



Fig. A1 A is for armadillo (*Oryzomys ather*).

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A See **ADENINE (A)**

aardvark (*Orycteropus afer*) Traditionally the animal that represents the letter A in the alphabet. It is the only extant member of the mammalian family Orycteropodidae. Adults are the size of a small pig, with little body hair (Fig. A1). The aardvark is **NOC-TURNAL** and lives in underground burrows. It possesses large ears, a long snout and a long thin tongue which it uses for collecting insects. Its limbs are specialised for digging (see also **FOSSORIAL**). Aardvarks occur in Africa south of the Sahara.

AAZK See **AMERICAN ASSOCIATION OF ZOO KEEPERS (AAZK)**. See also **KEEPER ASSOCIATION**

AAZPA American Association of Zoological Parks and Aquariums, now the **ASSOCIATION OF ZOOS AND AQUARIUMS (AZA)**. See also **ZOO ORGANISATION**

Abandonment of Animals Act 1960 An Act in Britain that made it a criminal offence to abandon an animal, or permit it to be abandoned, in circumstances likely to cause the animal any unnecessary **SUFFERING**. The Act was repealed and effectively replaced in England and Wales by the **ANIMAL WELFARE ACT 2006** and in Scotland by the Animal Health and Welfare (Scotland) Act 2006.

ABC species The species that visitors expect to see in a traditional zoo that are often used to illustrate letters of the alphabet, e.g. **AARDVARK**, bear, camel, deer, elephant, **ZEBRA** etc. See also **AMBASADOR SPECIES**

abdomen

1. The part of the body between the thorax and the pelvis in vertebrates, bounded by the diaphragm in mammals but not other classes. It contains the viscera (e.g. most of the organs of the digestive system, kidneys etc.).

2. The part of the trunk of the body which is posterior to the thorax in arthropods.

abdominal skinfold A method of measuring **OBESITY** by assessing the amount of excess fat under the skin around the **ABDOMEN (1)**. The method has been used in chimpanzees. See also **BODY CONDITION SCORE**, **BODY MASS INDEX (BMI)**

abductor muscle A muscle that moves a limb or other structure away from the centre line (midline) of the body. Compare **ADDUCTOR MUSCLE (1)**

abiotic Without life.

abiotic environment See **PHYSICAL ENVIRONMENT**

abiotic stress Stress caused by non-biological factors in the environment, e.g. heat and cold.

abnormal behaviour A general term for behaviour which is not part of the usual (normal) repertoire of a species, especially that which is exhibited in the wild. May occur as a result of a pathological condition, including **ANXIETY** and **STRESS**, and is sometimes observed in captive animals. See also **APATHY**, **STEREOTYPIC BEHAVIOUR**

abomasal ulcer An ulcer in the **ABOMASUM**. A common disease in cattle, especially milk-fed calves.

Causes loss of appetite, poor growth and, in extreme cases, death from bleeding.

abomasum In **RUMINANTS**, the fourth (and last) stomach. It is a 'secretory stomach' the lining of which produces hydrochloric acid and **PROTEOLYTIC ENZYMES**, and is therefore equivalent to the stomach of other mammals.

aboral Located on the side of the body opposite the mouth, especially in relation to **ECHINODERM** anatomy. Compare **ORAL**

abortion, miscarriage The natural or intentional termination of a pregnancy by the removal or expulsion of the **EMBRYO** or **FOETUS**. Spontaneous abortion (miscarriage) may result from a problem that arises during the development of the embryo or foetus (e.g. infection, **UMBILICAL CORD TORSION**, congenital defects) or abortion may be induced by a veterinary surgeon, e.g. to preserve the health of the pregnant female.

abrasion

1. A scraped area of the skin or a **MUCOUS MEMBRANE** which has been caused by an injury or irritation.

2. Pathological wearing away of the teeth by grinding.

abscess A swollen, inflamed area of the body containing a collection of **PUS** formed by the disintegration of tissue. May be caused by the presence of disease (e.g. bacteria, parasites) or a foreign object (e.g. a bullet wound, wood splinter). Depending upon the cause and condition, may be treated with antibiotics and may need to be surgically drained.

absorption

1. The uptake by cells of water by (**OSMOSIS**) and/or solutes (e.g. by **DIFFUSION** or **ACTIVE TRANSPORT**).

2. In the digestive system, the passage of water and solutes through the gut wall into the blood system.

ABWAK See **ASSOCIATION OF BRITISH AND IRISH WILD ANIMAL KEEPERS (ABWAK)**. See also **KEEPER ASSOCIATION**

abyssal Relating to the depths of the oceans. The abyssal zone is located between approximately 2000 and 6000 m below the surface of the sea, and is in perpetual darkness, cold and nutrient poor.

academic journal A periodical publication in which original scientific and other academic work is published after a process of **PEER REVIEW** (Table A1). See also **ACADEMIC PAPER**

academic paper A paper (article) published in an **ACADEMIC JOURNAL**, which describes the results of an original scientific study, discusses a scientific problem, reviews research published on a particular subject, or is an account of some other academic endeavour.

acarasis A skin condition caused by mites and ticks.

acaricide, acaridicide A substance which kills mites and ticks.

accelerometer An electronic device that detects movements by measuring acceleration. A tri-axial

Table A1 Selected academic journals which publish original scientific studies of interest in zoo biology and animal management.

Acta Primatologica	Journal of Environmental Education
Acta Zoologica	Journal of Equine Veterinary Science
African Journal of Ecology	Journal of Experimental Psychology
American Journal of Primatology	Journal of Experimental Zoology
American Naturalist	Journal of Field Ornithology
Animal	Journal of Herpetology
Animal Behaviour	Journal of International Wildlife Law and Policy
Animal Conservation	Journal of Mammalogy
Animal Genetics	Journal of Medical Primatology
Animal Production Science	Journal of Parasitology
Animal Welfare	Journal of Reproduction and Fertility
Anthrozoös	Journal of the Bombay Natural History Society
Applied Animal Behaviour Science	Journal of Theoretical Biology
Aquatic Conservation: Marine and Freshwater Ecosystems	Journal of Tourism Studies
Auk	Journal of Veterinary Behavior
Avian Diseases	Journal of Veterinary Epidemiology
Behaviour	Journal of Veterinary Science
Biodiversity and Conservation	Journal of Wildlife Diseases
Biological Conservation	Journal of Wildlife Management
BioScience	Journal of Wildlife Rehabilitation
Bird Study	Journal of Zoo and Aquarium Research
British Poultry Science	Journal of Zoo and Wildlife Medicine
Canadian Journal of Animal Science	Journal of Zoology
Canadian Journal of Zoology	Laboratory Animal Science
Companion Animal	Laboratory Primate Newsletter
Consciousness and Cognition	Leisure Studies
Conservation	Mammal Review
Conservation Biology	Molecular Ecology
Conservation Genetics	Museum Studies
Conservation Letters	Nature
Copeia	Oryx – The International Journal of Conservation
Current Trends in Audience Research	Parks and Recreation
Ecology and Evolution	PLOS Biology
Environment and Behavior	Primate Report
Equine Veterinary Journal	Reproductive Biology and Endocrinology
Ethology	Restoration Ecology
Fisheries Research	Science
Folia Primatologica	Scientific American
Folia Zoologica	Sexuality, Reproduction and Menopause
Frontiers in Zoology	Social Cognitive and Affective Neuroscience
Herpetological Journal	Society and Animals Journal
Human Dimensions of Wildlife	South African Journal of Wildlife Research
Ibis	The Bulletin of Zoological Nomenclature
Insect Conservation and Diversity	The Veterinary Journal
International Journal of Fisheries and Aquaculture	Trends in Ecology and Evolution
International Journal of Livestock Production	Trends in Neurosciences
International Journal of Primatology	Tropical Animal Health and Production
International Journal of Zoonoses	Veterinary Ophthalmology
International Zoo Educators Journal	Veterinary Pathology
International Zoo Yearbook	Veterinary Quarterly
Journal of Agricultural Science	Veterinary Record
Journal of Animal Ecology	Visitor Behavior
Journal of Animal Physiology and Animal Nutrition	Visitor Studies
Journal of Animal Production	Wildlife Society Bulletin
Journal of Animal Science	Zoo Biology
Journal of Applied Animal Welfare Science	Zoologica
Journal of Aquatic Animal Health	Zoological Journal of the Linnean Society
Journal of Biological Macromolecules	Zoonoses and Public Health
Journal of Comparative Psychology	Zoos' Print Journal
Journal of Dairy Science	

accelerometer can detect movement in three dimensions. May be used to detect movements of animals and sometimes built into a collar incorporating a **DATA LOGGER** or wireless transmitter. Accelerometers have been used to study swimming behaviour in sharks, walking in zoo elephants, 'flying' behaviour in colugos (**DERMOPTERA**: flying lemurs), and movements of cattle on farms.

acceptable daily intake The daily amount of a substance (e.g. a nutrient, vitamin, food additive or pollutant) that an animal may safely consume throughout its life.

accidental An animal which occurs in a particular location by accident. Often applied to birds blown off course so that they appear in an area which is outside their normal range.

acclimation See **ACCLIMATISATION**

acclimatisation, acclimation A reversible adjustment made by an organism to the local environmental conditions. Usually occurs in nature in response to seasonal climate changes. Also occurs in fish when introduced to a new tank. See also **NEW TANK SYNDROME**

accredited herd In the UK, a herd of animals that has been registered as being free from certain diseases, e.g. **BRUCELLOSIS**, Johnne's disease, **LEPTOSPIROSIS**.

accredited vet See **APPROVED VET**

accredited zoo A **ZOO** which is accredited by a zoo organisation, e.g. AZA-accredited zoo. Accreditation is conditional upon the zoo conforming to a number of standards in relation to, for example, **ANIMAL WELFARE**, **ENCLOSURE DESIGN**, provision of **ENVIRONMENTAL ENRICHMENT** etc.

acetylcholine (ACh) A **NEUROTRANSMITTER** which creates an **ACTION POTENTIAL** across the membrane of a neurone, thereby propagating a nerve impulse.

acid A chemical which produces hydrogen ions when dissolved in water. Acid solutions have a **pH** below 7.0.

acidity The relative concentration of hydrogen ions in a solution. Acid solutions have a high concentration of hydrogen ions and a **pH** of less than 7.0.

acidosis A condition in which there is a high proportion of acid waste such as urea in the blood. This may be the result of a number of conditions, for example **DIABETES MELLITUS**, kidney disease, respiratory acidosis (caused by **HYPOVENTILATION**), or lactic acidosis (when oxygen levels in the blood fall).

Acipenseriformes An order of fishes: sturgeons and their allies.

acoelomate Possessing no body cavity. Compare **COELOMATE**

acoustic signalling The use of sound as a method of communication in animals. Sound allows animals to produce a great variety of signals by varying frequency, pitch, loudness and temporal pattern. See also **ALARM CALL**

acoustic tag A small electronic device that emits radio signals whose presence is detected by listening stations. These tags may be attached to aquatic animals (e.g. manta rays, sharks) and used to record their movements.

acoustic-lateralis system, lateral line system A system for sensing the external environment in fish and some amphibians which consists of the **INNER EAR** region (which responds to sound and gravity) and lateral line organs in the skin (which respond to changes in water pressure and displacement).

acrosome A **LYSOSOME** in a sperm that contains enzymes capable of digesting a path through the covering of an egg during the process of **FERTILISATION**.

Act of Congress A statute enacted by the Congress of the United States of America (or other legislature called a congress), e.g. **ASIAN ELEPHANT CONSERVATION ACT OF 1997 (USA)**, **WILD BIRD CONSERVATION ACT OF 1992 (USA)**.

Act of Parliament Primary legislation of the UK and some other jurisdictions with a legislature called a parliament (especially countries within the Commonwealth). Many Acts are concerned with the welfare or conservation of animals, e.g. the **ANIMAL WELFARE ACT 2006** (England and Wales), **ZOO LICENSING ACT 1981** (Great Britain), **HEALTH OF ANIMALS ACT 1990 (CANADA)**.

ACTH See **ADRENOCORTICOTROPHIC HORMONE (ACTH)**

actin See **MUSCLE**

actinomycosis This disease occurs mainly in cattle and is one of several conditions known as '**LUMPY JAW**'. It is caused by an anaerobic bacterium, *Actinomyces bovis*, which probably only becomes pathogenic by invading tissues through a wound. It commonly occurs when the permanent cheek teeth are erupting. Typically, lesions occur on the cheeks, pharynx and the jaws. Swelling in bone and other tissue may cause interference with mastication, swallowing or breathing depending on the location of the lesion. Antibiotics are rarely an effective treatment. Other *Actinomyces* species can cause infections in dogs, pigs, sheep, horses, reptiles and humans.

Actinopterygii A subclass of bony fishes: ray-finned fishes.

action potential The condition in which the inside of an **AXON** is positively charged and the outside is negatively charged which occurs when the nerve membrane is depolarised. This is the reverse of the situation when the axon is exhibiting the **RESTING POTENTIAL** (i.e. the electrical polarity is reversed). A nerve impulse is the result of the movement of this depolarised area along the axon. A similar process occurs in muscle cells when excited.

activated charcoal A highly porous form of carbon which has been processed to produce a very large surface area. Formed by heating wood and other

materials in the absence of oxygen. The large surface area makes the material suitable for the removal of unwanted chemicals by adsorption. Used in some filters in aquariums.

active site The region of an **ENZYME** that binds to the substrate when it catalyses a chemical reaction and gives the enzyme its specificity.

active sleep The part of the sleep cycle in mammals and birds during which **RAPID EYE MOVEMENTS (REM)** or ear movements occur and during which a characteristic **ELECTROENCEPHALOGRAPH (EEG)** is produced along with signs of **DREAMING**. Thermoregulatory mechanisms in animals do not respond to thermal stress during active sleep. This may be problematic for small mammals as their body temperature is influenced by ambient temperature much more than is the case in large mammals.

active transport The movement of molecules or ions across a biological membrane, against a chemical or electrochemical gradient, with the use of energy. The process uses 'pumps' made of **PROTEINS** which cross the **CELL MEMBRANE**.

activity budget, behaviour budget A description of the amount of time an individual animal spends on various activities during the day (e.g. feeding, sleeping, resting, walking, etc.) as defined by an **ETHOGRAM**. Usually expressed as a percentage (or proportion) of the total amount of time the animal is observed (Table A2). Data is often collected by instantaneous **SCAN SAMPLING**.

acupressure A treatment similar to **ACUPUNCTURE** but which involves the gentle massage of acupuncture points and channels.

acupuncture An ancient Chinese treatment that involves placing needles into special locations on the body to treat the pain associated with a wide variety of illnesses including **ARTHRITIS**, **HIP DYSPLASIA** and **SPONDYLOSIS**.

acute condition A disease or disorder which appears rapidly, lasts a short time, has distinct signs, and which may require short-term treatment and care. It may or may not be severe. *Compare* **CHRONIC CONDITION**

ad lib *See* **AD LIBITUM**

Table A2 Activity budget: mean proportion of time active coyotes (*Canis latrans*) kept in outdoor pens spent exhibiting different behaviours (based on Shivik *et al.*, 2009).

Behaviour	Proportion of time
Resting	0.58
Locomotion	0.21
Standing	0.16
Foraging	0.03
Social	0.02
Eating	0.01

ad lib feeder An animal feeder designed in such a way that the animal may obtain food whenever desired.

ad lib sampling, opportunistic sampling In the context of studying behaviour, *ad libitum* sampling refers to opportunistic observations which are made at the convenience of the recorder or when the opportunity arises. This is especially important for some relatively rare behaviours (e.g. mating) which might be missed during other types of sampling, such as instantaneous **SCAN SAMPLING**. *Compare* **ONE-ZERO SAMPLING**

ad libitum, ad lib Latin for 'at one's pleasure'.

