

= Sheep =

The sheep (*Ovis aries*) is a quadrupedal , ruminant mammal typically kept as livestock . Like all ruminants , sheep are members of the order Artiodactyla , the even @-@ toed ungulates . Although the name " sheep " applies to many species in the genus *Ovis* , in everyday usage it almost always refers to *Ovis aries* . Numbering a little over one billion , domestic sheep are also the most numerous species of sheep . An adult female sheep is referred to as a ewe (/ ju? /) , an intact male as a ram or occasionally a tup , a castrated male as a wether , and a younger sheep as a lamb .

Sheep are most likely descended from the wild mouflon of Europe and Asia . One of the earliest animals to be domesticated for agricultural purposes , sheep are raised for fleece , meat (lamb , hogget or mutton) and milk . A sheep 's wool is the most widely used animal fiber , and is usually harvested by shearing . Ovine meat is called lamb when from younger animals and mutton when from older ones . Sheep continue to be important for wool and meat today , and are also occasionally raised for pelts , as dairy animals , or as model organisms for science .

Sheep husbandry is practised throughout the majority of the inhabited world , and has been fundamental to many civilizations . In the modern era , Australia , New Zealand , the southern and central South American nations , and the British Isles are most closely associated with sheep production .

Sheepraising has a large lexicon of unique terms which vary considerably by region and dialect . Use of the word sheep began in Middle English as a derivation of the Old English word *sc?ap* ; it is both the singular and plural name for the animal . A group of sheep is called a flock , herd or mob . Many other specific terms for the various life stages of sheep exist , generally related to lambing , shearing , and age .

Being a key animal in the history of farming , sheep have a deeply entrenched place in human culture , and find representation in much modern language and symbology . As livestock , sheep are most often associated with pastoral , Arcadian imagery . Sheep figure in many mythologies ? such as the Golden Fleece ? and major religions , especially the Abrahamic traditions . In both ancient and modern religious ritual , sheep are used as sacrificial animals .

= = Description and evolution = =

Domestic sheep are relatively small ruminants , usually with a crimped hair called wool and often with horns forming a lateral spiral . Domestic sheep differ from their wild relatives and ancestors in several respects , having become uniquely neotenic as a result of selective breeding by humans . A few primitive breeds of sheep retain some of the characteristics of their wild cousins , such as short tails . Depending on breed , domestic sheep may have no horns at all (i.e. polled) , or horns in both sexes , or in males only . Most horned breeds have a single pair , but a few breeds may have several .

Another trait unique to domestic sheep as compared to wild ovines is their wide variation in color . Wild sheep are largely variations of brown hues , and variation within species is extremely limited . Colors of domestic sheep range from pure white to dark chocolate brown and even spotted or piebald . Selection for easily dyeable white fleeces began early in sheep domestication , and as white wool is a dominant trait it spread quickly . However , colored sheep do appear in many modern breeds , and may even appear as a recessive trait in white flocks . While white wool is desirable for large commercial markets , there is a niche market for colored fleeces , mostly for handspinning . The nature of the fleece varies widely among the breeds , from dense and highly crimped , to long and hairlike . There is variation of wool type and quality even among members of the same flock , so wool classing is a step in the commercial processing of the fibre .

Depending on breed , sheep show a range of heights and weights . Their rate of growth and mature weight is a heritable trait that is often selected for in breeding . Ewes typically weigh between 45 and 100 kilograms (99 and 220 lb) , and rams between 45 and 160 kilograms (99 and 353 lb) . When all deciduous teeth have erupted , the sheep has 20 teeth . Mature sheep have 32 teeth . As with other ruminants , the front teeth in the lower jaw bite against a hard , toothless pad in the upper jaw .

These are used to pick off vegetation , then the rear teeth grind it before it is swallowed . There are eight lower front teeth in ruminants , but there is some disagreement as to whether these are eight incisors , or six incisors and two incisor @-@ shaped canines . This means that the dental formula for sheep is either $0 \text{ @ } 0 \text{ @ } 3 \text{ @ } 34 \text{ @ } 0 \text{ @ } 3 \text{ @ } 3$ or $0 \text{ @ } 0 \text{ @ } 3 \text{ @ } 33 \text{ @ } 1 \text{ @ } 3 \text{ @ } 3$ There is a large diastema between the incisors and the molars . For the first few years of life it is possible to calculate the age of sheep from their front teeth , as a pair of milk teeth is replaced by larger adult teeth each year , the full set of eight adult front teeth being complete at about four years of age . The front teeth are then gradually lost as sheep age , making it harder for them to feed and hindering the health and productivity of the animal . For this reason , domestic sheep on normal pasture begin to slowly decline from four years on , and the average life expectancy of a sheep is 10 to 12 years , though some sheep may live as long as 20 years .

