

Domestic pig

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The **domestic pig** (*Sus scrofa domesticus* or *Sus domesticus*), often called **swine**, **hog**, or **pig** when there is no need to distinguish it from other pigs, is a large, even-toed ungulate. It is variously considered a subspecies of the wild boar or a distinct species. The domestic pig's head-plus-body-length ranges from 0.9 to 1.8 m (35 to 71 in), and the adult can weigh between 50 to 350 kg (110 to 770 lb). Compared to other artiodactyls, its head is relatively long, pointed, and free of warts. Even-toed ungulates are generally herbivorous, but the domestic pig is an omnivore, like its wild relative.

Domestic pigs are farmed primarily for the consumption of their meat called pork. The animal's bones, hide, and bristles are also used in commercial products. Domestic pigs, especially the pot-bellied pig, are sometimes kept as pets.

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Description

The domestic pig typically has a large head, with a long snout which is strengthened by a special prenasal bone

Domestic pig



Female (sow) with piglet

Conservation status

Domesticated

Scientific classification

Kingdom:	Animalia
Phylum:	Chordata
<i>Clade</i> :	Synapsida
Class:	Mammalia
Order:	Artiodactyla
Family:	Suidae
Genus:	<i>Sus</i>
Species:	<i>S. scrofa</i>
Subspecies:	<i>S. s. domesticus</i>

Trinomial name

Sus scrofa domesticus

Erxleben, 1777

Synonyms^[1]

- *Sus scrofa domestica* Erxleben, 1777
- *Sus domesticus* Erxleben, 1777
- *Sus domestica* Erxleben, 1777

and a disk of cartilage at the tip.^[2] The snout is used to dig into the soil to find food, and is a very acute sense organ. The dental formula of adult pigs is $\frac{3.1.4.3}{3.1.4.3}$, giving a total of 44 teeth. The rear teeth are adapted for crushing. In the male the canine teeth can form tusks, which grow continuously and are sharpened by constantly being ground against each other.^[2]

There are four hoofed toes on each foot, or trotter, with the two larger central toes bearing most of the weight, but the outer two also being used in soft ground.^[3]

Most domestic pigs have rather a sparse hair covering on their skin, although woolly-coated breeds, such as the Mangalitsa, are raised.^[4]

Pigs possess both apocrine and eccrine sweat glands, although the latter appear limited to the snout and dorsonasal areas.^[5] Pigs, however, like other "hairless" mammals (e.g. elephants, rhinos, and mole-rats), do not use thermal sweat glands in cooling.^[6] Pigs are also less able than many other mammals to dissipate heat from wet mucous membranes in the mouth through panting. Their thermoneutral zone is 16 to 22 °C.^[7] At higher temperatures, pigs lose heat by wallowing in mud or water; although it has been suggested that wallowing may serve other functions, such as protection from sunburn, ecto-parasite control, and scent-marking.^[8]

Pigs are one of four known mammalian species which possess mutations in the nicotinic acetylcholine receptor that protect against snake venom. Mongooses, honey badgers, hedgehogs, and pigs all have modifications to the receptor pocket which prevents the snake venom α -neurotoxin from binding. These represent four separate, independent mutations.^[9]

Female hogs reach sexual maturity at 3–12 months of age and come into estrus every 18–24 days if they are not successfully bred. The gestation period averages 112–120 days.^[10]

Taxonomy

The domestic pig is most often considered to be a subspecies of the wild boar, which was given the name *Sus scrofa* by Carl Linnaeus in 1758; following from this, the formal name of the domestic pig is *Sus scrofa domesticus*.^{[11][12]} However, in 1777, Johann Christian Polycarp Erxleben classified the domestic pig as a separate species from the wild boar. He gave it the name *Sus domesticus*, which is still used by some taxonomists.^{[13][14]}

History

Archaeological evidence suggests that pigs were domesticated from wild boar as early as 13,000–12,700 BC in the Near East in the Tigris Basin^[15] being managed in the wild in a way similar to the way they are managed by some modern New Guineans.^[16] Remains of pigs have been dated to earlier than 11,400 BC in Cyprus. Those animals must have been introduced from the mainland, which suggests domestication in the adjacent



Domestic pig skull



Skeleton specimen of a swine

mainland by then.^[17] There was also a separate domestication in China which took place about 8000 years ago.^{[18][19]}