Adamson, George (1906–1989) and Joy (1910–1980) A game warden and his artist wife who lived in Kenya and became famous as a result of their successful rehabilitation of an orphaned lion cub (*Elsa*) who was returned to the wild, mated with a wild lion, and produced her own cubs. Joy Adamson wrote a book about Elsa entitled **BORN FREE** which became a bestseller and was made into a film of the same name. Bill Travers and Virginia McKenna played the Adamsons in the film and as a result of their experiences working with lions established the **BORN FREE FOUNDATION** and **ZOO CHECK**.

adaptation

1. A beneficial character possessed by an organism as a result of **EVOLUTION**, e.g. the ability to survive for long periods without water.
2. An adjustment made by a **SENSE ORGAN** to changes in the strength of stimulation; a reduction in the sensitivity of a sensory receptor due to use.
3. A behavioural change caused by **LEARNING** which allows the animal to adjust to a variety of environmental changes.
4. A physiological change which allows the animal to adjust to a change in climate, food quality etc. *See also* **ACCLIMATISATION**

adaptive heterothermy A physiological adaptation to heat stress found in some mammals that inhabit arid areas, e.g. camels, **ARABIAN ORYX (ORYX LEUCORYX)**. These animals allow their core body temperature to increase during the heat of the day, reducing evaporative losses by storing body heat. This excess heat is then lost to the environment at night.

adaptive radiation The evolutionary process which causes diversification from a single ancestral type which results in descendant **POPULATIONS** occupying increasing numbers of **ECOLOGICAL NICHES**.

adductor muscle

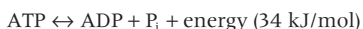
1. A muscle that moves a limb or other structure towards the centre line of the body. *Compare* **ABDUCTOR MUSCLE**
2. A muscle that closes the valves in a bivalve mollusc.

adenine (A) A **NUCLEOTIDE** base which pairs with T (thymine) in **DNA** and is also found in **ADENOSINE TRIPHOSPHATE (ATP)**.

adenohypophysis See **ANTERIOR PITUITARY**

adenosine diphosphate (ADP) See **ADENOSINE TRIPHOSPHATE (ATP)**

adenosine triphosphate (ATP) The energy 'currency' of the cell; a chemical which moves energy around the cell by releasing an inorganic phosphate ion (as a result of hydrolysis) and becoming adenosine diphosphate (ADP). ADP may combine with an inorganic phosphate ion (P_i), using energy, to form ATP.



adipose Relating to cells or tissue where fat is deposited. See also **ADIPOSE TISSUE**

adipose fin A fatty, fin-like lobe located behind the **DORSAL** fin of some male **SALMONID** fishes.

adipose tissue A type of **CONNECTIVE TISSUE** which contains fat.

1. Brown adipose tissue (brown fat) appears to be concerned with the release of heat in neonate mammals and occurs around the neck and between the scapulae in these and hibernating mammals.

2. White adipose tissue occurs widely in animal bodies.

adoption scheme A method of fund-raising which involves visitors paying an annual subscription for the right to 'adopt' an animal kept in a zoo. The adopter may receive an adoption certificate, a photograph and updates on the animal's activities at regular intervals. The adopter's name is often displayed in a prominent place near the animal's enclosure. Similar schemes are used by wildlife conservation **NON-GOVERNMENTAL ORGANISATIONS (NGOs)** and animal **SANCTUARIES** to raise funds for conservation or animal welfare.

ADP See **ADENOSINE TRIPHOSPHATE (ATP)**

adrenal cortex The outer region of the adrenal gland which produces a number of hormones including **CORTISOL** and other glucocorticoids, aldosterone (which promotes water retention by the kidneys) and some sex (mainly male) hormones.

adrenal gland A hormone-secreting gland located near each kidney in most vertebrates. Consists of an inner **ADRENAL MEDULLA** and an outer **ADRENAL CORTEX**.

adrenal medulla The central region of the **ADRENAL GLAND** which secretes **ADRENALINE** (epinephrine) in response to **STRESS**. It also secretes a little **NORADRENALINE** (norepinephrine).

adrenaline, adrenalin, epinephrine A hormone secreted by the **ADRENAL MEDULLA** and to some extent by sympathetic nerve endings. It is secreted in response to fear, excitement and anger. Adrenaline increases heart rate and blood pressure, and diverts blood from the intestines and towards the muscles, preparing the body for 'flight or fright'.

adenocorticotrophic hormone (ACTH) A hormone secreted by the **PITUITARY GLAND** which stimulates the release of a number of glucocorticoid hormones from the **ADRENAL CORTEX**, especially

CORTISOL. These stimulate the conversion of amino acids into glucose to provide energy.

advertisement A visual, oral or chemical display used by an individual to indicate the possession of a territory by a male, the fertility state of a female, or for some other reason. See also **ADVERTISEMENT CALL**

advertisement call A **VOCALISATION** used by animals, especially male frogs, during rivalry and **COURTSHIP**.

aerial census See **AERIAL SURVEY**

aerial gunning The use of aircraft to pursue and shoot animals. See also **AIRBORNE HUNTING ACT OF 1971 (USA)**

aerial photography The process of producing a film or digital image of the ground taken from an aircraft. May be used to count and record the location of wild animals (especially colonial birds or large grassland mammals), and to map vegetation types. See also **REMOTE SENSING, SATELLITE IMAGE**

aerial survey, aerial census A survey undertaken from the air, usually from a light aircraft. Often involves flying along invisible **TRANSECT** lines and counting animals within a strip of land of known length and width, sometimes utilising **AERIAL PHOTOGRAPHY**. Often used to count large mammals in **SAVANNA** habitats. See also **ELTRINGHAM**

aerobic

1. Of a chemical process which requires free oxygen, e.g. **AEROBIC RESPIRATION**.

2. Of an organism which requires oxygen to survive.

aerobic respiration The biochemical process by which cells extract the energy from sugars using oxygen. This begins with the splitting of glucose into two three-carbon sugars in the process of **GLYCOLYSIS**, thereby producing **ADENOSINE TRIPHOSPHATE (ATP)**. Each of these sugars enters the **KREBS CYCLE** and produces additional molecules of ATP. The NAD (an electron carrier) produced during glycolysis and the Krebs cycle generates further ATP via an **ELECTRON TRANSPORT SYSTEM** within the **MITOCHONDRIA**. The entire process produces 36–38 molecules of ATP from a single molecule of glucose, along with carbon dioxide and water.



Compare **ANAEROBIC RESPIRATION, FERMENTATION**

aerosol delivery system See **METERED DOSE INHALER (MDI), NEBULISER**

aestivation, estivation A dormant condition exhibited by some animals (e.g. lungfish) which allows them to avoid excessive heat during the summer or a dry period. Commonly occurs in desert species. See also **HIBERNATION**

aetiology, etiology The study of the cause or origin of a phenomenon, especially a disease or an **ABNORMAL BEHAVIOUR**, e.g. the aetiology of **STEREOTYPIC BEHAVIOUR** in a particular animal.

AEWA See **AGREEMENT ON THE CONSERVATION OF AFRICAN-EURASIAN MIGRATORY WATERBIRDS 1995 (AEWA)**

affective states Emotional states, e.g. happy, sad, excited, calm, aroused, alert.

afferent Conduction towards. For example, an afferent blood vessel carries blood towards the heart, an afferent nerve conducts impulses from the **SENSORY RECEPTORS** towards the **CENTRAL NERVOUS SYSTEM (CNS)**. Compare **EFFERENT**

affiliative behaviour A form of social behaviour which involves an animal's tendency to approach, interact with and remain near a **CONSPECIFIC**. Behaviour between animals which promotes group cohesion, e.g. **GROOMING**, touching, positive gestures.

affiliative exhibit An exhibit which encourages **AFFILIATIVE BEHAVIOUR** among and between people and other animals in the arrangement of activities, space and features of the design, in collaboration with management practices. For example, food, shelter, shade, water and **ENVIRONMENTAL ENRICHMENT** features are provided throughout the exhibit to reduce confrontation and competition between individuals; focal points are provided for collaborative activities, e.g. an artificial termite mound for apes, located near public viewing areas; visual access is provided between holding and isolation areas so social contact can be maintained between animals.

afforestation The process or practice of planting trees (or tree seeds), to create new forest from open land, often to replace that which has been removed by **DEFORESTATION**.

AfiFarm Management software used for dairy farming and herd management which analyses information from individual cows using pedometers and milk meters.

Africa USA The first drive-through **SAFARI PARK** in the USA, which opened in Florida in 1953 and closed in 1961. Visitors travelled around the artificially created African landscape in a 'Jungle Train'. See also **LAND TRAIN**

African Elephant Conservation Act of 1989 (USA) A US law whose purpose is to assist in the conservation and protection of the African elephant by financially supporting the conservation programmes of African countries and the **CITES** Secretariat, and to restrict trade in ivory.

Afrotropical region See **FAUNAL REGIONS**

aftershaft A second feather growing from the main shaft at the base of the vane. Important in insulation in some taxa, e.g. grouse and quail.

agar plate A Petri dish containing agar as a growth medium for microbes. Used to culture microbes and to test for the presence of infection.

age class A category into which individual animals in a population are grouped based on their age. For example, we could count all animals that are 1 year old and place them in a single class, and all animals

that are 2 years old and allocate them to the next class. Alternatively we could group together animals aged 0 to less than 4 years into one class, and then those between 4 and up to 8 years in the next class and so on. A population of animals must be separated into age classes in order to construct a **LIFE TABLE** or **AGE PYRAMID**.

age pyramid A diagrammatic representation of the **AGE STRUCTURE** of a population that uses horizontal bars to represent the number of males and females in each **AGE CLASS**. Useful for comparing the age structures of different populations and for predicting future changes in the size and structure of a population.

age structure The relative numbers of animals of different ages present in a population. See also **AGE PYRAMID**, **LIFE TABLE**

age-specific mortality rate The death rate of a specific age class within a population (e.g. individuals that are 1 year old), especially in the context of a **LIFE TABLE** (Table L1).

agglutination The process of sticking together, especially in bacteria and blood cells. See **BLOOD GROUP**

aggregation A group of animals which has formed as a result of each being individually attracted to the same place, e.g. birds attracted to a food source, woodlice attracted to a location with high humidity.

See also **GREGARIOUSNESS**

aggression See **AGONISTIC BEHAVIOUR**

aggressive mimicry The resemblance of a predator (the mimic) to a harmless animal or object (the model) that is attractive to a third organism (the dupe) on which the mimic preys, e.g. the angel fish possesses a dorsal spine that mimics a small organism which acts as a lure for its prey. Compare **AUTOMIMICRY**, **BATESIAN MIMICRY**, **MÜLLERIAN MIMICRY**

Agnatha A superclass of vertebrates which are fish-like but jawless and possess sucker-like mouths: lampreys, hagfishes and allies.

agonistic behaviour The complex of agonistic behaviours which may occur when two individuals of the same species encounter one another: Aggression, competition, threat, **APPEASEMENT BEHAVIOUR**, **RECONCILIATION**, avoidance, retreat/flight, offensive attacks, defensive fighting. This often includes species-specific **DISPLAYS**. See also **REDIRECTED BEHAVIOUR**.

Agreement on the Conservation of African-Eurasian Migratory Waterbirds 1995 (AEWA) An international agreement requiring parties to engage in a wide range of conservation actions for waterbirds including species and habitat conservation, management of human activities, research and monitoring, education and the provision of information. Also known as the African-Eurasian Waterbird Agreement (AEWA).

Agreement on the Conservation of Bats in Europe 1991 (EUROBATS) A regional agreement on the

protection of bats concluded under the auspices of the **CONVENTION ON THE CONSERVATION OF MIGRATORY SPECIES OF WILD ANIMALS 1979 (CMS)**.

Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic Area 1996 (ACCOBAMS) A regional agreement on the protection of **CETACEANS** concluded under the auspices of the **CONVENTION ON THE CONSERVATION OF MIGRATORY SPECIES OF WILD ANIMALS 1979 (CMS)**. It covers all Odontoceti and Mysticeti. Its purpose is to prohibit and, where possible, eliminate any deliberate taking of cetaceans and to create and maintain a network of specially protected areas to conserve cetaceans, and to promote education, research and the management of human–cetacean interactions.

Agreement on the Conservation of Polar Bears 1973 An agreement between Canada, Denmark (for Greenland), Norway, the Union of Soviet Socialist Republics (now Russia) and the USA which prohibits the taking of polar bears, except for scientific or conservation purposes, to protect other living resources, or by indigenous peoples according to their traditional rights. It requires the parties to protect polar bear habitat (especially denning and feeding sites, and migratory routes), conduct research and cooperate in the management and conservation of migrating populations.

Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas 1991 (ASCOBANS) A regional agreement on the protection of small **CETACEANS** concluded under the auspices of the **CONVENTION ON THE CONSERVATION OF MIGRATORY SPECIES OF WILD ANIMALS 1979 (CMS)**. Originally called the Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas but extended and renamed in 2008. It covers all toothed whales (Odontoceti), except the sperm whale (*Physeter macrocephalus*) and requires parties to prohibit the taking and killing of small cetaceans, control marine pollution, conduct research, take measures to reduce and collect data on bycatches, and educate the public.

Agricultural Revolution A series of changes that took place in the agricultural practices used in England and later across Western Europe between 1700 and 1850 (and possibly earlier), including the intensification of land use, the enclosure of land and the development of scientific animal breeding.

agricultural show An event at which farmers exhibit their animals to the public and compete for prizes awarded in recognition of the quality of their livestock. May also include exhibitions of pet animals, agricultural machinery, countryside skills (e.g. **SHEEP DOG TRIALS**) etc. In the UK often organised as a county show, e.g. Cheshire Show, Great Yorkshire Show (Fig. A2).

Agriculture and Agri-Food Canada (AAFC) The department of the Canadian government responsi-

ble for agriculture and food (formerly the Department of Agriculture). It provides information, research, policies and programmes to achieve environmentally sustainable and competitive agricultural products.

agri-environment scheme A payment system which rewards farmers for environmentally sensitive land management.

agronomy The scientific study of the use of plants for food, fuel, fibre and other purposes; the study of soil science and crop production.

AI See **ARTIFICIAL INSEMINATION (AI)**

air bladder See **SWIM BLADDER**

air flow The movement or exchange of air. Adequate air flow is important in regulating the environment by providing **VENTILATION (3)** within a cage, vivarium, animal house, cow shed or other space or building containing animals. It prevents the build-up of noxious gases and helps to control temperature and humidity. Air flow may be achieved naturally as a result of the design of an enclosed space or 'forced' using fans. Ventilation is important in preventing the spread of airborne diseases. Air flow should be proportionate to the density of animals, i.e. the higher the density the more air exchanges necessary per unit time. See also **VENTILATION SHUTDOWN**

air sac One of several air-filled sacs which form part of the respiratory system of birds and assist in creating a one-way air flow resulting in **VENTILATION (1)** of the lungs.

air stone A block of porous material which produces a column or curtain of fine air bubbles that aerate aquarium water when it is connected to a pump via a plastic tube (Fig. A3).

Airborne Hunting Act of 1971 (USA) An Act in the USA which bans the shooting, harassing, capturing or killing of any bird, fish or other animal from aircraft, except for legitimate wildlife management purposes.

airplane wing See **ANGEL WING**

air-stripper See **PROTEIN SKIMMER**

airway The route through which oxygen reaches the **LUNGS**, i.e. via the nose or mouth and **TRACHEA (1)**.

AKAA Animal Keepers' Association of Africa. See also **KEEPER ASSOCIATION**

alarm A device for generating a sound during an emergency. Some zoos use alarms with different sounds for emergencies in different sections of the zoo. This ensures that staff respond appropriately. See also **ALARM CALL**, **ALARM PHEROMONE**, **ALARM RESPONSE**, **DETECTOR BEAM ACTIVATED SURVEILLANCE SYSTEM**

alarm call A **VOCALISATION** made by an animal (particularly a social animal, especially birds and mammals) to indicate the presence of danger to others of the same species (particularly the same social group). In some species, for example prairie dogs (*Cynomys* spp.) and some primates, distinctive



Fig. A2 Agricultural show. Two Prizewinning British Blue cattle at the Cheshire Show in the UK.