Sheep have good hearing , and are sensitive to noise when being handled . Sheep have horizontal slit @-@ shaped pupils , possessing excellent peripheral vision ; with visual fields of approximately 270° to 320° , sheep can see behind themselves without turning their heads . Many breeds have only short hair on the face , and some have facial wool (if any) confined to the poll and or the area of the mandibular angle ; the wide angles of peripheral vision apply to these breeds . A few breeds tend to have considerable wool on the face ; for some individuals of these breeds , peripheral vision may be greatly reduced by " wool blindness " , unless recently shorn about the face . Sheep have poor depth perception ; shadows and dips in the ground may cause sheep to baulk . In general , sheep have a tendency to move out of the dark and into well lit areas , and prefer to move uphill when disturbed . Sheep also have an excellent sense of smell , and , like all species of their genus , have scent glands just in front of the eyes , and interdigitally on the feet . The purpose of these glands is uncertain , but those on the face may be used in breeding behaviors . The foot glands might also be related to reproduction , but alternative reasons , such as secretion of a waste product or a scent marker to help lost sheep find their flock , have also been proposed .

== Sheep compared to goats ==

Sheep and goats are closely related as both are in the subfamily Caprinae . However , they are separate species , so hybrids rarely occur , and are always infertile . A hybrid of a ewe and a buck (a male goat) is called a sheep @-@ goat hybrid (only a single such animal has been confirmed) , and is not to be confused with the sheep @-@ goat chimera , though both are known as " geep " . Visual differences between sheep and goats include the beard of goats and divided upper lip of sheep . Sheep tails also hang down , even when short or docked , while the short tails of goats are held upwards . Sheep breeds are also often naturally polled (either in both sexes or just in the female) , while naturally polled goats are rare (though many are polled artificially) . Males of the two species differ in that buck goats acquire a unique and strong odor during the rut , whereas rams do not .

== Breeds ==

The domestic sheep is a multi @-@ purpose animal , and the more than 200 breeds now in existence were created to serve these diverse purposes . Some sources give a count of a thousand or more breeds , but these numbers cannot be verified , according to some sources . However , several hundred breeds of sheep have been identified by the FAO (Food and Agriculture Organization of the UN) , with the estimated number varying somewhat from time to time : e.g. 863 breeds as of 1993 , 1314 breeds as of 1995 and 1229 breeds as of 2006 . (These numbers exclude extinct breeds , which are also tallied by the FAO .) For purposes of such tallies , the FAO definition of a breed is " either a subspecific group of domestic livestock with definable and identifiable external characteristics that enable it to be separated by visual appraisal from other similarly defined groups within the same species or a group for which geographical and / or cultural separation from phenotypically similar groups has led to acceptance of its separate identity . " Almost all sheep are classified as being best suited to furnishing a certain product : wool , meat , milk , hides , or a

combination in a dual @-@ purpose breed . Other features used when classifying sheep include face color (generally white or black) , tail length , presence or lack of horns , and the topography for which the breed has been developed . This last point is especially stressed in the UK , where breeds are described as either upland (hill or mountain) or lowland breeds . A sheep may also be of a fat @-@ tailed type , which is a dual @-@ purpose sheep common in Africa and Asia with larger deposits of fat within and around its tail .

Breeds are often categorized by the type of their wool . Fine wool breeds are those that have wool of great crimp and density , which are preferred for textiles . Most of these were derived from Merino sheep , and the breed continues to dominate the world sheep industry . Downs breeds have wool between the extremes , and are typically fast @-@ growing meat and ram breeds with dark faces . Some major medium wool breeds , such as the Corriedale , are dual @-@ purpose crosses of long and fine @-@ woolled breeds and were created for high @-@ production commercial flocks . Long wool breeds are the largest of sheep , with long wool and a slow rate of growth . Long wool sheep are most valued for crossbreeding to improve the attributes of other sheep types . For example : the American Columbia breed was developed by crossing Lincoln rams (a long wool breed) with fine @-@ woolled Rambouillet ewes .

Coarse or carpet wool sheep are those with a medium to long length wool of characteristic coarseness . Breeds traditionally used for carpet wool show great variability , but the chief requirement is a wool that will not break down under heavy use (as would that of the finer breeds) . As the demand for carpet @-@ quality wool declines , some breeders of this type of sheep are attempting to use a few of these traditional breeds for alternative purposes . Others have always been primarily meat @-@ class sheep .

