of vestibular integration. No dizziness or discomfort, or the opposite (including nausea), indicates the presence of vestibular problems also. Spinning is contraindicated when individuals are seizure-prone, or have inner ear or upper-respiratory infections.

See also under AGING.

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BALL AND SOCKET JOINT Enarthrosis. *See under* JOINT.

BALLISTIC MOVEMENT *See under* MOTOR UNIT; MOVEMENT.

BARBITURATES *See under* DEPRESSANTS.

BARORECEPTORS Nerve endings found mainly in the walls of the carotid sinuses and the aortic arch. They are sensitive to stretch, and thus to changes in blood pressure. They send nerve impulses to the medulla of the brain, which helps regulate blood pressure.

C

CADAVER DISSECTION ANALYSIS Dissection of fresh human cadavers (dead bodies). It may be performed for direct body composition. *See under* BODY COMPOSITION.

CAFFEINE A central nervous system (CNS) stimulant that has been used as an ergogenic aid for many years. It is a member of the group of chemicals called methylxanthines, which are found in over 60 species of plant. Coffee is derived from the beans of several species of coffee plants, e.g. *Coffea arabica*. Tea is made from the *Camellia sinensis* plant and its predominant methylxanthine, **theophylline**, is also a CNS stimulant. Chocolate contains small amounts of caffeine. The predominant methylxanthine in chocolate, **theobromine**, named after the cocoa tree (*Theobroma cacao*), does not bind as well into the adenosine receptors as caffeine and is virtually inert as a CNS stimulant. Adenosine generally decreases the concentration of the major neurotransmitters, including serotonin, dopamine, acetylcholine, norepinephrine and glutamate. Caffeine is an adenosine receptor antagonist and increases the concentration of these major neurotransmitters.

A brewed cup of coffee (6 oz) typically contains 60 to 100 mg of caffeine and soft drink beverages (8 oz) contain about 30 to 60 mg.

There is strong evidence that caffeine can improve performance by directly affecting the CNS. Although there are wide individual differences in response to caffeine, a dose of 80 to 200 mg leads to increased alertness, shortened reaction time, improved concentration and decreased perception of fatigue. Even small quantities of caffeine seem to have a facilitative effect on activities that require quick reaction time and rapid movements.

Caffeine causes vasoconstriction (except in the renal afferent artery), increased diuresis and naturesis, and increased gastric secretion. Due to its mild vasoconstriction and stimulant effects, caffeine is used in pain and anti-migraine medications. Most headache sufferers can consume up to 200 mg per

day, but some patients with frequent headaches need to abstain from caffeine use.

Positive effects of caffeine can be obtained in a variety of exercise conditions with caffeine doses of 3 mg/kg or less. Coffee may not produce an ergogenic effect in circumstances where caffeine is effective, even though the same plasma concentration results. Although the research evidence is equivocal, it seems that caffeine has an ergogenic effect during exercise of greater than 30 minutes at moderate intensity (75 to 80% of maximal oxygen uptake). Costill et al. (1978) were the first to demonstrate that caffeine ingestion resulted in increased endurance. It seems that the increased endurance is a result of increased fatty acid oxidation and thus a glycogen-sparing effect. It is not clearly understood whether caffeine acts directly on adipose and peripheral vascular tissue, or indirectly via its stimulating effect on epinephrine released from the adrenal medulla. Considering the latter, it is possible that epinephrine acts as an antagonist of the adenosine receptors on adipocyte cells that usually repress lipolysis. Inhibition of adenosine receptors increases cellular levels of cyclic AMP that, in turn, activate hormone-sensitive lipases to promote lipolysis, hence releasing free fatty acids into the plasma. Increased levels of free fatty acids in the plasma then contribute to increased fatty acid oxidation, thus sparing glycogen. It is possible, however, that the sparing of muscle glycogen by caffeine may be unrelated to increased delivery of free fatty acids as a substrate. Instead, it may be due to increased neuromuscular efficiency and a subsequent decreased demand for glycogen and other fuels.

Ergogenic effects of caffeine are less apparent in individuals who are habitual users of caffeine or who consume a high-carbohydrate diet. High carbohydrate levels stimulate insulin release, which appears to block the effect of caffeine in raising levels of free fatty acids. Epinephrine responses to caffeine ingestion may be greater in non-users compared to habitual caffeine users.

D

DACTYLION An anatomical landmark that is the tip of the middle (third) finger, or the most distal point of the middle finger when the arm is hanging and the fingers are stretched downward. The corresponding tips of the other fingers are designated the 2nd, 4th and 5th dactylions (the thumb being the first digit).

D'ALEMBERT'S PRINCIPLE *See under* INERTIAL FORCE.

DALTON'S LAW *See under* GAS.

DAMPING *See under* RESILIENCE.

DANDY-WALKER CYST Congenital hydrocephalus caused by a blockage in the brain. It is characterized by an abnormally enlarged space at the back of the brain (cystic 4th ventricle) that interferes with the normal flow of cerebrospinal fluid through the openings between the ventricle and other parts of the brain.

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DASHBOARD INJURY *See under* HIP JOINT, DISLOCATIONS; KNEE LIGAMENTS.