Fig. A3 Air stone.

calls are used to indicate different types of predator, e.g. snake, bird of prey. *See* **ALARM RESPONSE**, **SENTRY**

alarm pheromone A short-lived chemical signal released by an animal to indicate the presence of danger to conspecifics, e.g. by ants, bees and other insects.

alarm response A response made to a sign of danger by an individual animal to warn others. It may be visual, olfactory or auditory. An animal may draw the attention of a predator to itself when giving an **ALARM CALL** to assist others. This type of **ALTRU-**

ISM occurs when the animal giving the warning is closely related to those it is trying to warn. *See also* **ALARM PHEROMONE**

albinism A condition in which the pigment **MELANIN** fails to develop in the hair, skin and iris. Individuals have pale skin, white hair and pink pupils. Albinism in mammals is inherited via an autosomal recessive gene. Albinos are homozygous for the gene. *Compare* **LEUCISM**, **MELANISM**

albino An animal that exhibits **ALBINISM**.

Albuliformes An order of fishes: bonefishes and their allies.

albumen Egg white. The fluid contained in an **AMNIOTIC EGG** that contains large quantities of **ALBUMIN**.

albumin One of a group of soluble proteins found in blood, **ALBUMEN** and many other tissues.

aldosterone *See* **ADRENAL CORTEX**

alertness A state of readiness, in an animal, to detect environmental changes. *See also* **VIGILANCE BEHAVIOUR**

alevin A newly hatched fish, especially a salmon or trout.

Alex the African grey parrot An African grey parrot (*Psittacus erithacus*) who was the subject of a 30-year

study by Irene Pepperberg. She taught him to recognise words, colours, objects and some numbers and could communicate with him using words.

alfalfa See **LUCERNE**

algal bloom An increase in the number of algae in a body of water. May be seasonal or caused by **EUTROPHICATION** as a result of pollution, especially fertilisers. See also **BLUE-GREEN ALGAE**

alien species

1. A species which occurs in a location which is not part of its normal geographical range. Often established as a result of accidental or intentional introduction by humans, e.g. **FERAL CATS**, goats, rats.

2. In the US, Executive Order 13112 of February 3, 1999 defines alien species as '*... with respect to a particular ecosystem, any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem*'.

alimentary canal The gut.

alkalage A fodder produced by preserving whole-crop (grain, stem and leaves) using a process of ammoniation, which involves spreading an additive pellet containing urea and urease. This is a means of storing cereal crops as forage which helps to retain the nutrient qualities of the fodder. See also **SILAGE**

alkali A hydroxide of any of a number of metallic elements, e.g. sodium hydroxide, that dissolves in water to produce an alkaline solution: a solution with a **pH** above 7.0 as a result of an excess of hydroxyl ions, which neutralises acids to form salts.

alkaline Possessing the properties of an **ALKALI**.

allantois A cavity, formed by a membrane, which stores metabolic wastes and assists with gaseous exchange through the egg shell in birds and reptiles. Also forms part of the **PLACENTA** in mammals.

allele, allelomorph Any of a number of different forms of a gene that may exist at a specific **LOCUS** on a chromosome, each of which produces a different variety of the same trait. In diploid organisms, each individual normally possesses two alleles (one from each parent), for each gene in each **SOMATIC CELL**. See also **DOMINANT ALLELE**, **RECESSIVE ALLELE**

allele fixation See **FIXATION**

allele frequency See **GENE FREQUENCY**

allele retention The expected proportion of founder X's alleles that have survived to generation *t*. This is a measure of the extent to which a population has been able to retain the alleles originally present in the founder individuals. Conservation management should attempt to maximise allele retention.

allelomorph See **ALLELE**

Allen's rule A rule in biology which states that endotherms that have evolved in warmer climates have longer appendages or extremities than related forms that have evolved in colder climates. The rule may apply to different, related species or to individuals of the same species that originate from different

parts of its geographical distribution. The rule is named after Joel Asaph Allen who proposed it in 1877. Long, thin appendages (e.g. ears or legs) have a high **SURFACE AREA:VOLUME RATIO**, resulting in high heat loss. Animals that live in cold climates need to conserve heat so should evolve short appendages. The reverse is true in warm climates. The red fox (*Vulpes vulpes*) of temperate latitudes has relatively small ears, whereas the fennec (*Fennecus zerda*) and bat-eared fox (*Otocyon magalotis*), that both inhabit areas of Africa with a warmer climate, both have very large ears (Fig. A4). See also **BERGMANN'S RULE**

allergen Any foreign substance (usually a protein) which induces an **ALLERGIC REACTION** in the body of an animal who is hypersensitive to it.

allergic reaction An **IMMUNE REACTION** with no purpose which occurs when the body responds to a non-threatening foreign substance (usually a protein). Results in the release of **HISTAMINE** which causes allergic signs including **INFLAMMATION**. See also **ANAPHYLACTIC SHOCK**, **ANTI-HISTAMINE**

allergy An immune response to an **ANTIGEN** which is otherwise harmless. See also **ALLERGIC REACTION**

alligator farm A facility where alligators are bred commercially for their meat, skins and other products. Some are open to the public as visitor attractions, particularly in the southern United States.

allocarer See **ALLOPARENT**

allgrooming Social **GROOMING**. The grooming of one individual by another within a social group. May have hygienic and **SIGNALLING** functions, e.g. appeasement. Occurs widely in primate societies (Fig. A5). See also **ALLOPREENING**, **APPEASEMENT BEHAVIOUR**

allometry The study of biological scaling: the differential effect of changing the linear, area and volume dimensions of organisms, and the impact this has on their evolution and ecology. Allometric relationships may be studied during the growth of a single organism; between different organisms within a single species; or between individuals which belong to different species. For example, the allometric relationship between brain size and body size is such that animals with bigger bodies tend to have bigger brains.

allomother See **ALLOPARENT**

alloparent, allocarer A 'false' or 'other' parent or mother (allomother). An animal who assists in providing **PARENTAL CARE** to an individual who is not its offspring and may not even be related, e.g. cow elephants (allomothers) may take care of the offspring of others. See also **ALTRUISM**, **SURROGATE (1)**

allopatric Having non-overlapping distributions. Two species are said to be allopatric if their distributions do not overlap in time and space. Often refers to a mode of evolution caused by the geographical separation of members of a population which then



Fig. A4 Allen's rule. Bat-eared fox (*Otocyon megalotis*), left; red fox (*Vulpes vulpes*), right.



Fig. A5 Allogrooming. Hamadryas baboons (*Papio hamadryas*).

diverge into separate species. *Compare* **PARAPATRIC**, **SYMPATRIC**

allopatric speciation The formation of new species as a result of the geographical separation of populations of the ancestral species such that each evolves independently, adapting to local conditions and eventually becoming genetically isolated from other populations and unable to interbreed. This may occur when habitats become fragmented or when

major dispersal barriers such as mountains or oceans separate populations. *Compare* **PARAPATRIC SPECIATION**, **SYMPATRIC SPECIATION**

allogrooming Mutual **PREENING** that occurs between birds. May have a hygienic function in removing **ECTOPARASITES** and also a social function in helping to maintain social bonds. It may also replace aggressive behaviour in some species. *See also* **ALLOGROOMING**

all-terrain vehicle (ATV) *See* **QUAD BIKE**

alpaca farming The rearing of alpacas (*Vicugna pacos*) for their fleeces, most of which are processed into yarn for knitting or weaving. Alpacas are **CAMELIDS** used as pack animals in South America and also bred in North America, Australia, New Zealand, South Africa, China, the UK and throughout Europe. Some alpaca farm owners also offer 'alpaca walking' and 'alpaca trekking' experiences. *See also* **BRITISH ALPACA SOCIETY (BAS)**

alpha (α) diversity The biological diversity within a particular area or **ECOSYSTEM** (usually expressed as the number of species in that ecosystem, i.e. species richness). *See also* **BETA (β) DIVERSITY**, **BIODIVERSITY**, **GAMMA (γ) DIVERSITY**

alpha male *See* **ALPHA STATUS**

alpha predator *See* **APEX PREDATOR**

alpha status The status afforded to the most dominant or important individual in a group of animals, to which all other individuals are subordinate. The

A

alpha male is the most dominant male animal in a **DOMINANCE HIERARCHY**. See also **BETA STATUS**

alpha-tocopherol See **VITAMIN E**

alternating tripod gait A walking pattern found in insects in which three alternating legs support the body at any one time.

alternative hypothesis (H_1) See **NULL HYPOTHESIS (H_0)**

altricial Referring to a species (especially a mammal or bird) in which very young animals are helpless and incapable of caring for themselves at birth or when they hatch, e.g. canids, rodents. In relation to birds, a young bird which is incapable of moving around on its own soon after hatching. Altricial chicks possess little or no down, hatch with their eyes closed and are incapable of leaving the nest. They are fed by their parents. All **PASSERINES** produce altricial chicks. Compare **PRECOCIAL**

altruism The act of unselfishly helping or showing concern for another. An animal may suffer some detriment as a result of engaging in an altruistic act. See also **ALARM CALL**, **INCLUSIVE FITNESS**, **INDIRECT FITNESS**, **PROSOCIAL BEHAVIOUR**, **RECIPROCAL ALTRUISM**

altruistic behaviour See **ALTRUISM**

alula (alulae pl.) The first digit on a bird's wing.

alveolus (alveoli pl.)

1. A minute air sac in the lungs over which **GASEOUS EXCHANGE** occurs. These sacs have the effect of increasing the total surface area of the **LUNGS** substantially.

2. A milk reservoir in a **MAMMARY GLAND**.

ambassador species A species kept by a zoo which may have little conservation value, e.g. common zebra (*Equus burchelli*). Visitors may expect to see such species and they may help to generate interest in conservation in general. See also **ABC SPECIES**, **EDUCATION OUTREACH ANIMAL**

ambient temperature The surrounding air temperature.

ambivalent behaviour A behaviour which is typical of conflict situations and in which an animal appears to be trying to perform two incompatible activities at the same time, e.g. pecking at food while moving away from it. This is the result of motivational conflict and the behaviour may have evolved into a stereotypical display as a result of **RITUALISATION**. See also **STEREOTYPICAL BEHAVIOUR**

ambush behaviour A form of hunting whereby a predator lurks (often camouflaged) in a place which prey are likely to frequent, rather than actively hunting.

ambush predator See **AMBUSH BEHAVIOUR**

amebiasis See **AMOEBIASIS**

amenorrhoea The absence or suppression of **MENSTRUATION (OVULATION)**. Lactational amenorrhoea is the suppression of menstruation when the mother is producing milk and prevents her from becoming pregnant while nursing a young infant. See also **MENSTRUAL CYCLE**

amensalism An ecological relationship between two organisms of different species in which one is adversely affected and the other is unaffected.

American Anti-vivisection Society (AAVS) The first non-profit animal advocacy and educational organisation in the USA (founded in 1883) dedicated to ending experimentation on animals in research, testing and education. It also opposes other forms of cruelty to animals. See also **VIVISECTION**

American Association of Zoo Keepers (AAZK) A professional organisation for zoo keepers and aquarists, which supports keeper education and education of the public in conservation.

American Association of Zoo Veterinarians (AAZV) An association of veterinary surgeons whose aim is to advance programmes for preventive medicine, husbandry and scientific research in the field of veterinary medicine dealing with captive and free-ranging wild animals. It disseminates research by publishing the *Journal of Zoo and Wildlife Medicine*.

American Association of Zoos and Aquariums See **ASSOCIATION OF ZOOS AND AQUARIUMS (AZA)**

American Birding Association (ABA) An organisation which represents the North American **BIRDING** community. It supports birders through publications, conferences, workshops, tours, partnerships and networks.

American Farm Bureau An NGO in the USA that promotes the wellbeing of farm and ranch communities and acts on behalf of these communities in dealings with the government and others at local, county, state, national and international levels. Each state has its own State Farm Bureau. See also **WYOMING FARM BUREAU FEDERATION V. BABBITT (1997)**

American Horse Council An organisation that represents all aspects of the horse industry in the United States.

American Humane Association An organisation that exists to protect children, pets and farm animals from abuse and neglect in the United States. It was founded in 1877.

American Kennel Club An organisation, founded in 1884, which registers dog breeds and whose aim is to advance the study, breeding, exhibiting, running and maintenance of purebred dogs. See also **AMERICAN RARE BREED ASSOCIATION (ARBA)**, **KENNEL CLUB**

American Livestock Breeds Conservancy (ALBC) A non-profit membership organisation, founded in 1977, which works to protect over 150 breeds of livestock and poultry from extinction, including asses, cattle, goats, horses, sheep, pigs, rabbits, chickens, ducks, geese and turkeys. See also **RARE BREEDS CONSERVATION SOCIETY OF NEW ZEALAND**, **RARE BREEDS SURVIVAL TRUST (RBST)**

American Museum of Natural History A major natural history museum in New York which was founded in 1869.

American Rare Breed Association (ARBA) An organisation which provides a registration system and show venues across the USA for 'rare breeds' of dogs which are not recognised by the **AMERICAN KENNEL CLUB**.

American Society for the Prevention of Cruelty to Animals (ASPCA) The first humane organisation in the Western Hemisphere. It was founded by Henry Bergh in 1866. Its aim is to prevent cruelty to animals and it works to rescue animals from abuse, and pass humane laws. It operates animal shelters and animal adoption schemes.

American Society of Animal Science An organisation which fosters the discovery, sharing and application of scientific knowledge regarding the responsible use of animals to enhance human life and well-being. It publishes the *Journal of Animal Science*.

American Stud Book The registry maintained by the **JOCKEY CLUB (USA)** for all **THOROUGHBREDS** foaled in the United States, Puerto Rico and Canada and for all thoroughbreds imported into the United States, Puerto Rico and Canada from countries that have a studbook approved by the Jockey Club and the **INTERNATIONAL STUD BOOK COMMITTEE**.

American Veterinary Medical Association A non-profit organisation founded in 1863 to represent the interests of veterinary surgeons in the United States. It works to advance veterinary medicine, including its relationship to public health, biological science and agriculture.

Amiiformes An order of fishes: bowfin.

amino acid A subunit of a protein which contains an amine group and an acidic carboxyl group, along with a side chain that varies between different amino acids. There are 22 different types of standard amino acid.

amnion A fluid-filled cavity formed by a membrane which encloses the embryo of birds, reptiles and mammals.

amniote

1. Possessing an **AMNION**.
2. A vertebrate (mammal, bird or reptile) in which the embryo possesses an **AMNION**.

amniotic egg The egg of an **AMNIOTE** (2).

amniotic fluid Fluid contained within the amnion formed in reptiles, birds and some mammals. Provides a buffer against mechanical damage and helps to stabilise temperature, especially in placental mammals.

Amoeba A genus of sarcodine **PROTOZOANS**, members of which consist of a single irregular-shaped cell which moves and feeds using pseudopodia (cytoplasmic extensions). Some cause disease. See also **AMOEBIASIS**

amoebiasis, amebiasis An infection caused by the **AMOEBA** *Entamoeba histolytica*.

Amphibia A class of chordates; **POIKILOTHERMIC**, mostly terrestrial **TETRAPOD** vertebrates. Most species return to water to lay eggs which develop

into tadpoles, but some are **VIVIPAROUS**. Fertilisation is internal or external but there is no **INTROMITTANT ORGAN**. The skin is soft, naked and glandular (being rich in **MUCUS** glands) and used for gaseous exchange. Some species possess poison glands in the skin.

amphibian Member of the class **AMPHIBIA**.

Amphibian Ark (AArk) An organisation which was established as a joint effort between the **WORLD ASSOCIATION OF ZOOS AND AQUARIUMS (WAZA)**, the **IUCN/SSC CONSERVATION BREEDING SPECIALIST GROUP (CBSG)** and the **IUCN/SSC Amphibian Specialist Group (ASG)**, and other partners around the world, aimed at ensuring the global survival of amphibians. Since 2006, AArk has been assisting the *ex-situ* conservation community to address the captive components of the Amphibian Conservation Action Plan of the **INTERNATIONAL UNION FOR THE CONSERVATION OF NATURE AND NATURAL RESOURCES (IUCN)**. This involves taking species at immediate risk of extinction into captivity in order to establish captive-survival assurance colonies. The survival of many amphibian species is threatened by **CHYTRIDIOMYCOSIS**.

amplexus The mating embrace in frogs in which the male grasps the female from behind and both sexes release gametes (Fig. A6).

ampulla (ampullae pl.)