A minor class of sheep are the dairy breeds . Dual @-@ purpose breeds that may primarily be meat or wool sheep are often used secondarily as milking animals , but there are a few breeds that are predominantly used for milking . These sheep do produce a higher quantity of milk and have slightly longer lactation curves . In the quality of their milk , fat and protein content percentages of dairy sheep vary from non @-@ dairy breeds but lactose content does not .

A last group of sheep breeds is that of fur or hair sheep , which do not grow wool at all . Hair sheep are similar to the early domesticated sheep kept before woolly breeds were developed , and are raised for meat and pelts . Some modern breeds of hair sheep , such as the Dorper , result from crosses between wool and hair breeds . For meat and hide producers , hair sheep are cheaper to keep , as they do not need shearing . Hair sheep are also more resistant to parasites and hot weather .

With the modern rise of corporate agribusiness and the decline of localized family farms , many breeds of sheep are in danger of extinction . The Rare Breeds Survival Trust of the UK lists 22 native breeds as having only 3 @, @ 000 registered animals (each) , and The Livestock Conservancy lists 14 as either " critical " or " threatened " . Preferences for breeds with uniform characteristics and fast growth have pushed heritage (or heirloom) breeds to the margins of the sheep industry . Those that remain are maintained through the efforts of conservation organizations , breed registries , and individual farmers dedicated to their preservation .

= = Diet = =

Sheep are exclusively herbivorous mammals . Most breeds prefer to graze on grass and other short roughage , avoiding the taller woody parts of plants that goats readily consume . Both sheep and goats use their lips and tongues to select parts of the plant that are easier to digest or higher in nutrition . Sheep , however , graze well in monoculture pastures where most goats fare poorly . Like all ruminants , sheep have a complex digestive system composed of four chambers , allowing them to break down cellulose from stems , leaves , and seed hulls into simpler carbohydrates . When sheep graze , vegetation is chewed into a mass called a bolus , which is then passed into the rumen , via the reticulum . The rumen is a 19- to 38 @-@ liter (5 to 10 gal) organ in which feed is fermented . The fermenting organisms include bacteria , fungi , and protozoa . (Other important rumen organisms include some archaea , which produce methane from carbon dioxide .) The bolus

is periodically regurgitated back to the mouth as cud for additional chewing and salivation . Cud chewing is an adaptation allowing ruminants to graze more quickly in the morning , and then fully chew and digest feed later in the day . This is safer than grazing , which requires lowering the head thus leaving the animal vulnerable to predators , while cud chewing does not .

Other than forage , the other staple feed for sheep is hay , often during the winter months . The ability to thrive solely on pasture (even without hay) varies with breed , but all sheep can survive on this diet . Also included in some sheep 's diets are minerals , either in a trace mix or in licks .

= = = Grazing behavior = = =

Sheep follow a diurnal pattern of activity , feeding from dawn to dusk , stopping sporadically to rest and chew their cud . Ideal pasture for sheep is not lawnlike grass , but an array of grasses , legumes and forbs . Types of land where sheep are raised vary widely , from pastures that are seeded and improved intentionally to rough , native lands . Common plants toxic to sheep are present in most of the world , and include (but are not limited to) cherry , some oaks and acorns , tomato , yew , rhubarb , potato , and rhododendron .

= = = Effects on pasture = = =

Sheep are largely grazing herbivores , unlike browsing animals such as goats and deer that prefer taller foliage . With a much narrower face , sheep crop plants very close to the ground and can overgraze a pasture much faster than cattle . For this reason , many shepherds use managed intensive rotational grazing , where a flock is rotated through multiple pastures , giving plants time to recover . Paradoxically , sheep can both cause and solve the spread of invasive plant species . By disturbing the natural state of pasture , sheep and other livestock can pave the way for invasive plants . However , sheep also prefer to eat invasives such as cheatgrass , leafy spurge , kudzu and spotted knapweed over native species such as sagebrush , making grazing sheep effective for conservation grazing . Research conducted in Imperial County , California compared lamb grazing with herbicides for weed control in seedling alfalfa fields . Three trials demonstrated that grazing lambs were just as effective as herbicides in controlling winter weeds . Entomologists also compared grazing lambs to insecticides for insect control in winter alfalfa . In this trial , lambs provided insect control as effectively as insecticides .

= = = Rumination = = =

During fermentation , the rumen produces gas that must be expelled ; disturbances of the organ , such as sudden changes in a sheep 's diet , can cause the potentially fatal condition of bloat , when gas becomes trapped in the rumen , due to reflex closure of the caudal esophageal sphincter when in contact with foam or liquid . After fermentation in the rumen , feed passes into the reticulum and the omasum ; special feeds such as grains may bypass the rumen altogether . After the first three chambers , food moves into the abomasum for final digestion before processing by the intestines . The abomasum is the only one of the four chambers analogous to the human stomach , and is sometimes called the " true stomach " .

