

the simpler forms of animal life, such as amoebae, phagocytosis is a means of feeding; in higher animals it is chiefly a defensive reaction against infection.

Due to the chief credit for recognizing the process of phagocytosis in protecting the body against infection and in vertebrates generally, the most effective cells are the macrophages (large phagocytic cells) and leukocytes (small phagocytic cells). The macrophages are found in the liver, spleen, and lymph nodes, where they remove the blood and lymph of bacteria and other foreign particles. They are also found in all tissues as wandering cells. A cell related to the macrophage is found in the form of a smaller type of phagocyte (granular leukocyte) circulating in the blood until it reaches an area of inflammation, where it crawls through the blood vessel wall, being attracted by substances given off by invading bacteria by means of substances given off.

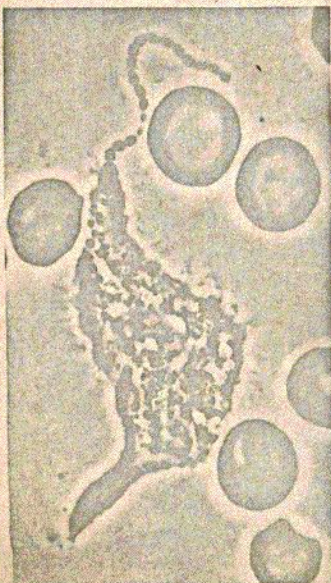
The process is known as chemotaxis. When phagocytosis is accomplished, the phagocyte and particle become one, and whether this is possible depends on the chemical nature of the surface of the particle. On the surface of ordinary proteins from the blood form a layer of leukocytes adhere, and phagocytosis follows. Particles that are ingested with more difficulty. Leukocytes adhering to them, succeed only in pushing them through the lining of a blood vessel, the bacteria are ingested. This process is known as "phagocytosis." Other virulent bacteria may succeed in pushing through until their surfaces are coated with peculiar substances formed by the body in response to the presence of the bacterium. Such globulins are called antibodies and are of great importance in establishing immunity to diseases. (See also IMMUNITY AND IMMUNIZATION.)

In phagocytosis a phagocytic cell ingests a particle of a certain size of the particle. Small particles, such as bacteria, seem to be ingested in a process that when they appear through the microscope to be the process of the phagocyte; at another moment they are seen as objects such as clumps of bacteria or tissue fragments. This is followed by a more prolonged response of the leukocyte, in which it surrounds the object until it has been completely

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PHAGOCYTOSIS OF STREPTOCOCCI BY A LEUKOCYTE, SURROUNDED BY ERYTHROCYTES

chloroform. Under these conditions, the glass is not taken up by the chloroform. Then the glass thread is coated with shellac and, since the chloroform is able to spread on the shellacked surface, the drop of chloroform phagocytizes the glass thread. Finally the chloroform dissolves the shellac and then ejects the uncoated glass thread.

See also BACTERIAL AND INFECTIOUS DISEASES; INFLAMMATION.

See Stuart Mudd, Morton McCutcheon and Balduin Lucké, "Phagocytosis," *Physiol. Rev.*, 14:210-275 (1934); J. Berry and T. T. Spies, *Medicine, Baltimore*, 28:239 (1949); M. R. Smith and W. B. Wood, Jr., *J. Exp. Med.*, 103:509 (1956). (M. McC.)

PHALANGER, a name applied to small to medium-sized, woolly-coated pouched mammals of the family Phalangeridae, native to Australia (where they are called opossums or possums), New Guinea and nearby islands. They have long, often prehensile tails, large claws and opposable, nailless, first hind toes. They are nocturnal in habit and feed on fruit, leaves and blossoms, though a few are insect-eaters. Several species possess gliding membranes between the fore and hind limbs.

Included among the arboreal gliding species are the flying opossums or sugar gliders, *Petaurus*, with several species on the Australian continent, the Aru Islands and New Guinea, and a parachuting form, the minute pygmy glider or feather tail (*Acrobates pygmaeus*) of eastern Australia.

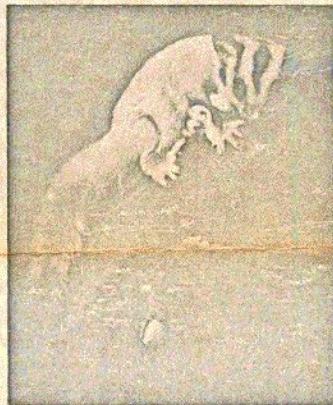
The cuscuses (*Phalanger*) are arboreal animals the size of cats. The tail is prehensile. They inhabit the Solomon Islands, ranging thence to Timor and the Celebes. Nearly allied to these are the Australian forms, of which the common or brush-tailed phalanger (*Trichosurus vulpecula*), about the size of a small fox, is the best known. Others of the family include the pen-tailed phalangers (*Distoechurus*) and the long-snouted phalangers or honey possums (*Tarsipes*). The greater gliders (*Schoinobates*) and the ring-tailed opossums (*Pseudocheirus*) compose, with the koalas, the subfamily Phascolarctinae, which is sometimes elevated to a family. See MARSUPIAL.

PHALARIS, tyrant of Agragas (modern Agrigento) in Sicily c. 570-554 B.C., notorious for his cruelty, was responsible for the building of the Temple of Zeus Atabyrios in the citadel and took advantage of his position to make himself despot. Agragas seems to have prospered under his rule; its splendid planning probably belongs to his time. He fought against the Sicans and extended the territory of Agragas.

In a bronze bull, designed by Perilaus or Perillus, his victims were roasted alive, their shrieks representing the bellowing of the bull. Perilaus himself is said to have been the first victim. A bull of some kind seems historical, though probably embellished by fiction. Phalaris was overthrown by Telemachus, the ancestor of Theron (tyrant c. 488-472), and, it is said, was burned in his own bronze bull.

The later sophists perversely represented Phalaris as a naturally humane and cultured man. Lucian wrote two *Phalaris* speeches; the famous 148 *Letters of Phalaris* were proved by Richard Bentley (*q.v.*) to have been written by a sophist or rhetorician (possibly Adrianus of Tyre, d. c. A.D. 192) hundreds of years after the death of Phalaris. Before their exposure by Bentley the letters were highly thought of, e.g., by Sir William Temple in his *Essay on Ancient and Modern Learning* (1692), though others, such as Politian and Erasmus, perceived that they were not by Phalaris.

For the letters see R. Hercher, *Epistolographi Graeci*, pp. 409-459 (1873); R. C. Jebb, *Bentley*, ch. 4-5 (1882). See also T. J. Dunbabin, *The Western Greeks*, ch. 10 (1948), for history.



PETAURUS SCIUREUS, A FLYING OPOSSUM OF THE PHALANGER FAMILY

in 1697-99