DNA evidence from sub-fossil remains of teeth and jawbones of Neolithic pigs shows that the first domestic pigs in Europe had been brought from the Near East. This stimulated the domestication of local European wild boar resulting in a third domestication event with the Near Eastern genes dying out in European pig stock. Modern domesticated pigs have involved complex exchanges, with European domesticated lines being exported in turn to the ancient Near East.^{[20][21]} Historical records indicate that Asian pigs were introduced into Europe during the 18th and early 19th centuries.^[18]

In August 2015, a study looked at over 100 pig genome sequences to ascertain their process of domestication. The process of domestication was assumed to have been initiated by humans, involved few individuals and relied on reproductive isolation between wild and domestic forms. The study found that the assumption of reproductive isolation with population bottlenecks was not supported. The study indicated that pigs were domesticated separately in Western Asia and China, with Western Asian pigs introduced into Europe where they crossed with wild boar. A model that fitted the data included admixture with a now extinct ghost population of wild pigs during the Pleistocene. The study also found that despite back-crossing with wild pigs, the genomes of domestic pigs have strong signatures of selection at DNA loci that affect behavior and morphology. The study concluded that human selection for domestic traits likely counteracted the homogenizing effect of gene flow from wild boars and created domestication islands in the genome. The same process may also apply to other domesticated animals.^{[22] [23]}

The adaptable nature and omnivorous diet of the wild boar allowed early humans to domesticate it readily. Pigs were mostly used for food, but early civilizations also used the pigs' hides for shields, bones for tools and weapons, and bristles for brushes.^[24] In India, pigs have been domesticated for a long time, mostly in Goa and some rural areas, for pig toilets. Though ecologically logical as well as economical, pig toilets are waning in popularity as use of septic tanks and sewage systems is increasing in rural areas.

Pigs were brought to southeastern North America from Europe by de Soto and other early Spanish explorers. Escaped pigs became feral and caused a great deal of disruption to Native Americans, who had no domesticated livestock.^[25] Domestic pigs have become feral in many other parts of the world (e.g. New Zealand and northern Queensland) and have caused substantial environmental damage.^{[26][27]} Feral hybrids of the European wild boar with the domestic pig are also very disruptive to both environment and agriculture (among the 100 most damaging animal species), especially in southeastern South America from Uruguay to Brazil's Mato Grosso do Sul (Center-West Region), and São Paulo (state) (Southeast Region), where they are known as *javaporcos* (from *javali* and *porco*, thus "boar-pigs").^{[28][29][30][31][32]}

With around 1 billion individuals alive at any time, the domesticated pig is one of the most numerous large mammals on the planet.^{[33][34]}

Behaviour

The behaviour of domestic pigs resembles that of dogs and humans more than that of cattle or sheep. In many ways, their behaviour appears to be intermediate between that of carnivores and artiodactyls.^[35] Domestic pigs seek out the company of other pigs, and often huddle to maintain physical contact, although they do not naturally form large herds. They typically live in groups of about 8-10 adult sows, some young individuals, and some single males.^[36]

Because of their relative lack of sweat glands, pigs often control their body temperature using behavioural thermoregulation. Wallowing, which often consists of coating the body with mud, is a behaviour frequently exhibited by pigs.^[37] Pigs root to make wallows that sometimes contains sticky mud with which the pigs cover their body. Pigs do not submerge completely under the mud, but vary the depth and duration of wallowing depending on environmental conditions.^[37] Typically, adult pigs start wallowing once the ambient temperature is around 17-21°C. On hot days, pigs cover themselves from head to toe in mud.^[37] Pigs may also use mud as a sunscreen, protecting their skin from ultraviolet light, or as a method of keeping parasites away.^[37]



Domestic pigs in a wallow

If conditions permit, domesticated pigs feed continuously for many hours and then sleep for many hours, in contrast to ruminants which tend to feed for a short time and then sleep for a short time. Pigs are omnivores and are highly versatile in their feeding behaviour. They can survive well by scavenging on the same types of foods that humans and dogs can live on. In the wild, they are foraging animals, primarily eating leaves, grasses, roots, fruits and flowers.^[38] Domestic pigs are intelligent^[39] and can be trained to perform numerous tasks and tricks.^[40]