= = = Concentrated diets = = =

Sheep are one of the few livestock animals raised for meat today that have rarely been raised in an intensive , confined animal feeding operation (CAFO) . Although there is a growing movement advocating alternative farming styles , a large percentage of beef cattle , pigs , and poultry are still produced under such conditions . In contrast , only some sheep are regularly given high @-@ concentration grain feed , much less kept in confinement . Especially in industrialized countries , sheep producers may fatten market lambs before slaughter (called " finishing ") in feedlots . Many sheep breeders flush ewes and rams with a daily ration of grain during breeding to increase fertility .

Ewes may be flushed during pregnancy to increase birth weights , as 70 % of a lamb 's growth occurs in the last five to six weeks of gestation . However , overfeeding of ewe hoggets (i.e. adolescent ewes) in early pregnancy can result in restricted placental development , restricting growth of fetal lambs in late pregnancy . Otherwise , only lactating ewes and especially old or infirm sheep are commonly provided with grain . Feed provided to sheep must be specially formulated , as most cattle , poultry , pig , and even some goat feeds contain levels of copper that are lethal to sheep . The same danger applies to mineral supplements such as salt licks .

= = Behavior = =

= = = Flock behavior = = =

Sheep are flock animals and strongly gregarious ; much sheep behavior can be understood on the basis of these tendencies . The dominance hierarchy of sheep and their natural inclination to follow a leader to new pastures were the pivotal factors in sheep being one of the first domesticated livestock species . Furthermore , in contrast to the red deer and gazelle (two other ungulates of primary importance to meat production in prehistoric times) , sheep do not defend territories although they do form home ranges . All sheep have a tendency to congregate close to other members of a flock , although this behavior varies with breed , and sheep can become stressed when separated from their flock members . During flocking , sheep have a strong tendency to follow and a leader may simply be the first individual to move . Relationships in flocks tend to be closest among related sheep : in mixed @-@ breed flocks , subgroups of the same breed tend to form , and a ewe and her direct descendants often move as a unit within large flocks . Sheep can become hefted to one particular local pasture (heft) so they do not roam freely in unfenced landscapes . Lambs learn the heft from ewes and if whole flocks are culled it must be retaught to the replacement animals .

Flock behaviour in sheep is generally only exhibited in groups of four or more sheep ; fewer sheep may not react as expected when alone or with few other sheep . Being a prey species , the primary defense mechanism of sheep is to flee from danger when their flight zone is entered . Cornered sheep may charge and butt , or threaten by hoof stamping and adopting an aggressive posture . This is particularly true for ewes with newborn lambs .

In regions where sheep have no natural predators , none of the native breeds of sheep exhibit a strong flocking behavior .

= = = = Herding = = = =

Farmers exploit flocking behavior to keep sheep together on unfenced pastures such as hill farming , and to move them more easily . Shepherds may also use herding dogs in this effort , whose highly bred herding ability can assist in moving flocks . Sheep are food @-@ oriented and association of humans with regular feeding often results in sheep soliciting people for food . Those who are moving sheep may exploit this behavior by leading sheep with buckets of feed , rather than forcing their movements with herding .

= = = Dominance hierarchy = = =

Sheep establish a dominance hierarchy through fighting , threats and competitiveness . Dominant animals are inclined to be more aggressive with other sheep , and usually feed first at troughs . Primarily among rams , horn size is a factor in the flock hierarchy . Rams with different size horns may be less inclined to fight to establish the dominance order , while rams with similarly sized horns are more so . Merinos have an almost linear hierarchy whereas there is a less rigid structure in Border Leicesters when a competitive feeding situation arises .

In sheep , position in a moving flock is highly correlated with social dominance , but there is no

definitive study to show consistent voluntary leadership by an individual sheep .

== Intelligence and learning ability ==

Sheep are frequently thought of as unintelligent animals . Their flocking behavior and quickness to flee and panic can make shepherding a difficult endeavor for the uninitiated . Despite these perceptions , a University of Illinois monograph on sheep reported them to be just below pigs and on par with cattle in IQ . Sheep can recognize individual human and ovine faces , and remember them for years . In addition to long @-@ term facial recognition of individuals , sheep can also differentiate emotional states through facial characteristics . If worked with patiently , sheep may learn their names and many sheep are trained to be led by halter for showing and other purposes . Sheep have also responded well to clicker training . Sheep have been used as pack animals ; Tibetan nomads distribute baggage equally throughout a flock as it is herded between living sites .