1. A bulge at the end of each semi-circular canal in the **INNER EAR** containing hair cells that detect the acceleration of the head.
2. A reservoir in the water vascular system of **ECHINODERMS**.
3. A low-frequency electroreceptor found in some fishes.

amputation The removal of a limb, usually as part of a surgical procedure.



Fig. A6 Amplexus in glass frogs (Centrolenidae).

A

amylase An enzyme found in saliva in some taxa, which breaks starch down into simple sugars. It is also released into the small intestine from the pancreas.

anabolic

1. Relating to **ANABOLISM**.

2. Describing a substance which promotes the growth of body tissue, e.g. **ANABOLIC STEROID**.

anabolic steroid A drug that simulates the effect of male sex hormones and increases tissue growth, especially in **SKELETAL MUSCLES**. Sometimes used to enhance performance in racehorses and greyhounds.

anabolism **METABOLISM** in which complex organic molecules are synthesised from simpler ones, storing energy, e.g. carbohydrate anabolism involves the conversion of glucose to glycogen; protein anabolism involves the creation of complex proteins from amino acids. *Compare* **CATABOLISM**.

anachoresis The avoidance of predators by living in a crevice, hole or other retreat. Species which exhibit this behaviour are called anachorettes. Some live entirely in a burrow (e.g. some polychaete worms), while others emerge at night (e.g. rabbits, badgers).

anadromous Migrating from the oceans to freshwater for **SPAWNING**. Anadromous fishes are those that are born in freshwater, spend most of their lives at sea, and then return to freshwater streams and rivers to spawn, e.g. salmon, trout, lampreys. *Compare* **CATADROMOUS**, **DIADROMOUS**

anaemia, anemia An abnormal reduction in the amount of **HAEMOGLOBIN** in red blood cells resulting in reduced oxygen-carrying capacity. This causes fatigue and breathlessness. It may be caused by blood loss, iron deficiency, red cell destruction or an inability to produce a sufficient quantity of red cells (as in pernicious anaemia caused by vitamin B₁₂ deficiency).

anaerobic Relating to conditions in which no oxygen is present, e.g. **ANAEROBIC RESPIRATION**. *See also* **ANOXIC**

anaerobic respiration The cellular process by which energy is released from food molecules (e.g. **GLUCOSE**) in the absence of oxygen. **ADENOSINE TRIPHOSPHATE (ATP)** is generated from an **ELECTRON TRANSPORT SYSTEM**. *See also* **LACTIC ACID FERMENTATION**

anaesthesia, anesthesia A loss of sensation which may affect the whole body, and involve a loss of consciousness (general anaesthesia), or a localised area (local anaesthesia). *See also* **ANALGESIA**

anaesthesia induction chamber A container used for anaesthetising small animals which usually consists of a sealed transparent plastic box with a gas inlet and a waste gas outlet.

anaesthesia vaporiser A device attached to an **ANAESTHETIC MACHINE** which delivers a specific concentration of a volatile anaesthetic agent, which is liquid at room temperature but vaporises easily.



Fig. A7 Anaesthetic machine.

anaesthesiologist *See* **ANAESTHETIST**

anaesthesiology *See* **ANAESTHETICS**

anaesthetic, anesthetic

1. A drug that causes a temporary loss of sensation (**ANAESTHESIA**). *See also* **ANALGESIC (1)**

2. Relating to or inducing a loss of sensation.

anaesthetic machine A device used to support the administration of anaesthesia (Fig. A7). It generally consists of a ventilator, a gas delivery system (for oxygen, air and anaesthetic), including a vaporiser, flow meters and monitors to measure and record the patient's vital signs, e.g. **BLOOD PRESSURE (BP)**, **HEART RATE**, **OXYGEN SATURATION** etc.

anaesthetics, anaesthesiology The study and application of anaesthetics. *See also* **ANAESTHETIC (1)**

anaesthetist, anaesthesiologist Someone who is expert in the use of anaesthetics. *See also* **ANAESTHETIC (1)**

anal glands Paired sacs located either side of the anus in many mammals including most carnivores. Their secretions contain chemicals which allow individual animals to identify other particular **CONSPECIFICS**. *See also* **SCENT GLAND**

analgesia Pain relief without loss of consciousness. *See also* **ANAESTHESIA**

analgesic

1. A drug that provides pain relief. *See also* **ANAESTHETIC (1)**

2. Having the effect of providing pain relief.

analogous

1. An anatomical structure in one type of animal is said to be analogous with a structure in another type of animal when both have the same function and when they are not **HOMOLOGOUS (1)**, i.e. they have a different evolutionary origin such as the wings of insects and those of birds. *See also CONVERGENT EVOLUTION*

2. The term may be used to describe structures with a similar function whether or not these structures are **HOMOLOGOUS (1)**.

analysis of variance *See ANOVA*

anaphylactic shock A fall in **BLOOD PRESSURE (BP)** caused by an extreme **IMMUNE REACTION**.

anapsid A vertebrate, especially a reptile, which does not possess a temporal opening in its skull.

anatomical terms of location Standard terms of anatomical location used within **ZOOLOGY** (Fig. A8).

ancient forest *See PRIMARY FOREST*

ancient woodland *See PRIMARY FOREST*

androgen A **STEROID** hormone which has masculinising effects, e.g. **TESTOSTERONE**.

anemia *See ANAEMIA*

anesthetic *See ANAESTHETIC*

anestrus *See ANOESTROUS*

anestrus *See ANOESTRUS*

angel wing, airplane wing A deformity of the scapulae in which they bow outward as a result of the pull of the scapular muscles (*see PECTORAL GIRDLE*). Caused by a condition called osteodys-trophia fibrosa. Occurs particularly in kittens.

Anguilliformes An order of fishes: eels.

animal

1. An organism which belongs to the animal kingdom (Animalia) and is characterised by being **MOTILE** (in some stage of its life cycle), multicellular, made of **EUKARYOTIC** cells which are almost always **DIPLOID**, and usually arranged into **TISSUES**, **HETEROTROPHIC**, possessing cells without cell walls, usually reproducing sexually, and with an embryo which has a **BLASTULA** stage. In law, animals are divided into **DOMESTIC ANIMALS**, **CAPTIVE ANIMALS** and **WILD ANIMALS**. In addition, the general term 'animal' may have a specific meaning within a particular piece of legislation which is different from the zoological meaning.

2. In English law, in the **PERFORMING ANIMALS (REGULATION) ACT 1925**, the **PET ANIMALS ACT 1951** and the **ANIMAL WELFARE ACT 2006**, 'animal' means a **VERTEBRATE**.

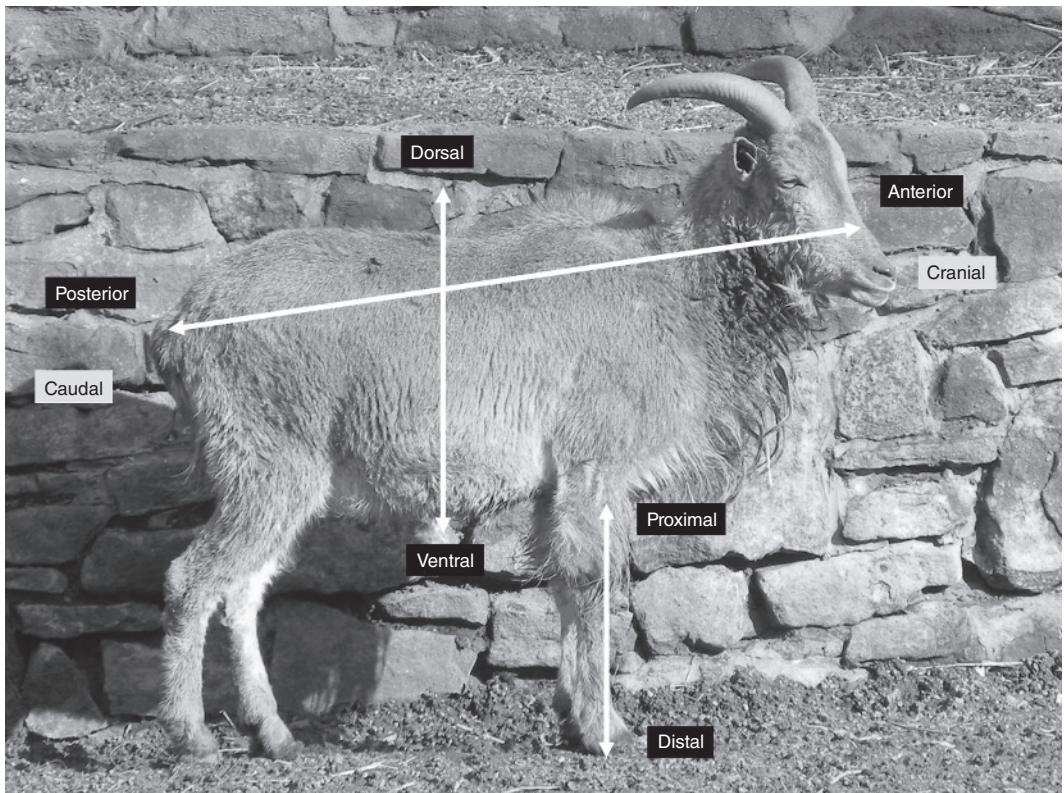


Fig. A8 Anatomical terms of location. Barbary sheep (*Ammotragus lervia*).

3. In the **ZOO LICENSING ACT 1981**, s21(1), “‘animals’ means animals of the classes **MAMMALIA**, **AVES**, **REPTILIA**, **AMPHIBIA**, **PISCES** and **INSECTA** and any other multi cellular organism that is not a plant or a fungus . . .’ (i.e. the legal definition is essentially the same as the zoological definition).

4. In the **PROTECTION OF ANIMALS ACT 1911** the expression ‘animal’ means any **DOMESTIC ANIMAL (2)** or **CAPTIVE ANIMAL (2)**.

5. Under the Animal Boarding Establishments Act 1963 (s.5(2)), “‘animal’ means any dog or cat’.

6. In the USA, the **ANIMAL WELFARE ACT OF 1966 (USA)**, (USC § 2132 (g)), ‘The term “animal” means any live or dead dog, cat, monkey (nonhuman primate mammal), guinea pig, hamster, rabbit, or such other warm-blooded animal, as the Secretary may determine is being used, or is intended for use, for research, testing, experimentation, or exhibition purposes, or as a pet; but such term excludes (1) birds, rats of the genus *Rattus*, and mice of the genus *Mus*, bred for use in research, (2) horses not used for research purposes, and (3) other farm animals, such as, but not limited to livestock or poultry, used or intended for use as food or fiber, or livestock or poultry used or intended for use for improving animal nutrition, breeding, management, or production efficiency, or for improving the quality of food or fiber. With respect to a dog, the term means all dogs including those used for hunting, security, or breeding purposes;’

7. In New York State, under the Agriculture and Markets Law § 350 (1) “Animal,” . . . includes ‘every living creature except a human being.’

animal £ The amount of money the public is prepared to donate to (spend on) charities which support animals. Much of this is given to organisations concerned with animal cruelty, animal **SANCTUARIES** etc., rather than those that support wildlife **CONSERVATION**.

animal actors Animals which are used in the entertainment industry. They are usually taken from their parents at an early age and trained to perform in films, television programmes and advertisements. In many cases social animals, such as apes, are forced to live alone. When they become too large and difficult to handle many in the USA live out the rest of their lives in **ROADSIDE ZOOS**. *See also* **ANIMALS IN FILM**, **CHEETAH**, **FLIPPER**, **LASSIE**, **SKIPPY THE BUSH KANGAROO**

animal advocate A person who acts for or speaks on behalf of animals, usually in relation to animal welfare issues. *See also* **LEGAL PERSONALITY**, **LOCUS STANDI**

Animal Aid An animal rights group founded in the UK in 1977. It campaigns peacefully against animal abuse and promotes a cruelty-free lifestyle.

Animal and Plant Health Inspection Service (APHIS) The Agency of the **UNITED STATES DEPARTMENT OF AGRICULTURE (USDA)** responsible for protecting and promoting agricultural health, the regulation of genetically engineered organisms, and

carrying out wildlife damage management activities. It administers the **ANIMAL WELFARE ACT OF 1966 (USA)** and inspects zoos.

animal ark *See* **ARK (2)**, **POULTRY ARK**

Animal Behavior Society (ABS) A society whose purpose is to promote and encourage the biological study of animal behaviour, including studies at all levels of organisation using both descriptive and experimental methods under natural and controlled conditions. It encourages research studies and the dissemination of knowledge about animal behaviour through publications, educational programmes and activities. *See also* **ANIMAL BEHAVIOUR**

Animal Behaviour An academic journal which publishes original work on animal behaviour. Published by the **ASSOCIATION FOR THE STUDY OF ANIMAL BEHAVIOUR (ASAB)** in collaboration with the **ANIMAL BEHAVIOR SOCIETY (ABS)**.

Animal Boarding Establishments Act 1963 An Act which regulates animal boarding establishments (for dogs or cats) in Great Britain by a system of licensing and inspections.

Animal By-Products (Enforcement) (England) Regulations 2011 A statutory instrument which regulates the collection, transportation, storage, handling, processing and disposal of animal by-products in England, in compliance with EU law.

animal carer Alternative name for an animal **KEEPER (1)**.

animal cognition The study of the mental life of animals. *See* **COGNITION**

Animal Conservation A scientific journal which publishes research on the conservation of species and their habitats, published by the **ZOOLOGICAL SOCIETY OF LONDON (ZSL)**.

animal cruelty Treating an animal in such a way as to cause pain or suffering either intentionally or by **NEGLECT**. Apart from **CRUELTY** caused by neglect many instances of gratuitous cruelty towards animals have been recorded: a kitten killed by being heated in a microwave oven, a dog dragged behind a car, a deer killed by dogs, a hamster attached to a firework rocket, a cat boil-washed in a washing machine, a puppy kicked to death. *See also* **ANIMAL CRUELTY LAWS**, **ROYAL SOCIETY FOR THE PREVENTION OF CRUELTY TO ANIMALS (RSPCA)**

animal cruelty and violence towards humans In the USA the Federal Bureau of Investigation (FBI) has recognised animal cruelty as an indicator of violence against people since the 1970s, including children, partners and elders. In a study of serial killers the FBI found that most had killed or tortured animals as children.

animal cruelty as a component of domestic violence There is a strong association between domestic violence between people and cruelty to animals. In America the **HUMANE SOCIETY OF THE UNITED STATES (HSUS)** estimates that nearly 1

million animals a year are abused or killed in connection with domestic violence. Ascione (1998) found that 71% of battered women who had pets reported that their partner had either threatened or had actually hurt or killed one of their pets, and actual pet abuse was reported by 57% of the women.

animal cruelty laws Legislation aimed at the prevention of **CRUELTY** to animals developed first in the UK in the early 19th century (*see* **MARTIN'S ACT**). Most countries have laws which protect **COMPANION ANIMALS**, animals used in experiments, **FARM ANIMALS** and animals living in zoos. In more recent times this has been extended to some wild animals (e.g. **WILD MAMMALS (PROTECTION) ACT 1996**). In the USA each state has its own animal cruelty laws. *See also* **ANIMAL CRUELTY**, **ANIMAL WELFARE ACT 1999 (NZ)**, **ANIMAL WELFARE ACT 2006**, **ANIMAL WELFARE ACT OF 1966 (USA)**, **CRUELTY TO ANIMALS ACT 1835**, **CRUELTY TO ANIMALS ACT 1876**, **PROTECTION OF ANIMALS ACT 1911**

animal dealer A person who buys (or captures) and then sells animals. In the past zoos relied on such dealers to provide their animals, e.g. the **WORLD'S ZOOLOGICAL TRADING COMPANY LTD**. *See also* **GAME AUCTION**, **HAGENBECK**

Animal Defenders International (ADI) An organisation whose aim is to create awareness of, and campaign against, cruelty to animals, including **ANIMAL TESTING** and circuses. It works to alleviate suffering, and conserve and protect animals and the environment.