Nest building

A behavioural characteristic of domestic pigs which they share with carnivores is nest building and bed making (although modern production systems often prevent these). Pigs root out wallows or depressions (digging with their snout) and the females (sows) will build nests in which to give birth. First the sow digs a depression about the size of her body. She then collects twigs, grasses and leaves, and carries these in her mouth to the depression, building them into a mound. She digs in smaller, finer material to the centre of the mound using her feet. When the mound reaches the desired height, she places large branches, up to 2 metres in length, on the surface. She enters into the mound and roots around to create a depression within the gathered material. She then gives birth in a lying position, which again is different from other artiodactyls which usually give birth in a standing position.^[35]

Nest-building behaviour is an important part in the process of pre and post-partum maternal behaviour. Nest building will occur during the last 24 hours before the onset of farrowing and becomes most intense during 12 to 6 hours before farrowing.^[41] Nest building is divided into two phases: one of which is the initial phase of rooting and pawing the ground while the second phase is the collecting, carrying and arranging of the nest material.^[41] One type of animal that does nest building are sows.^[42] The sow will separate from the group and seek a suitable nest site with some shelter from rain and wind, and which has well-drained soil. This nest building behaviour is performed to provide the offspring with shelter, comfort, and thermoregulation. The piglets need an increased environmental temperature otherwise they could die due to the cold.^[42] The nest will provide protection against weather and predators, while keeping the piglets close to the sow and away from the rest of the herd. This ensures they do not get trampled on and that other piglets are not stealing the milk from the sow (food resource).^[42] The nest building behaviour can be influenced by internal and external stimuli. Internal hormonal changes and the completion of one nesting phase are indicators of this maternal behaviour.^[42] The onset of nest building is triggered by the rise in prolactin levels, which is caused by a decrease in progesterone and an increase in prostaglandin. While the gathering of the nest material seems to be regulated more by external stimuli such as temperature or udder comfort.^[41] Nest building ends when the sow gathers softer material and distributes throughout nest by nodding head movements and pawing with the front

legs.^[41] The longer time spent on nest building will increase pre-partum oxytocin, allowing for higher piglet weight gain. Nest building is related to the increased litter size, a higher responsiveness to piglet distress, and lower mortality rate in piglets. Letting the sow perform the nest-building behaviour can lead to better health and welfare for both the sow and piglet.^[42]

Nursing and suckling behaviour

Compared to most other mammals, pigs display complex nursing and suckling behaviour.^[43] Nursing occurs every 50–60 minutes, and the sow requires stimulation from piglets before milk let-down. Sensory inputs (vocalisation, odours from mammary and birth fluids and hair patterns of the sow) are particularly important immediately post-birth to facilitate teat location by the piglets.^[44] Initially, the piglets compete for position at the udder, then each piglet massages around its respective teat with its snout, during which time the sow grunts at slow, regular intervals. Each series of grunts varies in frequency, tone and magnitude, indicating the stages of nursing to the piglets.^[45]

The phase of competition for teats and of nosing the udder lasts for about one minute, and ends when milk flow begins. In the third phase, the piglets hold the teats in their mouths and suck with slow mouth movements (one per second), and the rate of the sow's grunting increases for approximately 20 seconds. The grunt peak in the third phase of suckling does not coincide with milk ejection but rather the release of oxytocin from the pituitary into the bloodstream.^[46] Phase four coincides with the period of main milk flow (10–20 seconds) when the piglets suddenly withdraw slightly from the udder and start sucking with rapid mouth movements of about three per second. The sow grunts rapidly, lower in tone and often in quick runs of three or four, during this phase. Finally, the flow stops and so does the grunting of the sow. The piglets may then dart from teat to teat and recommence suckling with slow movements, or nosing the udder. Piglets massage and suckle the sow's teats after milk flow ceases as a way of letting the sow know their nutritional status. This helps her to regulate the amount of milk released from that teat in future sucklings. The more intense the post-feed massaging of a teat, the greater the future milk release from that teat will be.^[47]



A sow with suckling piglets. Note the greater use of the anterior teats thus forming the teat order

Teat order

In pigs, dominance hierarchies can be formed at a very early age. Domestic piglets are highly precocious and within minutes of being born, or sometimes seconds, will attempt to suckle. The piglets are born with sharp teeth and fight to develop a teat order as the anterior teats produce a greater quantity of milk. Once established, this teat order remains stable with each piglet tending to feed from a particular teat or group of teats.^[35] Stimulation of the anterior teats appears to be important in causing milk letdown^[48] so it might be advantageous to the entire litter to have these teats occupied by healthy piglets. Using an artificial sow to rear groups of piglets, recognition of a teat in a particular area of the udder depended initially on visual orientation by means of reference points on the udder to find the area, and then the olfactory sense for the more accurate search within that area.^[49]