It has been reported that some sheep have apparently shown problem @-@ solving abilities ; a flock in West Yorkshire , England allegedly found a way to get over cattle grids by rolling on their backs , although documentation of this has relied on anecdotal accounts .

== Vocalisations ==

Sounds made by domestic sheep include bleats , grunts , rumbles and snorts . Bleating (" baaing ") is used mostly for contact communication , especially between dam and lambs , but also at times between other flock members . The bleats of individual sheep are distinctive , enabling the ewe and her lambs to recognize each other 's vocalizations . Vocal communication between lambs and their dam declines to a very low level within several weeks after parturition . A variety of bleats may be heard , depending on sheep age and circumstances . Apart from contact communication , bleating may signal distress , frustration or impatience ; however , sheep are usually silent when in pain . Isolation commonly prompts bleating by sheep . Pregnant ewes may grunt when in labor . Rumbling sounds are made by the ram during courting ; somewhat similar rumbling sounds may be made by the ewe , especially when with her neonate lambs . A snort (explosive exhalation through the nostrils) may signal aggression or a warning , and is often elicited from startled sheep .

== Senses ==

In sheep breeds lacking facial wool , the visual field is wide . For 10 sheep (Cambridge , Lleyn and Welsh Mountain breeds , which lack facial wool) , the visual field ranged from 298 ° to 325 ° , averaging 313 @. @ 1 ° , with binocular overlap ranging from 44 @. @ 5 ° to 74 ° , averaging 61 @. @ 7 ° In some breeds , unshorn facial wool can limit the visual field ; in some individuals , this may be enough to cause " wool blindness " . For 60 Merinos , visual fields ranged from 219 @. @ 1 ° to 303 @. @ 0 ° , averaging 269 @. @ 9 ° , and the binocular field ranged from 8 @. @ 9 ° to 77 @. @ 7 ° , averaging 47 @. @ 5 ° ; 36 percent of the measurements were limited by wool , although photographs of the experiments indicate that only limited facial wool regrowth had occurred since shearing . In addition to facial wool (in some breeds) , visual field limitations can include ears and (in some breeds) horns , so the visual field can be extended by tilting the head . Sheep eyes possess very low hyperopia and little astigmatism . Such visual characteristics are likely to produce a well @-@ focused retinal image of objects in both the middle and long distance . Because sheep eyes have no accommodation , one might expect the image of very near objects to be blurred , but a rather clear near image could be provided by the tapetum and large retinal image of the sheep 's eye , and adequate close vision may occur at muzzle length . Good depth perception , inferred from the sheep 's sure @-@ footedness , was confirmed in " visual cliff " experiments ; behavioral responses indicating depth perception are seen in lambs at one day of age . Sheep are thought to have colour vision and are able to distinguish between a variety of colours : black , red , brown , green , yellow and white Sight is a vital part of sheep communication and when grazing , they maintain visual contact with each other . Each sheep lifts its head upwards to check the position of

other sheep in the flock . This constant monitoring is probably what keeps the sheep in a flock as they move along grazing . Sheep become stressed when isolated ; this stress is reduced if they are provided with a mirror , indicating that the sight of other sheep has stress @-@ reducing properties .

Taste is the most important sense in sheep establishing forage preferences , with sweet and sour plants being preferred and bitter plants being more commonly rejected . Touch and sight are also important in relation to specific plant characteristics , such as succulence and growth form .

The ram uses his vomeronasal organ (sometimes called the Jacobson 's organ) for sensing the pheromones of ewes and detecting when they are in estrus . The ewe uses her vomeronasal organ for early recognition of her neonate lamb .

= = Reproduction = =

Sheep follow a similar reproductive strategy to other herd animals . A group of ewes is generally mated by a single ram , who has either been chosen by a breeder or has established dominance through physical contest with other rams (in feral populations) . Most sheep are seasonal breeders , although some are able to breed year @-@ round . Ewes generally reach sexual maturity at six to eight months of age , and rams generally at four to six months . However , there are exceptions . For example , Finnsheep ewe lambs may reach puberty as early as 3 to 4 months , and Merino ewes sometimes reach puberty at 18 to 20 months . Ewes have estrus cycles about every 17 days , during which they emit a scent and indicate readiness through physical displays towards rams . A minority of rams display a preference for homosexuality (8 % on average) and a small number of the females that were accompanied by a male fetus in utero are freemartins (female animals that are behaviorally masculine and lack functioning ovaries) .

In feral sheep , rams may fight during the rut to determine which individuals may mate with ewes . Rams , especially unfamiliar ones , will also fight outside the breeding period to establish dominance ; rams can kill one another if allowed to mix freely . During the rut , even normally friendly rams may become aggressive towards humans due to increases in their hormone levels .