animal density *See* **STOCKING DENSITY**

animal economics *See* **BEHAVIOURAL ECONOMIC THEORY**

animal enclosure

1. A space which is enclosed in order to contain animals.

2. In India, under the **RECOGNITION OF ZOO RULES 2009 (INDIA)**, "*Enclosure means any accommodation provided for zoo animals.*"

See also **ANIMAL EXHIBIT**, **ENCLOSURE DESIGN**, **ENCLOSURE SIZE**

Animal Equity UK An animal rights organisation based in the UK.

animal exhibit An **ANIMAL ENCLOSURE** (including a building in a zoo, farm or other facility) containing one or more species on display to the public, plus the associated **INTERPRETATION** and, in some cases, the visitor paths and landscape surrounding the enclosure. *See also* **AFFILIATIVE EXHIBIT**, **BIOPARK**, **ENCLOSURE DESIGN**, **EXHIBIT STRUCTURE**, **GREEN EXHIBIT**, **HUMAN EXHIBIT**, **IMMERSION EXHIBIT**, **INTERACTIVE SIGN**, **MULTI-SPECIES EXHIBIT**, **NATURALISTIC EXHIBIT**, **ROTATIONAL EXHIBIT DESIGN**, **THEMED EXHIBIT**, **WALK-THROUGH EXHIBIT**

animal experience An animal encounter in a zoo or similar facility, whereby members of the public come into close contact with animals.

animal experimentation *See* **ANIMAL TESTING**. *See also* **VIVISECTION**

animal feed cake Any of a number of animal foods pressed into a solid mass, especially for agricultural use, e.g. cotton seed cake, coconut copra cake, palm kernel cake, rapeseed cake. *See also* **FIBRE NUGGETS**

Animal Finder's Guide A magazine and website for owners of exotic wild animals. Based in Indiana, USA. Contains information about animal care, legislation and animal auctions. *See also* **GAME AUCTION**

Animal Gatherings (England) Order 2006 A statutory instrument in England which regulates the use of premises for animal gatherings for the sale of agricultural animals, including licensing, time limits on gatherings, movement of animals, disinfection etc.

animal grabber Any of a number of devices for catching and restraining animals. *See also* **CATCH POLE**, **SNAKE HOOK**

animal handling chute *See* **CRUSH**

Animal Health An organisation in Great Britain previously known as the State Veterinary Service (and including other agencies), but now part of the **ANIMAL HEALTH AND VETERINARY LABORATORIES AGENCY (AHVLA)**.

Animal Health and Veterinary Laboratories Agency (AHVLA) An executive agency which works on behalf of the **DEPARTMENT FOR ENVIRONMENT, FOOD AND RURAL AFFAIRS (DEFRA)**, the Scottish Government and the Welsh Government. The agency was formed in April 2011, following the merger of **ANIMAL HEALTH** and the **VETERINARY LABORATORIES AGENCY**. The agency's role is to safeguard animal health and welfare, protect public health and enhance food security by conducting research, surveillance and inspections. The AHVLA also acts as the national, European and international reference laboratory for several exotic and zoonotic **NOTIFIABLE DISEASES**, and has a registration and licensing role in relation to **CITES** listed wildlife species.

Animal Health and Welfare Board for England An organisation created in 2011 which makes direct recommendations to **DEPARTMENT FOR ENVIRONMENT, FOOD AND RURAL AFFAIRS (DEFRA)** Ministers on policies affecting the health and welfare of kept animals in England including farm animals, horses and pets. It is not concerned with the welfare of zoo and circus animals.

Animal Health Trust An organisation in the UK concerned with fighting disease and injury in animals. It aims to develop new technology and knowledge for the better diagnosis, prevention and cure of animal diseases. It provides a clinical referral service for veterinary surgeons in practice and promotes postgraduate education.

animal hospital A facility which provides first aid and minor treatment for a wide range of pets and also

surgical treatment for more serious conditions. In England and Wales, the **ROYAL SOCIETY FOR THE PREVENTION OF CRUELTY TO ANIMALS (RSPCA)** provides a low-cost veterinary service to the public via its animal hospitals, and facilities for injured and rescued animals collected by **RSPCA INSPECTORS**. *See also* **ANIMAL WELLNESS CENTRE**

Animal Liberation A book published by Peter **SINGER** in 1975 supporting the concept of rights for animals. It examines the fate of animals in factory farms, science laboratories and other situations where they are exploited for the benefit of humans. It does not specifically discuss zoos, but was extremely important in bringing the fate of exploited animals to the attention of the public and it was instrumental in establishing **ANIMAL RIGHTS** as a legitimate subject of academic study.

Animal Liberation Front (ALF) A secret loose association of individuals (with no formal membership) who carry out illegal actions against industries which profit from animal exploitation, including the liberation of live animals from fur farms, slaughterhouses and other places, and economic sabotage in the form of property destruction.

animal loading *See* **STOCKING DENSITY**

Animal Machines A book published in 1964 by Ruth **HARRISON** which exposed the cruel practices of the **INTENSIVE FARMING** industry.

Animal Magic A popular children's television programme about animals produced by the BBC and broadcast between 1962 and 1983. The original presenter, Johnny Morris, made regular visits to Bristol Zoo, playing the part of a keeper who could talk to the animals.

animal needs index (ANI) *See* **ANIMAL WELFARE INDEX**

animal noise monitor collar A device designed by the US Air Force and used to record and study the effect of noise – particularly aircraft noise – on animals. It records location (using the **GLOBAL POSITIONING SYSTEM (GPS)**), movements, acoustic noise level and heart rate. Initially tested on free-ranging bighorn sheep (*Ovis canadensis*) in Idaho to monitor their reactions to low-level military aircraft in 1997.

animal personality Animals may be considered to possess a personality when individuals differ from one another in either single behaviours or suites of related behaviours in a way that is consistent over time. It is usually assumed that such consistent individual differences in behaviour are driven by variation in how individuals respond to information about their environment, rather than by differences in external factors such as variation in **MICROHABITAT** (Briffa and Greenaway, 2011).

animal recognition technology An animal management system that uses a video camera and computer software to distinguish between animal types. This information can then be used to open or close a gate

and to count animals. Animals are funnelled towards the gate by a V-shaped fence and walk in front of a blue screen. The animal's shape is recorded by a video camera and compared to a database of shapes. Such a system is used by farmers in Australia to protect water resources and can distinguish between horses, cows, sheep, goats, pigs, kangaroos and emus. *See also* **AUTO DRAFTER**, **RADIO FREQUENCY IDENTIFICATION (RFID) TECHNOLOGY**

Animal Record Keeping System (ARKS) Software used for keeping animal records within an individual institution. It is a PC-based application and is multi-lingual. The software allows a zoo to produce a number of different reports based on its own records. ARKS4 allows individual institutions to contribute their data to the pooled **INTERNATIONAL SPECIES INFORMATION SYSTEM (ISIS)** database so that it is then available to others through the ISIS website. *See also* **MEDICAL ANIMAL RECORD KEEPING SYSTEM (MEDARKS)**, **ZOOLOGICAL INFORMATION MANAGEMENT SYSTEM (ZIMS)**

animal records *See* **ANIMAL RECORD KEEPING SYSTEM (ARKS)**, **PEDIGREE REGISTER**, **RECORD KEEPING**, **STUDBOOK**

animal research *See* **ANIMAL TESTING**

Animal Research Act 1995 (NSW) A law introduced in New South Wales, Australia, to protect animal welfare by ensuring that the use of animals in research is always humane, considerate, responsible and justified.

animal ride A ride given by a tame animal (e.g. horse, donkey, elephant, camel) in a zoo, on a farm or at some other facility, for entertainment.

animal rights The concept in moral philosophy that animals (or at least some animals) should have rights. *See also* **ANIMAL LIBERATION**, **ARISTOTLE**, **BASIC NEEDS TEST**, **BENTHAM**, **COBBE**, **DECLARATION OF RIGHTS FOR CETACEANS: WHALES AND DOLPHINS**, **DESCARTES**, **ETHICS**, **GREAT APE PROJECT**, **KANT**, **RYDER**, **SINGER**, **SPECIESISM**, **UNIVERSAL DECLARATION ON ANIMAL WELFARE (UDAW)**, **UTILITARIANISM**, **WHO**

animal rights legal cases A number of attempts have been made to achieve rights for animals using the courts. In 2012 the **PEOPLE FOR THE ETHICAL TREATMENT OF ANIMALS (PETA) FOUNDATION** brought a lawsuit in the US District Court for the Southern District of California against *SeaWorld* on behalf of five wild-caught orcas, claiming that they were held in violation of Section One of the Thirteenth Amendment to the Constitution of the United States, which prohibits slavery and involuntary servitude. In November 2011 the Free Morgan Support Group failed in its attempt to use a Dutch court to prevent a killer whale from being transferred from the dolphinarium in Harderwijk that rescued her from shallow waters in Waddenzee to Loro Parque in Tenerife. The group argued that the transfer would breach EU wildlife trade laws and that she should be returned to the wild. In 1988

approximately 15000 seals washed up on the beaches of the Adriatic and North Seas. A group of German environmental lawyers brought a case in the German courts naming North Sea Seals as the principal plaintiffs, with the lawyers appearing as guardians against the West German Government as they were responsible for issuing permits which resulted in the sea being polluted by heavy metals. The courts did not recognise the seals' standing (**LOCUS STANDI**) as they were not **PERSONS** and would not allow the lawyers to stand on their behalf as no specific legislation authorised this. *See also ASSOCIATION OF LAWYERS FOR ANIMAL WELFARE, DECLARATION OF RIGHTS FOR CETACEANS: WHALES AND DOLPHINS*

animal rotation exhibit *See* **ROTATIONAL EXHIBIT DESIGN**

animal sentinels Animals used to detect the presence of a toxic substance, disease or other hazard, e.g. canaries used to detect carbon monoxide and methane in coal mines. Murray Valley encephalitis (MVE) is a mosquito-borne viral disease of chickens which occurs in New South Wales, Australia. Wild birds act as a natural reservoir of the disease and it may be fatal if contracted by humans. During the mosquito breeding season the NSW government regularly tests sentinel flocks of chickens located near known bird breeding sites for MVE. *See also SENTRY, WORKING ANIMALS*

animal shelter A place where unwanted animals are cared for either on a temporary or permanent basis. *See also SANCTUARY (2)*

animal show An entertainment event which features the use of animals. Sometimes included in attractions within a zoo. In the past some zoos arranged inappropriate shows such as **CHIMPANZEES' TEA PARTIES**. Nowadays, some modern zoos use shows to inform visitors about the natural abilities of animals (e.g. climbing or flying) or to educate the public about conservation issues. At **WHIPSNADE ZOO** Asian elephants 'demolish' huts and 'trees' to illustrate human–elephant conflicts in Asia.

animal stars A number of animals have become stars in long-running television series and popular films, beginning with the *Tarzan* films in the 1930s (*see also CHEETAH, TARZAN OF THE APES*) and culminating in a number of popular TV series in the 1950s and 1960s (*see also DAKTARI, FLIPPER, LASSIE, SKIPPY THE BUSH KANGAROO*)

animal testing, animal experimentation, animal research The process of testing chemicals or procedures on animals, generally using them as models of how these chemicals or processes may affect humans. For example testing the efficacy of drugs, the toxicity of chemicals or the effectiveness of surgical procedures such as organ transplants. Some animal welfare organisations claim that all animal testing is immoral, scientifically flawed and unnecessary because other study methods are available

(e.g. the use of cell cultures). Some scientists claim that it is not possible to study complex biological systems by experimenting on cultures of cells. For example, it is not possible to determine how a drug may affect behaviour unless a whole live animal is used. *See also DRAIZE TEST, LD₅₀ TEST, THREE RS, VIVISECTION*

animal theme park A visitor attraction which consists of a zoo and an amusement park, usually operated on a commercial basis primarily for entertainment purposes, e.g. *Disney's Animal Kingdom*, Busch Gardens (Tampa).

animal therapy

1. May refer to animal-assisted activities. *See* **ANIMAL-ASSISTED THERAPY**

2. The treatment of illness or injury in an animal using complementary medicine instead of medication or surgery. *See also HOLISTIC VETERINARY MEDICINE*

animal trafficking The illegal international trade in animals, especially rare species, for the pet trade, use in **TRADITIONAL MEDICINE** etc. *See also CITES, TRADE RECORDS ANALYSIS OF FLORA AND FAUNA IN COMMERCE (TRAFFIC)*

Animal Transaction Policy A document published by the **BRITISH AND IRISH ASSOCIATION OF ZOOS AND AQUARIUMS (BIAZA)** which sets out its policy in relation to animal acquisitions, disposal of surplus animals, culling and euthanasia, use of animal dealers, and the transfer of animals between institutions.

Animal Welfare An academic journal which publishes **SCIENTIFIC PAPERS** concerned with the welfare of animals including those living in zoos. Published by the **UNIVERSITIES FEDERATION FOR ANIMAL WELFARE (UFAW)**.

animal welfare

1. The physical and psychological wellbeing of animals, including a consideration of the effects of their housing, transportation, handling, feeding, breeding etc. The welfare of an individual is defined by **BROOM** (1986) as 'its state as regards its attempts to cope with its environment.'

2. 'Welfare is a characteristic of an animal, not something given to it, and can be measured using an array of indicators' Broom (1991).

3. An academic discipline, taught in colleges and universities, concerned particularly with the welfare of companion animals and animals living on farms and in zoos.

Animal Welfare Act 1999 (NZ) A wide-ranging animal welfare law in New Zealand which regulates and makes provision for the care of and conduct towards animals, the use of traps, animal exports, the use of animals in research, testing and teaching, the disposal of animals, hunting, fishing, pest control and surgical procedures on animals. *See also ANIMAL WELFARE (ZOOS) CODE OF WELFARE 2004 (NZ)*

Animal Welfare Act 2006 A law in England and Wales which makes provisions relating to the

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welfare of domestic animals under human control (including pet owners). It aims to prevent unnecessary **SUFFERING** (e.g. by banning the docking of dogs' tails (**TAIL DOCKING**) except for medical treatment, mutilation, poisoning, and animal fighting) and promote welfare (by imposing a duty on persons responsible for animals to ensure welfare, banning the sale of animals to persons aged under 16 years and by licensing certain activities). The Act provides for the inspection of premises and the seizure of animals and equipment. *See also* **HUNTING ACT 2004, WILD MAMMALS (PROTECTION) ACT 1996**

Animal Welfare Act of 1966 (USA) The only Federal law in the United States that regulates the treatment of animals in research, exhibition, transport, and by dealers. It requires minimum standards of care and treatment for certain animals which are bred for commercial sale, used in research, transported commercially or exhibited to the public. It makes provision for the licensing of dealers, marking of animals and record keeping, and bans animal fighting.

animal welfare domains *See* **FIVE FREEDOMS**

animal welfare index A method of assessing welfare which is based on a list of parameters for which the presence/absence/degree is given a numerical value or weighting. The calculated value may be compared with minimum, target or threshold totals. Examples include the **ANIMAL NEEDS INDEX (ANI)** or **Tiegerechtheitsindex (TGI)**. *See also* **BODY CONDITION SCORE**

animal welfare needs *See* **FIVE FREEDOMS**

Animal Welfare (Zoos) Code of Welfare 2004 (NZ) A code of welfare for zoo animals in New Zealand issued under section 75 of the **ANIMAL WELFARE ACT 1999 (NZ)**.

animal wellness centre A facility which provides veterinary care for animals, often including holistic veterinary treatments. *See also* **ANIMAL HOSPITAL**

animal-assisted therapy The use of an animal to improve the health of a human, e.g. to treat depression due to loneliness, to provide mental and physical stimulation, reduce blood pressure, and improve verbal skills, social skills and attention span. May involve the use of pet animals such as cats or dogs, or contact with horses or farm animals. *See also* **DOLPHIN THERAPY**

Animalia The animal kingdom. *See also* **ANIMAL (1)**

Animals Act 1971 In England and Wales, an Act which makes provision for the civil liability for damage done by animals in general, dangerous animals, dogs and straying livestock. It allows for the killing of any dog for the protection of livestock and the detention and sale of trespassing livestock. *See also* **KEEPER (2)**

animals and religion Some animal species are protected by virtue of their status in a particular religion. For example the elephant god *Ganesh* is an important deity in Hinduism, Jainism and Buddhism



Fig. A9 Animals and religion: the elephant god *Ganesh* is an important deity in Hinduism, Jainism and Buddhism.