DEAD SPACE The theoretical volume of gas that is taken into the lung, but does not take part in gas exchange (assuming that the gases in the alveolar volume equilibrate with those of the pulmonary capillary blood as it leaves the lung). It consists of: i) anatomical dead space and ii) the volume of alveoli that are ventilated, but unperfused, in addition to a certain proportion of those alveoli that are underperfused. The **anatomical dead space** is the volume of air filling the nose, mouth, trachea and other non-diffusible parts of the respiratory tract. This volume of air does not undergo gas exchange,

because it does not reach the alveoli. The dead space air is fully saturated with water vapor, similar in composition to inspired air. The alveolar gas has a relatively high concentration of carbon dioxide and low concentration of oxygen.

Dead space-to-tidal volume ratio is the proportion of the tidal volume that is made up of the dead space. It is an index of the relative inefficiency of pulmonary gas exchange. It is normally 40% at rest and progressively declines (to about 20%) during exercise. It decreases with age.

Physiologic dead space is the part of alveolar volume that has poor alveolar ventilation-to-perfusion ratio (the ratio of alveolar ventilation to pulmonary blood flow), thus does not equilibrate with gas in the pulmonary capillary blood. It is negligible in the healthy lung.

DEAF How a person 'labels' themselves in terms of their hearing loss is personal and may reflect identification with the deaf community or merely how their hearing loss affects their ability to communicate. Generally, however, the term deaf refers to those who are unable to hear well enough to rely on their hearing and use it as a means of processing information. The federal government in the USA distinguishes between deafness and hearing impairment. **Deafness** is a hearing impairment that is so severe that the child is impaired in processing linguistic information through hearing, with or without amplification, and this adversely affects a child's educational performance. **Hearing impairment** is defined as impairment in hearing, whether permanent or fluctuating, which adversely affects a child's educational performance, but that is not included under the definition of deafness. In the USA, 7 to 15% of the population has significant hearing losses. Only about 10% of deaf children have deaf parents.

Total deafness means vibrations can only be felt. **Sound waves** are vibrations, with three attributes: intensity, frequency and timbre (tone). **Intensity**

E

EAR For hearing to take place, a sound wave passes into the external ear and through an inch-long canal to strike an oval-shaped membrane called the **tympanic membrane (ear drum)**. A sound wave causes the eardrum to vibrate with the same frequency and amplitude as the sound wave itself.

The **middle ear** is the small space between the eardrum and the bony capsule of the inner ear. It includes the **ossicles (malleus, incus and stapes)**, the small bones shaped like a hammer, anvil and stirrup, respectively. These bones transmit sound waves to the inner ear. The middle ear also contains the **eustachian tube**, which connects the back of the nose to the middle ear and is a selective valve that allows air to enter behind the sealed ear drum. The eustachian tube replaces the air the body absorbs from the middle ear. The eustachian tube also equalizes pressure changes in the outside air and causes the 'popping' that occurs when a person experiences a change in altitude, such as in an airplane. The eustachian tube is much affected by colds, sinus infections and allergies.

The **inner ear** is the inner most chamber of the ear. It is filled with fluid and contains the cochlea and the vestibular apparatus. The **cochlea** is a snail-shaped structure within the inner ear. The **organ of Corti**, a chamber inside the cochlea, is responsible for hearing. It contains hair cells that serve as the receptors for hearing. The **vestibular apparatus** is the organ of balance. Each vestibular apparatus contains 3 semi-circular canals designated as the horizontal, anterior and posterior canals. The **semicircular canals** are responsible for detecting rotational motion of the head. The canals are hoop-shaped structures that are arranged roughly at right angles with each other so that they represent all three planes of movement. The same arrangement of semicircular canals is mirrored on both sides of the head. It is important for the canals on both sides to agree as to what the head is doing. If there is disagreement, then the person will experience vertigo.

Otology is the branch of medical science concerned with the ear and related structures. Damage to the internal ear mechanism may occur in any sport, especially diving and scuba diving, but also sports such as soccer (e.g. when a player is hit on the ear by a ball). In some sports, such as shooting, hearing-protection devices are worn. **Non-explosive blast injury of the ear** refers to the otological trauma caused by a blow to the ear that seals the external auditory meatus. It results in a sudden increase of air pressure within the air canal that strikes the tympanic membrane. In a study of 91 patients with non-explosive blast injury of the ear, it was found that 60 cases were caused by a slap or a punch, 13 cases were from sports accidents (mostly in ball games), and 18 cases were from aquatic activities such as swimming. The common symptoms were hearing loss, earache, tinnitus, vertigo and otorrhea (discharge from the ear).

See also CAULIFLOWER EAR; COCHLEAR IMPLANT; DEAF; OTITIS MEDIA; PROPRIOCEPTIVE FEEDBACK; SWIMMER'S EAR.

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EATING DISORDERS A group of conditions characterized by abnormal dietary patterns and distorted body image. Estimates of the prevalence of symptoms of eating disorders and the existence of eating disorders among athletic populations vary from less than 1% to as high as 39%.

The term '**disordered eating**' refers to a spectrum of abnormal behavior, which at its extreme includes anorexia nervosa and bulimia nervosa. Disordered eating occurs when a person's attitudes about food, weight, and body size leads to very rigid eating and exercise habits that jeopardize one's health, happiness and safety. Disordered eating can become an obsession and may even turn into an