After mating , sheep have a gestation period of about five months , and normal labor takes one to three hours . Although some breeds regularly throw larger litters of lambs , most produce single or twin lambs . During or soon after labor , ewes and lambs may be confined to small lambing jugs , small pens designed to aid both careful observation of ewes and to cement the bond between them and their lambs .

Ovine obstetrics can be problematic . By selectively breeding ewes that produce multiple offspring with higher birth weights for generations , sheep producers have inadvertently caused some domestic sheep to have difficulty lambing ; balancing ease of lambing with high productivity is one of the dilemmas of sheep breeding . In the case of any such problems , those present at lambing may assist the ewe by extracting or repositioning lambs . After the birth , ewes ideally break the amniotic sac (if it is not broken during labor) , and begin licking clean the lamb . Most lambs will begin standing within an hour of birth . In normal situations , lambs nurse after standing , receiving vital colostrum milk . Lambs that either fail to nurse or that are rejected by the ewe require aid to live , such as bottle @-@ feeding or fostering by another ewe .

After lambs are several weeks old , lamb marking (the process of ear tagging , docking , and castrating) is carried out . Vaccinations are usually carried out at this point as well . Ear tags with numbers are attached , or ear marks are applied for ease of later identification of sheep . Castration is performed on ram lambs not intended for breeding , although some shepherds choose to avoid the procedure for ethical , economic or practical reasons . However , many would disagree with regard to timing . Docking and castration are commonly done after 24 hours (to avoid interference with maternal bonding and consumption of colostrum) and are often done not later than one week after birth , to minimize pain , stress , recovery time and complications . The first course of vaccinations (commonly anti @-@ clostridial) is commonly given at an age of about 10 to 12 weeks ; i.e. when the concentration of maternal antibodies passively acquired via colostrum is expected to have fallen low enough to permit development of active immunity . Ewes are often revaccinated

annually about 3 weeks before lambing , to provide high antibody concentrations in colostrum during the first several hours after lambing . Ram lambs that will either be slaughtered or separated from ewes before sexual maturity are not usually castrated . Tail docking is commonly done for welfare , having been shown to reduce risk of fly strike . Objections to all these procedures have been raised by animal rights groups , but farmers defend them by saying they solve many practical and veterinary problems , and inflict only temporary pain .

= = Health = =

Sheep may fall victim to poisons , infectious diseases , and physical injuries . As a prey species , a sheep 's system is adapted to hide the obvious signs of illness , to prevent being targeted by predators . However , some signs of ill health are obvious , with sick sheep eating little , vocalizing excessively , and being generally listless . Throughout history , much of the money and labor of sheep husbandry has aimed to prevent sheep ailments . Historically , shepherds often created remedies by experimentation on the farm . In some developed countries , including the United States , sheep lack the economic importance for drug companies to perform expensive clinical trials required to approve more than a relatively limited number of drugs for ovine use . However , extra @-@ label drug use in sheep production is permitted in many jurisdictions , subject to certain restrictions . In the US , for example , regulations governing extra @-@ label drug use in animals are found in 21 CFR (Code of Federal Regulations) Part 530 . In the 20th and 21st centuries , a minority of sheep owners have turned to alternative treatments such as homeopathy , herbalism and even traditional Chinese medicine to treat sheep veterinary problems . Despite some favorable anecdotal evidence , the effectiveness of alternative veterinary medicine has been met with skepticism in scientific journals . The need for traditional anti @-@ parasite drugs and antibiotics is widespread , and is the main impediment to certified organic farming with sheep .

Many breeders take a variety of preventive measures to ward off problems . The first is to ensure all sheep are healthy when purchased . Many buyers avoid outlets known to be clearing houses for animals culled from healthy flocks as either sick or simply inferior . This can also mean maintaining a closed flock , and quarantining new sheep for a month . Two fundamental preventive programs are maintaining good nutrition and reducing stress in the sheep . Restraint , isolation , loud noises , novel situations , pain , heat , extreme cold , fatigue and other stressors can lead to secretion of cortisol , a stress hormone , in amounts that may indicate welfare problems . Excessive stress can compromise the immune system . " Shipping fever " (pneumonic manheimiosis , formerly called pasteurellosis) is a disease of particular concern , that can occur as a result of stress , notably during transport and (or) handling . Pain , fear and several other stressors can cause secretion of epinephrine (adrenaline) . Considerable epinephrine secretion in the final days before slaughter can adversely affect meat quality (by causing glycogenolysis , removing the substrate for normal post @-@ slaughter acidification of meat) and result in meat becoming more susceptible to colonization by spoilage bacteria . Because of such issues , low @-@ stress handling is essential in sheep management . Avoiding poisoning is also important ; common poisons are pesticide sprays , inorganic fertilizer , motor oil , as well as radiator coolant containing ethylene glycol .