(Fig. A9). The Asian elephant is revered and kept at temples and used in religious ceremonies in Asia. *See also* **BUDDHISM AND ANIMALS, HINDUISM AND ANIMALS, ISLAM AND ANIMALS, JAINISM AND ANIMALS, JUDAISM AND ANIMALS, RELIGIOUS SLAUGHTER**

Animals and Society Institute An independent think tank which operates as a non-profit, independent research organisation whose aim is to advance the status of animals in public policy, and which promotes the study of animal-human relationships. The institute is based in the USA and produces educational resources, hold events and publishes academic journals (*SOCIETY AND ANIMALS JOURNAL* and the *JOURNAL OF APPLIED ANIMAL WELFARE SCIENCE (JAAWS)*).

animals in film The depiction of animals in film and television affects attitudes towards animals. Films such as *KING KONG* and *JAWS* engendered negative attitudes towards gorillas and sharks respectively. However, other films and TV series have promoted positive attitudes towards animals and the natural environment in general, e.g. *DAKTARI*, *FLIPPER*, *LASSIE*, *SKIPPY THE BUSH KANGAROO* and the TV series of David **ATTENBOROUGH**.

Animals (Scientific Procedures) Act 1986 A law in the UK which requires a Home Office licence for animal experiments ('regulated procedures')

involving any 'protected animal': a living vertebrate other than man or a specimen of the octopus *Octopus vulgaris* once it becomes capable of independent feeding. It replaced provisions within the **CRUELTY TO ANIMALS ACT 1876** and transposed into UK law Council Directive 86/609/EEC, which makes provision for the protection of animals used for experimental or other scientific purposes.

Animals' VC See **DICKIN MEDAL**

anion A negatively charged ion, e.g. chloride (Cl⁻).

Compare **CATION**

ankus, bullhook A tool used by some elephant keepers and mahouts in the training and control of elephants. Usually consists of a short wooden pole tipped with a metal spike and a metal hook. Known as a bullhook in the USA.

Annelida A phylum of animals. Most annelids are free-living segmented worms found in soil and aquatic environments, e.g. earthworms, ragworms. Some forms are parasitic (leeches). Their bodies are segmented, and constructed of muscular rings separated by thin partitions called septa. **SEGMENTATION** has allowed the development of advanced systems of co-ordinated **LOCOMOTION** with some terrestrial species using **SETAE** ('hairs') to grip the soil and marine species using a system of paddles (parapodia) attached to each segment. The **NERVOUS SYSTEM** is relatively advanced with a simple 'brain' at the head end. The **DIGESTIVE SYSTEM** consists of a tube which runs the length of the body. Annelids have an excretory system made up of individual excretory units (nephridia) in each segment.

Annex A species In relation to Council Regulation (EC) No 338/97 of 9 December 1996 on the protection of species of wild fauna and flora by regulating trade therein, all **CITES APPENDIX I** species, plus certain others (including some non-CITES species) that are considered to need a similar level of protection.

Annex B species In relation to Council Regulation (EC) No 338/97 of 9 December 1996 on the protection of species of wild fauna and flora by regulating trade therein, all **CITES APPENDIX II** species, plus certain others (including some non-CITES species) that are considered to need a similar level of protection.

Annex C species In relation to Council Regulation (EC) No 338/97 of 9 December 1996 on the protection of species of wild fauna and flora by regulating trade therein, all **CITES APPENDIX III** species, apart from those which EU countries have entered a reservation for and are included in Annex D.

Annex D species In relation to Council Regulation (EC) No 338/97 of 9 December 1996 on the protection of species of wild fauna and flora by regulating trade therein, certain non-CITES species that have been imported into the EU in high enough numbers to need monitoring.

annual plant A plant that germinates, flowers and dies within a single growing season or year. See also **PERENNIAL PLANT**

annual stock list See **STOCK LIST**

anoestrous, anestrus Relating to a female who is not experiencing an **OESTROUS CYCLE** and is not sexually receptive.

anoestrus, anestrus A period of sexual inactivity in female mammals between two periods of **OESTRUS**.

anogenital Relating to the area around the anus and genitals.

ANOVA Analysis of variance. A statistical method which compares the means of samples from several populations. It analyses the total variation shown by the data, splits this into the variation within the samples and the variation between the samples, and then compares these two components.

anovulatory The state of not ovulating. See also **OVULATION**

anoxic Relating to the absence of oxygen; a pathological deficiency of oxygen, e.g. anoxic water; anoxic seizure. See also **ANAEROBIC**

Anseriformes An order of birds: geese, swans, ducks, screamers.

antagonistic Functioning in an opposite manner or having opposite effects, e.g. the biceps and triceps are antagonistic muscles because they have opposite effects on the movement of the forelimb; **INSULIN** and **GLUCAGON** are antagonistic hormones because they have opposite effects on glucose.

Antarctic Relating to Antarctica: the continent which lies chiefly within the Antarctic Circle and is centred on the South Pole.

Antarctic Conservation Act of 1978 (USA) A US law which provides for the conservation and protection of Antarctic flora and fauna. It makes it unlawful for anyone in the US to possess, sell, offer for sale, deliver, receive, carry, transport, import into or export from the US any native mammal or bird taken in Antarctica.

Antarctic region See **FAUNAL REGIONS**

Antarctic Treaty 1959 An international agreement to use **ANTARCTICA** exclusively for peaceful purposes. The treaty requires parties to consider measures that should be taken regarding the preservation and conservation of living resources in Antarctica. See also **CONVENTION FOR THE CONSERVATION OF ANTARCTIC SEALS 1972**, **CONVENTION ON THE CONSERVATION OF ANTARCTIC MARINE LIVING RESOURCES 1980 (CCAMLR)**

antelope A member of the mammalian family Bovidae which is not a bison, buffalo, goat, sheep or cattle. It is not a recognised taxon. The term refers to many species of **EVEN-TOED UNGULATES**, most of which occur in Africa, although some species are found in Asia. They possess horns which are directed upward and backward which they do not shed, and have a graceful appearance, with long legs. See also **DEER**

antennal gland, green gland An excretory organ in the head of some crustaceans which excretes excess sulphate and magnesium and conserves calcium and potassium.

anterior At or near the head or front of the body, or front of a structure (Fig. A8). *Compare POSTERIOR*

anterior pituitary The anterior lobe of the pituitary gland located at the base of the brain. It consists partly of the adenohypophysis which secretes several hormones (e.g. **FOLLICLE-STIMULATING HORMONE (FSH)** and **LUTEINISING HORMONE (LH)**) in response to stimulation from other hormones secreted by the **HYPOTHALAMUS** (e.g. **GONADOTROPHIN-RELEASING HORMONE (GNRH)**). It also secretes **PROLACTIN**, thyrotrophic hormone and **ADRENOCORTICOTROPHIC HORMONE (ACTH)**.

anthelmintic An agent which kills or expels parasitic worms from the gut. Also called a vermicide if it kills the worm or a vermifuge if it expels it.

anthrax A disease caused by the bacterium *Bacillus anthracis*. It is found in mammals, especially herbivores, and is usually fatal. The bacterium may form highly resistant spores which may live in the soil for 10 years or more and still be capable of infection. Spores have been found in bone-meal, wool, hides, feeds and blood fertilisers, and they may be carried to the soil surface by earthworms. Infection may be spread by ingesting spores in food or water, through a cut or by inhalation. Three forms of anthrax are recognised. In peracute cases animals may be found dead without having shown any signs. Acute cases exhibit a raised temperature, rapid pulse, 'blood-shot' eyes, cold feet and ears, followed by prostration, unconsciousness and death. In subacute cases the animal may linger for up to 48 hours with a very high temperature and laboured respirations. Swellings may occur in the neck and lower chest. A 'carbuncle' may form at the site of infection if infected through the skin. Early administration of antibiotics may be effective.

Anthropocene An informal term for the period during which human activity has had a significant effect on the Earth's ecosystems, from the beginning of farming approximately 8000 years ago until the present. *See also* **HOMOGOCENE**

anthropoid ape A member of the primate suborder Anthropoidea (monkeys, apes and humans).

anthropology The study of humanity, including human **EVOLUTION** and our relationship with other **PRIMATES** (physical anthropology), social and cultural organisation (including relationships with non-human animals) and the development of **LANGUAGE**.

anthropomorphism The attribution of human traits to other animals. *See* **MR. ED**

anthrozoology The scientific study of the interactions and relationships between animals and people. This is a relatively new multi-disciplinary subject

which encompasses **ZOOLOGY**, **PSYCHOLOGY**, sociology, and veterinary science. *See also* **ANTHROZOÖS**, **INTERNATIONAL SOCIETY FOR ANTHROZOOLOGY (ISAZ)**

Anthrozoös An academic journal which reports studies on the interactions between people and animals from a range of disciplines including **ANTHROPOLOGY**, archaeozoology, art and literature, education, **ETHOLOGY**, history, human medicine, **PSYCHOLOGY**, sociology and **VETERINARY MEDICINE**. It is the official journal of the **INTERNATIONAL SOCIETY FOR ANTHROZOOLOGY (ISAZ)**.

antiaphrodisiac A **PEROMONE** that discourages mating, usually produced after a female has mated. In some reptiles (e.g. garter snakes (*Thamnophis*)), after copulation part of the ejaculate forms a **SPERM PLUG** in the **CLOACA (1)** that emits a substance that deters males.

antibiotics A group of organic compounds produced by spore-forming organisms (fungi and bacteria). They interfere with protein synthesis in pathogens and are used to treat a variety of bacterial infections and as antitumour agents, antiparasite agents, ruminant growth promoters, insecticides and for other purposes. Sir Alexander Fleming first observed that a strain of *Penicillium* prevented growth in the bacterium *Staphylococcus*. *See also* **BROAD-SPECTRUM ANTIBIOTIC**

antibody, immunoglobulin A protein from plasma cells (formed from a **B-LYMPHOCYTE**) that binds to a specific foreign molecule (**ANTIGEN**) as part of the body's **IMMUNE REACTION**.

anticoagulant A drug or other substance that prevents or slows down **BLOOD CLOTTING**. *See also* **WARFARIN**

anticodon The triplet sequence of **TRANSFER RNA (TRNA)** nucleotides which is capable of base-pairing with the **CODON** triplet of a **MESSANGER RNA (mRNA)** molecule by virtue of their complementary nature.

antidiuretic A hormone which reduces urine output. *Compare* **DIURETIC**

antidote A drug, or other agent, that prevents or counteracts the action of a poison.

anti-emetic A drug which prevents vomiting.

antifreeze A chemical in some animals that lowers the freezing point by changing the arrangement of water molecules in body fluids, thereby allowing them to survive in subzero temperatures. Glycerol is an important antifreeze in many insects and some frog species. Some Antarctic fishes produce antifreeze peptides and antifreeze glycopeptides.

antifungal Having the action of preventing the growth of, or destroying, fungi.

antigen A molecule, usually foreign to the body, which stimulates the production of **ANTIBODIES**.

antihistamine A drug used to give relief from allergic conditions by blocking the action of **HISTAMINE**.

Used, for example, to treat allergic skin diseases in cats and dogs.

anti-inflammatory Having the effect of reducing **INFLAMMATION**.

antioxidant A substance (e.g. **VITAMIN C**, **VITAMIN E**) which prevents or slows down the oxidation of stored foods etc. by molecular oxygen. It neutralises free radicals which may cause cell damage and cell death, so protects against some diseases.

anti-predator behaviour Defensive behaviour which protects against predators. *See also* **ALARM CALL**, **CAMOUFLAGE**, **ESCAPE BEHAVIOUR**, **MIMICRY**

antiseptics The containment or destruction of disease-causing organisms. *See also* **ANTISEPTIC**

antiseptic

1. Any substance that kills or inhibits the growth of bacteria and other microbes. It is not toxic to the skin so may be used to clean wounds. Alcohol and iodine function as antiseptics.
2. Relating to any such substance.

antiseptic mat A mat containing **ANTISEPTIC** which may be located at the entrance to a zoo enclosure, a **QUARANTINE** area, a farm or similar place to prevent the spread of **INFECTIOUS** disease on footwear.

antiserum **SERUM** that contains **ANTIBODIES** to a **TOXIN** or other **ANTIGEN**.

antivenene *See* **ANTIVENIN**

antivenin, antivenene An antidote or **ANTISERUM** to a **VENOM**, especially that of a snake. *See also* **MILKING (2)**

anti-zoo group An organisation that opposes the existence of zoos and campaigns for the closure of zoos and the transfer of their animals to **SANCTUARIES**. *See also* **BORN FREE FOUNDATION**, **ZOO CHECK**

antler A bony growth on the head of antelopes, deer and some other **EVEN-TOED UNGULATES**. Consists of dermal bone initially covered by furry skin called velvet. Shed and re-grown annually. May be used to age individuals in some species. Antlers only occur in mature males, except in reindeer (*Rangifer tarandus*). *Compare* **HORN**

Anura An order of amphibians: frogs and toads.

anus The opening at the end of the **ALIMENTARY CANAL** through which faeces are expelled.

anvil behaviour The use by an animal of a rock or other hard structure to break open a food object or to break food into smaller pieces. Birds such as thrushes (*Turdidae*) break snail shells open on rocks. These anvils can be identified by the presence of shell debris. Wild capuchin monkeys (*Cebus libidinosus*) use stones as tools to smash open nuts on stone anvils. The sixbar wrasse (*Thalassoma hardwicke*) has been observed in aquarium conditions using a rock as an anvil to break hard food pellets into pieces small enough to swallow. *See* **TOOL USE**

anxiety A strong feeling of fear or distress. Occurs as a normal response to a stressful or dangerous situa-

tion. Signs may include trembling, rapid pulse, sweating, dry mouth. *See also* **STRESS**

aorta

1. Largest artery in vertebrates, which carries oxygenated blood from the heart (left ventricle) to the body tissues.
2. Anterior part of the arthropod heart.

apathy A lack of emotion, feeling or interest; impassive, indifferent, listless. A lack of response to environmental stimuli. *Compare* **RESPONSIVENESS**

ape A general term for hominoid primates belonging to the families Pongidae (**GREAT APES**) and Hylobatidae (gibbons and siamangs, the **LESSER APES**).

apex predator, alpha predator, super carnivore, super predator, top carnivore, top predator A **PREDATOR** which, when adult, has no natural predators within its natural environment. An animal occupying the last **TROPHIC LEVEL** in many **FOOD CHAINS** or **FOOD WEBS**.

APHIS *See* **ANIMAL AND PLANT HEALTH INSPECTION SERVICE (APHIS)**

apiary, bee yard A place where the hives of honey bees are kept for their honey (Fig. A10). A collection of hives. Known as a bee yard in the USA.

apnoea, apnea The cessation of breathing for an uncertain period.

apocrine sweat gland Gland located in the armpit or groin of a mammal which produces odiferous sweat used in social communication.

Apodiformes An order of birds: swifts, hummingbirds.

aposematism The advertisement by an animal of its dangerous or unpleasant properties to others, often because it is venomous or unpalatable. This often takes the form of warning (aposematic) coloration, e.g. the black and yellow markings on the abdomen of stinging wasps and bees and the striped coloration of venomous coral snakes.

apparent dry matter digestibility (ADMD) *See* **GROSS ASSIMILATION EFFICIENCY (GAE)**

appeasement behaviour A **BEHAVIOUR** which is performed to inhibit or reduce the aggression shown by another individual of the same species, especially where escape is impossible. Generally exhibited by **SUBORDINATE INDIVIDUALS** in the presence of **DOMINANT INDIVIDUALS** and may involve the hiding or turning away of weapons such as claws and bills and the exposure of vulnerable parts of the body, such as the abdomen. In mammals appeasement behaviour often involves lowering the head and body or rolling onto the back to expose the underbelly. Sometimes appeasement involves the **RITUALISATION** of juvenile behaviour, e.g. food begging. *See also* **AGONISTIC BEHAVIOUR**

appendicitis Inflammation of the **APPENDIX (1)** caused by obstruction of the lumen by faeces, infection, **CANCER** etc.

appendicular skeleton The part of the skeleton of vertebrates which consists of the **PECTORAL GIRDLE**, the **PELVIC GIRDLE** and paired limbs or fins.