Senses

Pigs have panoramic vision of approximately 310° and binocular vision of 35° to 50°. It is thought they have

no eye accommodation.^[50] Other animals that have no accommodation, e.g. sheep, lift their heads to see distant objects.^[51] The extent to which pigs have colour vision is still a source of some debate; however, the presence of cone cells in the retina with two distinct wavelength sensitivities (blue and green) suggests that at least some colour vision is present.^[52]

Pigs have a well-developed sense of smell and use is made of this in Europe where they are trained to locate underground truffles. Olfactory rather than visual stimuli are used in the identification of other pigs.^[53] Hearing is also well developed, and localisation of sounds is made by moving the head. Pigs use auditory stimuli extensively as a means of communication in all social activities.^[54] Alarm or aversive stimuli are transmitted to other pigs not only by auditory cues but also by pheromones.^[55] Similarly, recognition between the sow and her piglets is by olfactory and vocal cues.^[56]

Xenotransplantation

Pigs are currently thought to be the best non-human candidates for organ donation to humans. The risk of cross-species disease transmission is decreased because of their increased phylogenetic distance from humans.^[57] They are readily available, their organs are anatomically comparable in size, and new infectious agents are less likely since they have been in close contact with humans through domestication for many generations.^[58]

To date no xenotransplantation trials have been entirely successful due to obstacles arising from the response of the recipient's immune system—generally more extreme than in allotransplantations, ultimately results in rejection of the xenograft, and in some cases result in the death of the recipient—including hyperacute rejection, acute vascular rejection, cellular rejection and chronic rejection. An early major breakthrough was the 1,3 galactosyl transferase gene knockout.^[59]

Examples of viruses carried by pigs include porcine herpesvirus, rotavirus, parvovirus, and circovirus. Of particular concern are PERVS (porcine endogenous retroviruses), vertically transmitted microbes that embed in swine genomes. The risks with xenosis are twofold, as not only could the individual become infected, but a novel infection could initiate an epidemic in the human population. Because of this risk, the FDA has suggested any recipients of xenotransplants shall be closely monitored for the remainder of their life, and quarantined if they show signs of xenosis.^[60]

Pig cells have been engineered to inactivate all 62 PERVs in the genome using CRISPR Cas9 genome editing technology, and eliminated infection from the pig to human cells in culture.^[61]

Breeds

Pigs are exhibited at agricultural shows, judged either as stud stock compared to the standard features of each breed, or in commercial classes where the animals are judged primarily on their suitability for slaughter to provide premium meat. According to The Livestock Conservancy,^[62] seven breeds of swine in the US are critically rare (having a global population of fewer than 2000), as are the Auckland Island Pig (New Zealand) and woolly-coated grazing pig (Danube area).

Human uses

The domestic pig is mostly used for its meat, pork. Other food products made from pigs include pork sausage (casings made from the intestines), bacon, gammon, ham and pork scratchings (cracklings or rinds). The head of a pig can be used to make a preserved jelly called head cheese (sometimes known as brawn). Liver, chitterlings, blood (for blood pudding or black pudding), and other offal from pigs are also widely used for food. In some religions, such as Judaism and Islam, pork is taboo food.

The use of pig milk for human consumption does take place, but as there are certain difficulties in obtaining it, there is little commercial production.

Pigskin is used to produce seat covers, apparel, pork rinds, and other items.

In farming

In some developing and developed nations, the domestic pig is usually raised outdoors in yards or fields. In some areas, pigs are allowed to forage in woods where they may be taken care of by swineherds. In industrialized nations such as the United States, domestic pig farming has switched from the traditional pig farm to large-scale intensive pig farms. This has resulted in lower production costs, but can cause significant cruelty problems, and demand for pasture-raised pork in the United States has increased as consumers become concerned with humane treatment of livestock.^[63]

As a pet

Asian pot-bellied pigs, a small type of domestic pig, have made popular house pets in the United States beginning in the latter half of the twentieth century. Domestic farmyard pigs have also been known to be kept indoors, but due to their large size and destructive tendencies, they typically need to be moved into an outdoor pen as they grow older. Most pigs have a fear of being picked up by the stomach, but will usually calm down once placed back on the floor. Pigs are rarely used as working animals. An important exception is the use of truffle pigs – ordinary pigs trained to find truffles.