Common forms of preventive medication for sheep are vaccinations and treatments for parasites . Both external and internal parasites are the most prevalent malady in sheep , and are either fatal , or reduce the productivity of flocks . Worms are the most common internal parasites . They are ingested during grazing , incubate within the sheep , and are expelled through the digestive system (beginning the cycle again) . Oral anti @-@ parasitic medicines , known as drenches , are given to a flock to treat worms , sometimes after worm eggs in the feces has been counted to assess infestation levels . Afterwards , sheep may be moved to a new pasture to avoid ingesting the same parasites . External sheep parasites include : lice (for different parts of the body) , sheep keds , nose bots , sheep itch mites , and maggots . Keds are blood @-@ sucking parasites that cause general malnutrition and decreased productivity , but are not fatal . Maggots are those of the bot fly and the blow @-@ fly . Fly maggots cause the extremely destructive condition of flystrike . Flies lay their eggs in wounds or wet , manure @-@ soiled wool ; when the maggots hatch they burrow into a

sheep 's flesh , eventually causing death if untreated . In addition to other treatments , crutching (shearing wool from a sheep 's rump) is a common preventive method . Some countries allow mulesing , a practice that involves stripping away the skin on the rump to prevent fly @-@ strike , normally performed when the sheep is a lamb . Nose bots are fly larvae that inhabit a sheep 's sinuses , causing breathing difficulties and discomfort . Common signs are a discharge from the nasal passage , sneezing , and frantic movement such as head shaking . External parasites may be controlled through the use of backliners , sprays or immersive sheep dips .

A wide array of bacterial and viral diseases affect sheep . Diseases of the hoof , such as foot rot and foot scald may occur , and are treated with footbaths and other remedies . These painful conditions cause lameness and hinder feeding . Ovine Johne 's disease is a wasting disease that affects young sheep . Bluetongue disease is an insect @-@ borne illness causing fever and inflammation of the mucous membranes . Ovine rinderpest (or peste des petits ruminants) is a highly contagious and often fatal viral disease affecting sheep and goats .

A few sheep conditions are transmissible to humans . Orf (also known as scabby mouth , contagious ecthyma or soremouth) is a skin disease leaving lesions that is transmitted through skin @-@ to @-@ skin contact . Cutaneous anthrax is also called woolsorter 's disease , as the spores can be transmitted in unwashed wool . More seriously , the organisms that can cause spontaneous enzootic abortion in sheep are easily transmitted to pregnant women . Also of concern are the prion disease scrapie and the virus that causes foot @-@ and @-@ mouth disease (FMD) , as both can devastate flocks . The latter poses a slight risk to humans . During the 2001 FMD pandemic in the UK , hundreds of sheep were culled and some rare British breeds were at risk of extinction due to this .

== Predation ==

Other than parasites and disease , predation is a threat to sheep and the profitability of sheep raising . Sheep have little ability to defend themselves , compared with other species kept as livestock . Even if sheep survive an attack , they may die from their injuries , or simply from panic . However , the impact of predation varies dramatically with region . In Africa , Australia , the Americas , and parts of Europe and Asia predators are a serious problem . In the United States , for instance , over one third of sheep deaths in 2004 were caused by predation . In contrast , other nations are virtually devoid of sheep predators , particularly islands known for extensive sheep husbandry . Worldwide , canids ? including the domestic dog ? are responsible for most sheep deaths . Other animals that occasionally prey on sheep include : felines , bears , birds of prey , ravens and feral hogs .

Sheep producers have used a wide variety of measures to combat predation . Pre @-@ modern shepherds used their own presence , livestock guardian dogs , and protective structures such as barns and fencing . Fencing (both regular and electric) , penning sheep at night and lambing indoors all continue to be widely used . More modern shepherds used guns , traps , and poisons to kill predators , causing significant decreases in predator populations . In the wake of the environmental and conservation movements , the use of these methods now usually falls under the purview of specially designated government agencies in most developed countries .

The 1970s saw a resurgence in the use of livestock guardian dogs and the development of new methods of predator control by sheep producers , many of them non @-@ lethal . Donkeys and guard llamas have been used since the 1980s in sheep operations , using the same basic principle as livestock guardian dogs . Interspecific pasturing , usually with larger livestock such as cattle or horses , may help to deter predators , even if such species do not actively guard sheep . In addition to animal guardians , contemporary sheep operations may use non @-@ lethal predator deterrents such as motion @-@ activated lights and noisy alarms .