Fig. A10 Apiary. Inset: bees entering and leaving.

appendix

1. In anatomy, a small diverticulum of the **CAECUM** in humans, many other primates and rodents, which contains **LYMPHOID TISSUE**. *See also* **APPENDICITIS**

2. In law, additional material added at the end of a legal instrument which contains details of, for example, protected species, e.g. **CITES APPENDIX I**.

appetite A desire for food and incentive to eat; a combination of hunger and the perceived quality of available foods. A hungry animal has no appetite in the absence of food or indicators of its presence, e.g. other animals feeding. Appetite is an important determinant of food selection and experiments have shown that, given the opportunity, animals will select foods that meet nutritional deficiencies and avoid **POISONS**. Control centres for feeding and satiety are located in the **HYPOTHALAMUS**. *See also* **CAFETERIA EXPERIMENT**

appetitive behaviour Goal-seeking, **EXPLORATORY BEHAVIOUR**, e.g. actively searching for prey. When the **GOAL** is reached appetitive behaviour normally ceases. *See also* **CONSUMMATORY BEHAVIOUR**

approved vet, accredited vet A veterinary surgeon who has undergone an approved programme of training and is accredited by or registered with an appropriate government body or professional veterinary organisation, e.g. in the UK, one who is regis-

tered with the **ROYAL COLLEGE OF VETERINARY SURGEONS (RCVS)**.

aquaciser *See* **UNDERWATER TREADMILL**

aquaculture The cultivation of aquatic animals (especially fish, molluscs and crustaceans) or plants for food.

aquaponics A food production system in which fish (and other aquatic organisms such as prawns and crayfish) are reared in tanks and the effluent from these tanks is used as fertiliser for plants grown hydroponically. *See also* **FISH FARM**

aquarist A person who works with and cares for fish in a captive environment, e.g. an **AQUARIUM (1)**.

aquarium

1. Place where fish and other aquatic species are kept for research or exhibition. Derived from the terms 'aquatic' and '**VIVARIUM**'. *See also* **BLUE PLANET, FISH HOUSE, MARINELAND, SHEDD AQUARIUM**. *Compare* **OCEANARIUM**

2. A single tank used for keeping fish.

Aquarium for Wildlife Conservation The name of the New York Aquarium since 1993. *See also* **WILDLIFE CONSERVATION SOCIETY (WCS)**

aquascape A scenic view artificially created in an aquarium or other body of water, by arranging aquatic plants, stones, rocks, drift wood, trees, roots and other features in an aesthetically pleasing and usually naturalistic way. Aquascaping is used by large aquariums and hobbyists to create naturalistic

environments for fish and other aquatic organisms. A number of different styles exist, e.g. *Dutch Nature Aquarium*, *Jungle*, and contests are held between members of specialist clubs.

aquated See **UNDERWATER TREADMILL**

Arab A horse breed, originating from the Arabian Peninsula, which is famous for its intelligence, speed and grace.

Arabian oryx (*Oryx leucoryx*) A rare species of large antelope native to the Middle East. During the first half of the twentieth century the Arabian oryx population declined rapidly as a result of hunting. By the 1960s only a handful of oryx remained in Oman. The last one was shot here in 1972. In 1961 the Fauna Preservation Society (now **FAUNA AND FLORA INTERNATIONAL (FFI)**) launched 'Operation Oryx'. They captured three wild oryx and obtained others from zoos and private collections in the Middle East. Eventually, a captive population was established at Phoenix Zoo in Arizona and Los Angeles Zoo in California. By 1964 there were 13 oryx in captivity in the USA. The Arabian oryx was first returned to the New Shaumari Reserve in Jordan in 1978. Later oryx were released in the Jiddat al-Harasis plateau in Oman. The first five animals arrived in 1980 and by 1996 there were 450 free-ranging animals. Around 50 zoos currently hold some 900 oryx in captivity.

Arachnida A class of arthropods: spiders, mites and scorpions.

arachnoid membrane The membrane that covers the brain. It contains **VILLI** through which **CEREBRO-SPINAL FLUID (CSF)** drains into the blood.

arachnophobia Fear of spiders. Some zoos (e.g. **LONDON ZOO** and **DUDLEY ZOO**) run special programmes or workshops to help people overcome their fear of spiders.

ARAZPA See **ZOO AND AQUARIUM ASSOCIATION (ZAA)**

arboreal Relating to trees, living in trees and adapted to life in trees, e.g. a spider monkey is an arboreal animal. Compare **CURSorial**

archipelago A chain or cluster of islands, e.g. **GALAPAGOS ISLANDS**.

architecture See **ZOO ARCHITECTURE**

archive A collection of material, often of historical interest. Zoos often keep archives of their own publications, old photographs etc., usually in the zoo's library. Such materials may be useful to researchers.

Arctic

1. The area around the north pole.

2. Relating to this area.

Used as the theme of some zoo exhibits, e.g. the **ARCTIC RING OF LIFE** at Detroit Zoo.

Arctic Ring of Life The world's largest polar bear exhibit. A major exhibit at Detroit Zoo which contains polar bears, arctic foxes and seals. Contains an underwater acrylic tunnel from which swimming polar bears and seals can be observed, and simulated ice and tundra landscapes (Fig. B1).

Argentiniformes An order of fishes: herring smelts, barreleyes and their allies.

Aristotle (384–322 BC) A Greek philosopher and teacher who wrote widely on scientific subjects. The first person to classify animals into groups. His major works include **HISTORY OF ANIMALS**, *On the Parts of Animals*, *On the Progression of Animals* and *On the Generation of Animals*.

Arizona–Sonora Desert Museum A private, non-profit organisation dedicated to the conservation of the Sonoran Desert in Arizona. It is a world-renowned zoo, natural history museum and botanical garden whose exhibits recreate the natural landscape of the Sonoran Desert Region. It contains more than 300 animal species and 1200 kinds of plants. It was founded in 1952 by William Carr and Arthur Pack.

ark

1. A term used to refer to the role of zoos in maintaining **INSURANCE POPULATIONS** of species in captivity, drawing parallels with the biblical story of Noah taking pairs of animals onto his ark to escape from a flood. The Holy Bible (King James Version), Genesis Chapter 7 (v 1–3): '*And the Lord said unto Noah, Come thou and all thy house into the ark; for thee have I seen righteous before me in this generation. Of every clean beast thou shalt take to thee by sevens, the male and his female: and of beasts that are not clean by two, the male and his female. Of fowls also of the air by sevens, the male and the female; to keep seed alive upon the face of all the earth.*'

See also **AMPHIBIAN ARK (AARK)**

2. Animal ark; a small house for keeping animals such as poultry or pet rabbits. See also **POULTRY ARK**

ARKive See **WILDScreen**

ARKS number An identification number assigned to an individual animal within the **ANIMAL RECORD KEEPING SYSTEM (ARKS)** used by many zoos to keep track of family relationships and animal movements between institutions etc.

ARKS4 See **ANIMAL RECORD KEEPING SYSTEM (ARKS)**

arrhythmia A change from the normal rhythm of the **HEARTBEAT**.

art in zoos See **ZOO ART**

arteriole The smallest diameter artery which carries blood from a larger **ARTERY** into a **CAPILLARY**.

artery A blood vessel that carries blood from the heart to the body tissues. The blood is usually oxygenated but not always. Vertebrate arteries have thick elastic walls made of smooth muscle and connective tissue, with an inner lining of endothelium and a narrow **LUMEN**. Arteries branch to form smaller **ARTERIOLES**.

arthritis Inflammation of the joints associated with swelling, pain, local heat and restricted movement of the affected parts. See also **OSTEOARTHRITIS**

arthropod A member of the phylum **ARTHROPODA**.

A

Arthropoda A **PHYLUM** of animals. The arthropods are segmented animals possessing a hard outer skeleton (**EXOSKELETON**) – made of the polysaccharide chitin – with paired, jointed limbs, e.g. insects, crabs, woodlice, spiders. They are advanced animals, many of which have developed impressive swimming, running or flying abilities. In many groups the exoskeleton is toughened with mineral salts, e.g. calcium carbonate. The muscular system is highly specialised and the legs are hinged, allowing the exoskeleton to move. The exoskeleton provided this group with the necessary structural support to evolve systems for walking on land.

arthroscope A fibre-optic **ENDOSCOPE** used in the examination of joints.

Article 10 certificate A certificate which authorises the sale and movement of CITES **ANNEX A SPECIES** within the EU. *See also* **ARTICLE 60 CERTIFICATE, CITES**

Article 60 certificate A certificate which allows a zoo to display specimens of CITES **ANNEX A SPECIES** to the public and trade specimens with other Article 60 holders in the **EUROPEAN UNION (EU)** without the need to apply for individual **ARTICLE 10 CERTIFICATES**. Formerly known as an Article 30 certificate. *See also* **CITES**

artificial embryo twinning A relatively low-tech type of **CLONING**. The process is essentially the same as that which produces identical twins in nature. It is accomplished in the laboratory by manually separating a very early **EMBRYO** into individual cells. Each cell is then allowed to divide and develop on its own. Each embryo that results is then implanted in a **SURROGATE (2)** mother.

artificial insemination (AI) The introduction of semen which has been collected from a male animal into the reproductive tract of a female animal for the purpose of creating a pregnancy without the need for the animals to mate. Techniques are well established for many farm animals and have more recently been developed for the purpose of captive breeding endangered species. The method has the advantage of allowing breeders to determine which animals breed and removes the need to transport males to females. It also allows semen to be collected from wild individuals to increase the **GENE POOLS** of captive populations in zoos. *See also* **ARTIFICIAL VAGINA (AV), BALAI DIRECTIVE 1992, CATHETER, ELECTRO-EJACULATOR, INDUCED OVULATOR, SEX-SORTED SEMEN**

artificial litter *See* **LITTER (1)**

artificial milk *See* **MILK SUBSTITUTE**

artificial selection Selection for particular hereditary traits during breeding controlled by humans. Important in increasing egg production in poultry, milk yield in cattle, speed in racehorses, and in producing the characteristic features of the various breeds of domestic pets. *Compare* **NATURAL SELECTION**

artificial uterus A life support system for embryos maintained outside the mother's body. An artificial

UTERUS consisting of a series of tanks, tubes and fluid-exchange systems equipped with monitoring equipment has been constructed at Port Stephens Fisheries Institute in New South Wales, Australia, and successfully used for the rare dwarf ornate wobbegong shark (*Orectolobus ornatus*).

artificial vagina (AV) A device which uses thermal and mechanical stimulation to induce ejaculation and collect semen from many species, especially cattle and horses, but also sheep, goats, rabbits and even cats.

artiodactyl A member of the order **ARTIODACTYLA**.

Artiodactyla An order of mammals. Even-toed ungulates: pigs, peccaries, hippopotamus, camels, llamas, okapi, giraffe, chevrotains, deer, musk deer, pronghorn, antelopes, cattle, bison, buffalo, goats, sheep (Fig. V2).

Arusha Conference An international conference of conservationists which considered the future of the fauna and flora of Africa, held in Arusha, Tanzania, in 1961. The speech given by the Tanzanian President Mwalimu Julius Nyerere became known as the *Arusha Manifesto* and made a commitment to conserve the wildlife of Africa.

ascites An accumulation of fluid in the **PERITONEAL CAVITY**. In **BROILER** chickens it is associated with poor **VENTILATION (3)**, and inadequate oxygen supply (especially at high altitude). Some strains are predisposed to the condition. *See also* **SLOWER-GROWING BROILER BREEDS**

ascorbic acid *See* **VITAMIN C**

asexual reproduction Reproduction which does not involve the fertilisation of a female gamete by a male gamete, e.g. fission, budding. *See also* **PARTHENOGENESIS. Compare** **SEXUAL REPRODUCTION**

Asian Elephant Conservation Act of 1997 (USA) A US law designed to assist in the conservation of Asian elephants (*Elephas maximus*) by supporting and providing financial resources for the conservation programmes of range states and projects of persons with demonstrated expertise in the conservation of Asian elephants, but not captive breeding unless for release into the wild.

ASPCA *See* **AMERICAN SOCIETY FOR THE PREVENTION OF CRUELTY TO ANIMALS (ASPCA)**

aspect ratio (AR) The ratio of the length to the width of a bird's wing.

$$AR = \frac{\text{wing length}}{\text{wing width}}$$

A high aspect ratio indicates long wings such as those found in gliding and soaring birds, e.g. many large soaring **BIRDS OF PREY** such as condors and **SEABIRDS** such as albatrosses. A low aspect ratio indicates short, wide wings such as those seen in small **PASSERINES, GAME BIRDS** and small hawks. Such wings are designed for rapid take-off and manoeuvrable flight. Examples of aspect ratios:

pheasant = 6.8; gull = 13.8; albatross = 20. *See also* **WING LOADING (WL)**

aspergillosis A severe respiratory disease of birds caused by the fungus *Aspergillus*. Infections can occur in the ear canal, eyes, nose, sinus cavities and lungs and may even affect the brain. Aspergillosis takes the form of an acute rapidly fatal **PNEUMONIA** in young chickens and turkeys.

asphyxia Suffocation by any cause that interferes with breathing (e.g. choking, drowning, inhalation of toxic gas) causing a loss of consciousness or death due to insufficient oxygen in the body (**HYPOXIA**) and increased levels of carbon dioxide in the **BLOOD** and **TISSUES**.

Aspinall, John (1926–2000) A British zoo owner who made his fortune as a bookmaker and owner of a gambling club. He founded Howletts and Port Lympne Wild Animal Parks in Kent, UK. Aspinall became notorious because of his willingness to associate freely with dangerous animals such as gorillas and tigers in their cages and to allow his family and staff to do so. Over a 20-year period five keepers were killed: three by tigers at Howletts and two by elephants at Port Lympne Wild Animal Park. In spite of initially being treated as an outcast by the zoo community, Aspinall achieved considerable breeding success, notably with gorillas.

aspiration *See* **PULMONARY ASPIRATION**

aspiration pneumonia *See* **INHALATION PNEUMONIA**

aspirator *See* **SUCTION DEVICE**

ass *See* **DONKEY**

assay The determination of the amount of a particular constituent of a mixture, or of the potency of a drug, e.g. the amount of a particular hormone in the urine. *See also* **BIOASSAY**

assimilated energy The portion of energy ingested as food that is available to the organism for growth, reproduction and storage. *See also* **GROSS ASSIMILATION EFFICIENCY (GAE)**

assimilation Within an organism, the process of absorbing small molecules and converting them into the more complex molecules that make up that organism. *See also* **GROSS ASSIMILATION EFFICIENCY (GAE)**

assimilation efficiency *See* **GROSS ASSIMILATION EFFICIENCY (GAE)**

assist hatch, manual pipping Artificially assisting a bird or reptile to hatch from its egg by breaking the egg surface. An important aid to conservation in species which have difficulty hatching, e.g. kiwis.

assistance animal

1. An animal trained to help a human with a disability perform everyday tasks.

2. In Australia, under the Disability Discrimination Act 1992 s9(2), an assistance animal is defined as 'a dog or other animal:

(a) accredited under a law of a State or Territory that provides for the accreditation of animals trained to assist a person with a disability to alleviate the effect of the disability; or

(b) accredited by an animal training organisation prescribed by the regulations for the purposes of this paragraph; or

(c) trained:

(i) to assist a person with a disability to alleviate the effect of the disability; and

(ii) to meet standards of hygiene and behaviour that are appropriate for an animal in a public place.'