Miniature pigs, also called micro or teacup pigs, which are specifically bred to be small, may weigh from 12–30 kg (26–66 lb). They gained in popularity in late 2009 after several mainstream press articles claimed they were a popular pet to celebrities.^[64] Despite claims that the "teacup pigs" will remain small their whole lives, these pigs grew to 50 kg,^[65] but Beijing Genomics Institute in Shenzhen have since engineered new micro pigs via TALEN genome editing to inactivate the growth hormone receptor gene (GHR); and these are just 15 kg at maturity.^[65]

In biomedical research



Interior of pig farm at Bjärka-Säby Castle, Sweden, 1911.

Global pig stocks

in 2014

(million)

 People's Republic of China	474.1
 United States	67.7
 Brazil	37.9
World total	986.6

Source:

UN Food & Agriculture Organisation (FAO) (<http://faostat3.fao.org/home/E>)



Two pot-bellied pigs, a breed of domestic pig originating in Vietnam

The domestic pig both as a live animal and source of post mortem tissues is one of the most valuable animal models used in biomedical research today because of its biological, physiological and anatomical similarities to human beings. Live porcine as well as post mortem tissues are used in finding treatments and cures for diseases and for teaching and education. Also they are used in the development of medical instruments and devices, surgical techniques and instrumentation and FDA approved research. As part of animal conservation (The Three Rs (animals)) live animals as well as post mortem porcine tissues contribute to the reduction and replacement methods for animal research as they supply more information from less animals or tissue used and also at a lower cost.

In entertainment

Miss Piggy, Babe, and Porky Pig represent the domestic pig in entertainment, and "The Three Little Pigs", Piglet in the stories of A. A. Milne, *Charlotte's Web*, *The Sheep-Pig*, Zhu Bajie and Napoleon in George Orwell's *Animal Farm* are prominent examples of the domestic pig in literature.

Glossary of terms

Because the domestic pig is a major domesticated animal, English has many terms unique to the species.

- *barrow* - a castrated male swine
- *boar* - a mature, male swine; often a wild or feral swine
- *farrow* (verb) - to give birth to piglets
- *farrow* (noun) - a litter of piglets
- *gilt* - a female pig that has never been pregnant
- *hog* - a domestic swine, especially a fully-grown specimen
- *parcel* - collective noun
- *pig* - strictly, an immature swine; more generally, any swine, especially of the domestic variety
- *piglet* - a very young pig
- *shoat* - a young hog, especially one that has been weaned
- *sow* - a mature, female swine
- *swine* (singular and plural) - a hog; hogs collectively or generally
- *swineherd* - one who tends swine; a pig farmer
- *queen* - a female pig that has never been mated

See also

- Exotic pet
- Extensive farming
- Food and drink prohibitions
- Free range
- Intensive animal farming
- Intensive farming
- *Mycoplasma hyorhinitis*
- Peccary (domestication)
- Truffle hog
- Xenotransfusion

Footnotes

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External links

- JSR Genetics (<http://www.jsrgenetics.com>), Pig genetics company
- An introduction to pig keeping (<http://www.accidentalsmallholder.net/articles/pigs/introduction/>)
- JJ Genetics (<http://www.pig-genetics.co.uk/gilt.htm>), gilt pig breeders
- Swine Study Guide (<http://ucce.ucdavis.edu/files/filelibrary/1385/2027.PDF>) from UC Davis
- British Pig Association (<http://www.britishpigs.org.uk>)
- The process of pig slaughterery (<http://www.hyfoma.com/en/content/food-branches-processing-manufacturing/meat-fish-shrimps/pig-slaughtering/>)



Wikimedia Commons has media related to *Sus domesticus*.

- Swine Care (<http://www.pork.org/newsandinformation/quickfacts/swinecare1.aspx>)
- Globe and Mail article Canada's transgenic Enviropig is stuck in a genetic modification poke (<http://www.theglobeandmail.com/news/national/time-to-lead/global-food/canadas-transgenic-enviropig-is-stuck-in-a-genetic-modification-poke/article1812708/>)
- Information on Micro Pigs (<http://www.micropigs.org>)

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