See also **ASSISTANCE DOG, GUIDE DOG, HEARING DOG, HELPER MONKEY**

assistance dog A dog trained to help a human with a disability. *See also* **GUIDE DOG, HEARING DOG**

assisted reproductive technology (ART) The collective term for a number of methods used to improve the reproductive performance of animals including **ARTIFICIAL EMBRYO TWINNING, ARTIFICIAL INSEMINATION (AI), CLONING, EMBRYO TRANSFER (ET), IN-VITRO FERTILISATION, NUCLEAR TRANSFER**. ART is particularly important in the conservation of some very rare species. *See also* **FROZEN ZOO**

association

1. In studies of learning, the pairing of a neutral stimulus with a stimulus which normally elicits a response such that eventually the **NEUTRAL STIMULUS** (e.g. a sound) may elicit the response in the absence of the original stimulus through the process of conditioning.

2. In social behaviour, a relationship between two individuals inferred by virtue of their being observed in close proximity. *See also* **ASSOCIATION INDEX, MAINTENANCE OF PROXIMITY INDEX (MPI)**

3. A group of people or organisations that have a common interest, e.g. **ASSOCIATION OF ZOOS AND AQUARIUMS (AZA)**. *See also* **KEEPER ASSOCIATION, ZOO ORGANISATIONS**

Association for the Study of Animal Behaviour (ASAB)

An organisation, founded in 1936, to promote the study of animal behaviour. The majority of its 2000 members are drawn from Britain and Europe. Publishes the journal **ANIMAL BEHAVIOUR** in collaboration with the **ANIMAL BEHAVIOR SOCIETY (ABS)**.

association index A measure of the extent to which an individual animal has spent time associating with another individual. The index is calculated for each **DYAD** in the group. In a group of three, A, B and C, the dyads are A-B, A-C and B-C. In its simplest form, the association index for A-B may be calculated as:

$$I_{AB} = \frac{2J}{N_A + N_B}$$

where J is the number of times A and B were seen together (including in a group with others), N_A is the total number of times A was seen (alone or as part of a group) and N_B is the total number of times B was seen (alone or as part of a group). If the value

A

is zero the two animals have never been recorded together; if it is one, they are always recorded together. A number of other formulae are available for calculating an association index. *See also* **INDIVIDUAL DISTANCE**, **MAINTENANCE OF PROXIMITY INDEX (MPI)**

Association of British and Irish Wild Animal Keepers (ABWAK) A **KEEPER ASSOCIATION** founded in 1974. Its members are interested in the keeping and conservation of wild animals and it seeks to achieve the highest possible standards in animal welfare. ABWAK is involved in the training, education and development of keepers and publishes a journal called *Ratel*.

Association of Lawyers for Animal Welfare A UK charity which brings together lawyers interested in animal protection law with the purpose of sharing experience, securing more effective animal protection laws and better enforcement of existing laws.

Association of Veterinarians for Animal Rights An association which works toward the acquisition of rights for all non-human animals by educating the public and the veterinary profession about non-human animal use.

Association of Zoos and Aquariums (AZA) A non-profit organisation, founded in the United States in 1924, dedicated to the advancement of zoos and aquariums in the areas of conservation, education, science and recreation. It was formerly the American Association of Zoos and Aquariums. It established the **SPECIES SURVIVAL PLAN® (SSP) PROGRAMS** in 1981 to manage and conserve selected threatened or endangered species. The AZA is based in Silver Spring, Maryland.

assurance population *See* **INSURANCE POPULATION**

asthma A chronic inflammatory disorder which results in obstruction of the airways when the bronchi fill with mucus and go into spasm as a result of an **ALLERGIC REACTION** causing wheezing, coughing and breathing difficulties. An asthma attack may be caused by irritants such as smoke or allergens such as animal hair, feathers, mould, pollen, dust and some foods and drugs. Asthma can be a problem for people who work with animals, food and bedding materials. It also occurs in some animals, e.g. cats, dogs, horses. *See also* **ATOPY**

Astley, Philip (1742–1814) An English ex-cavalryman who established a riding school and later the first circus in England at Astley's Royal Amphitheatre which opened in London in 1795 after the original building had burnt down.

asymmetry A form which is incapable of being bisected into two identical halves. *See also* **BILATERAL SYMMETRY**, **PENTAMEROUS (RADIAL) SYMMETRY**, **RADIAL SYMMETRY**

asymptomatic Exhibiting no **SIGNS (1)** of a disease. Strictly speaking the term symptom does not apply to animals.

asymptomatic carrier An animal that is a carrier of a disease, exhibits no **SIGNS (1)**, but may transmit it to another animal. Strictly speaking the term symptom does not apply to animals.

Ateleopodiformes An order of fishes: jellynose fishes.

Atheriniformes An order of fishes: silversides, rain-bowfishes and their allies.

atlas

1. The first cervical vertebra which is located at the anterior end of the vertebral column and articulates with and supports the skull. Allows nodding movement of the head. *See also* **AXIS (2)**

2. A bound collection of maps showing, for instance, the distribution of a particular taxon of animals, e.g. an atlas of the breeding birds of Britain, an atlas of the mammals of North America. Often based on presence or absence in 10km squares.

3. A book of photographs of anatomical or histological structures, e.g. an atlas of histology, *A Colour Atlas of Veterinary Dentistry and Oral Surgery*.

atopic Relating to **ATOPY**.

atopy A genetic predisposition toward the development of hypersensitivity to substances (**ANTIGENS**) in the environment, e.g. **ASTHMA**, **DERMATITIS**.

ATP *See* **ADENOSINE TRIPHOSPHATE (ATP)**

atrioventricular (AV) node A small area of specialised tissue which is located between the atria and ventricles of the heart. It receives a wave of excitation which passes from the **SINOATRIAL (SA) NODE** and conducts it to the ventricles causing them to contract after a short delay, which ensures that the ventricles have been filled with blood by the contracting atria before they contract themselves.

atrium (atria pl.)

1. A chamber within the **HEART**. In mammals there are two: the right atrium receives deoxygenated blood from the body and pumps it to the right ventricle which then pumps it to the lungs; the left atrium receives oxygenated blood from the lungs and pumps it to the left ventricle from where it is pumped around the body. *See also* **AURICLE (1)**

2. A general anatomical term for a chamber.

3. In architecture, a large open space inside a building.

4. Central chamber (spongocoel) of a sponge.

atrophy A reduction in the size of a structure, usually involving the destruction of cells. May be under genetic or hormonal control.

Attenborough, David (1926–) Sir David Attenborough is an English naturalist, author and broadcaster whose name is synonymous with the production of high-quality wildlife documentaries. His highly acclaimed BBC series include *The Life of Mammals*, *The Life of Birds*, *Life in the Undergrowth*, *The Blue Planet*, *Life in the Freezer*, *Life in Cold Blood*, *Planet Earth* and *Africa*. Attenborough's work has undoubtedly been extremely important in increasing awareness of conservation issues worldwide.

attendance See **VISITOR ATTENDANCE**

attenuated vaccine A vaccine which has been prepared from live microbes whose disease-producing ability has been weakened but which still retain their immunological properties.

attracting power In visitor studies, a measure of the number and kinds of visitors attracted to an **ANIMAL EXHIBIT**. Often measured as the number of visitors who stop at the exhibit expressed as a percentage of the total number who pass by. See also **HOLDING POWER**

ATV See **QUAD BIKE**

auditory Relating to hearing or the organs associated with hearing.

auditory enrichment A **SENSORY ENRICHMENT** technique that uses sound, e.g. music, to improve the environment of a captive animal. Music is played to shy, nervous animals, e.g. okapi (*Okapia johnstoni*); some cows on farms are played music to keep them calm thereby increasing milk production.

auditory ossicles See **EAR OSSICLES**

auditory signals See **ACOUSTIC SIGNALLING**

Audubon See **NATIONAL AUDUBON SOCIETY**

Audubon, John James (1785–1851) An American ornithologist, collector, artist and writer. He is commemorated in the name of Audubon's oriole (*Icterus graduacauda*). See also **NATIONAL AUDUBON SOCIETY**

Aulopiformes An order of fishes: lizardfishes and their allies.

auricle

1. An alternative, out-dated, name for an **ATRIUM (1)** of the heart.
2. A **PINNA (1)** (external ear) or any structure of similar shape.

Australasian region See **FAUNAL REGIONS**

Australasian Species Management Program (ASMP)

A captive breeding programme operated in Australasia by the **ZOO AND AQUARIUM ASSOCIATION (ZAA)**. Under the ASMP there are 14 **TAXON ADVISORY GROUPS (TAGs)** and more than 100 programmes.

Australian Animal Health Laboratory A national facility for animal health in Australia whose purpose is to protect the country against the threat of exotic and emerging animal diseases. It provides diagnostic services and surveillance capabilities.

autecology The **ECOLOGY** of individual species; the study of the relationship between a single **SPECIES** and the **ENVIRONMENT**. Compare **SYNECOLOGY**

auto drafter A device which automatically sorts livestock, e.g. sheep. Animals are briefly held in a **RACE** where they are identified using **RADIO FREQUENCY IDENTIFICATION (RFID) TECHNOLOGY** (e.g. by tags). An automatically operated pens system then sorts individuals into different pens based on specified criteria, e.g. sex, weight etc. This equipment may be combined with a **WALK-OVER**

WEIGHING SYSTEM. See also **ANIMAL RECOGNITION TECHNOLOGY**

autoclave, steriliser A device that sterilises laboratory and veterinary equipment etc. (e.g. test tubes, **AGAR PLATES**) using steam under high pressure.

autoimmune disease An **IMMUNE REACTION** exhibited by an animal against its own molecules.

automata, animals as A view held by **DESCARTES** that animals are not conscious beings but simply self-operating machines that respond to simple instructions (like robots). This attitude to animals does not require us to care about **ANIMAL WELFARE** or how we treat them.

automated cat flap A small door which allows a particular domestic cat access to a house or other place after it has been identified using **RADIO FREQUENCY IDENTIFICATION (RFID) TECHNOLOGY**. See also **SMART DOOR**

automated feeding system A method of controlling the amount of feed individual animals receive in a livestock rearing system, often by only delivering food when a sensor linked to a computer detects the presence of a **TRANSPONDER (1)** attached to the animal. See also **RADIO FREQUENCY IDENTIFICATION (RFID) TECHNOLOGY, WET FEEDING**

automatic egg turner A device that turns eggs during incubation in an incubator to ensure an even warming, simulating the action of parent birds.

automatic food dispenser A programmable device designed to provide food for an animal at predetermined intervals. Many designs are available for feeding a variety of pets, from cats and dogs to lizards and fishes.

automatic water drinker A wall-mounted drinking water bowl fitted with a valve which causes it to fill automatically when the water level falls after use. Used for horses, bovids and other livestock. See also **NOSE FILL DRINKER**

automimicry Protection conferred on the harmless (or non-toxic) members of a species by virtue of their resemblance to harmful (or toxic) members of the same species. For example, female bees possess stingers while males of the same species do not; some butterfly larvae absorb toxins from poisonous plants while other individuals of the same species feed on non-poisonous plants. Compare **AGGRESSIVE MIMICRY, BATESIAN MIMICRY, MÜLLERIAN MIMICRY**

autonomic nervous system (ANS), involuntary nervous system The part of the vertebrate visceral nervous system (**PERIPHERAL NERVOUS SYSTEM (PNS)**) which supplies the **SMOOTH MUSCLES** and glands (the visceral motor system) and involuntarily controls organs. Divided into the **SYMPATHETIC NERVOUS SYSTEM (SNS)** and **PARASYMPATHETIC NERVOUS SYSTEM (PNS)**.

autonomous recording unit (ARU) A sound recording unit designed to record at preset intervals and durations, and save the sounds to a built-in hard

A

drive. Used to detect the presence of species, e.g. birds and bats, especially in inaccessible places such as caves and roof spaces.

autopsy See **POST-MORTEM (2)**

auto-reset pest traps Rat and squirrel traps which kill individuals without poison by crushing them with a powerful air-ram (operated by compressed air), remove the dead animals, and then reset themselves.

autosome Any **CHROMOSOME** that is not a **SEX CHROMOSOME**. Autosomes occur in the same number in males and females. See also **CHROMOSOME NUMBER**

autotomy The voluntary self-amputation of a body part (usually a limb or **TAIL (1)**) often as a result of attack and to escape capture. Occurs in the claws of some **CRUSTACEANS** and the tails of some lizards.

autotroph, primary producer An organism capable of obtaining its energy from inorganic sources by **PHOTOSYNTHESIS** or chemosynthesis. See also **CHEMOAUTOTROPH** Compare **HETEROTROPH**

autotrophic Relating to an **AUTOTROPH**.

aversion

1. A strong dislike of something.
2. Dislike of particular foods. Many species have an **INNATE** aversion to poisonous organisms. Others are capable of aversion learning (by conditioning) as a result of exposure to the sight, smell or taste of a food which has caused illness.

aversion learning See **AVERSION (2)**

aversion test A test which examines whether or not an animal is prepared to experience an aversive stimulus, e.g. an electric shock, in order to achieve a particular goal (e.g. access to food).

Aves A class of vertebrates containing the birds. There are around 10000 species. They are **BIPEDAL**, **HOMEOTHERMIC**, winged animals covered in **FEATHERS**. They reproduce by laying **CLEIDIC EGGS**. They possess a cornified bill (beak) with no teeth. Their forelimbs are developed as wings and most are capable of flight. All birds possess a reversed first toe and fewer than 26 tail **VERTEBRAE**.

avian cholera A contagious disease of birds resulting from infection by the bacterium *Pasteurella multocida*.

avian diphtheria, fowl pox A mild-to-severe, slow developing disease of birds caused by a virus belonging to the avipoxvirus group which is a subgroup of poxviruses.

avian influenza, bird flu, fowl plague This is a **NOTIFIABLE DISEASE** caused by influenza A virus. It mainly affects domesticated fowl but also occurs in ducks, geese, turkeys and most common wild birds. Affected birds may die suddenly. Signs include an elevated temperature, drooping wings and tail, fast and laboured respiration and lack of

movement. The bird may tuck its head under a wing while squatting on its breast. Oedema of the head and neck is common. Vaccines are available but their use depends upon government policy. See also **H5N1 VIRUS**

avian tuberculosis Avian tuberculosis is usually caused by the bacterium *Mycobacterium avium*. In captivity, turkeys, pheasants, quail, cranes, and certain birds of prey are commonly affected.

aviary A place where birds are kept for display or breeding.

aviary hack The process of releasing a bird of prey by keeping it in an aviary (hack aviary) at the release site prior to release. The aviary should have a good view of the surrounding area and one side should be solid. The carer approaches the aviary from this side and provides food via a hatch or pipe. Suitable for old birds, scavengers (e.g. kites and buzzards), owls and kestrels.

aviculture

1. The keeping and breeding of birds in captivity.
2. Under s.27(1) of the **WILDLIFE AND COUNTRY ACT 1981**, "aviculture" means the breeding and rearing of birds in captivity.'

avifauna Bird **FAUNA**, e.g. the avifauna of Morocco.

avoidance A behavioural defence against harmful circumstances which may be innate or learnt as a result of association (avoidance learning), e.g. the avoidance of places where predators occur or poisonous foods. See also **AVERSION (2)**

avoidance learning See **AVOIDANCE**

axial Located along the axis of an organism.

axial skeleton That part of the **VERTEBRATE** skeleton which consists of the **CRANIUM**, **VERTEBRAE**, **RIBS**, **STERNUM**, hyoid and associated cartilages.

axis

1. A plane of symmetry in animals: antero-posterior, dorso-ventral, medio-lateral. Important in the early development of the embryo.
2. Second vertebra, which has been modified to support the head. Allows rotation of the head. See also **ATLAS (1)**

axon A long thin process which extends away from the cell body of some nerve cells (**NEURONES**) towards a target structure (e.g. another neurone). The axon carries nerve impulses which are caused by a wave of depolarisation of its membrane. Myelinated axons are covered with a **MYELIN SHEATH** which increases the rate of conduction of **NERVE IMPULSES**. See also **ACTION POTENTIAL**

AZA See **ASSOCIATION OF ZOOS AND AQUARIUMS (AZA)**

AZK Australasian Zoo Keeping Association (AZK). See also **KEEPER ASSOCIATION**

Aztec zoo See **MONTEZUMA II**