== Economic importance ==

Sheep are an important part of the global agricultural economy . However , their once vital status

has been largely replaced by other livestock species , especially the pig , chicken , and cow . China , Australia , India , and Iran have the largest modern flocks , and serve both local and exportation needs for wool and mutton . Other countries such as New Zealand have smaller flocks but retain a large international economic impact due to their export of sheep products . Sheep also play a major role in many local economies , which may be niche markets focused on organic or sustainable agriculture and local food customers . Especially in developing countries , such flocks may be a part of subsistence agriculture rather than a system of trade . Sheep themselves may be a medium of trade in barter economies .

Domestic sheep provide a wide array of raw materials . Wool was one of the first textiles , although in the late 20th century wool prices began to fall dramatically as the result of the popularity and cheap prices for synthetic fabrics . For many sheep owners , the cost of shearing is greater than the possible profit from the fleece , making subsisting on wool production alone practically impossible without farm subsidies . Fleeces are used as material in making alternative products such as wool insulation . In the 21st century , the sale of meat is the most profitable enterprise in the sheep industry , even though far less sheep meat is consumed than chicken , pork or beef .

Sheepskin is likewise used for making clothes , footwear , rugs , and other products . Byproducts from the slaughter of sheep are also of value : sheep tallow can be used in candle and soap making , sheep bone and cartilage has been used to furnish carved items such as dice and buttons as well as rendered glue and gelatin . Sheep intestine can be formed into sausage casings , and lamb intestine has been formed into surgical sutures , as well as strings for musical instruments and tennis rackets . Sheep droppings , which are high in cellulose , have even been sterilized and mixed with traditional pulp materials to make paper . Of all sheep byproducts , perhaps the most valuable is lanolin : the waterproof , fatty substance found naturally in sheep 's wool and used as a base for innumerable cosmetics and other products .

Some farmers who keep sheep also make a profit from live sheep . Providing lambs for youth programs such as 4 @-@ H and competition at agricultural shows is often a dependable avenue for the sale of sheep . Farmers may also choose to focus on a particular breed of sheep in order to sell registered purebred animals , as well as provide a ram rental service for breeding . The most valuable sheep ever sold to date was a purebred Texel ram that fetched £ 231 @,@ 000 at auction . The previous record holder was a Merino ram sold for £ 205 @,@ 000 in 1989 . A new option for deriving profit from live sheep is the rental of flocks for grazing ; these " mowing services " are hired in order to keep unwanted vegetation down in public spaces and to lessen fire hazard .

Despite the falling demand and price for sheep products in many markets , sheep have distinct economic advantages when compared with other livestock . They do not require expensive housing , such as that used in the intensive farming of chickens or pigs . They are an efficient use of land ; roughly six sheep can be kept on the amount that would suffice for a single cow or horse . Sheep can also consume plants , such as noxious weeds , that most other animals will not touch , and produce more young at a faster rate . Also , in contrast to most livestock species , the cost of raising sheep is not necessarily tied to the price of feed crops such as grain , soybeans and corn . Combined with the lower cost of quality sheep , all these factors combine to equal a lower overhead for sheep producers , thus entailing a higher profitability potential for the small farmer . Sheep are especially beneficial for independent producers , including family farms with limited resources , as the sheep industry is one of the few types of animal agriculture that has not been vertically integrated by agribusiness .

= = Food = =

Sheep meat and milk were one of the earliest staple proteins consumed by human civilization after the transition from hunting and gathering to agriculture . Sheep meat prepared for food is known as either mutton or lamb . " Mutton " is derived from the Old French moton , which was the word for sheep used by the Anglo @-@ Norman rulers of much of the British Isles in the Middle Ages . This became the name for sheep meat in English , while the Old English word sceap was kept for the live animal . Throughout modern history , " mutton " has been limited to the meat of mature sheep

usually at least two years of age ; " lamb " is used for that of immature sheep less than a year .

In the 21st century , the nations with the highest consumption of sheep meat are the Arab States of the Persian Gulf , New Zealand , Australia , Greece , Uruguay , the United Kingdom and Ireland . These countries eat 14 ? 40 lbs (3 ? 18 kg) of sheep meat per capita , per annum . Sheep meat is also popular in France , Africa (especially the Maghreb) , the Caribbean , the rest of the Middle East , India , and parts of China . This often reflects a history of sheep production . In these countries in particular , dishes comprising alternative cuts and offal may be popular or traditional . Sheep testicles ? called animelles or lamb fries ? are considered a delicacy in many parts of the world . Perhaps the most unusual dish of sheep meat is the Scottish haggis , composed of various sheep innards cooked along with oatmeal and chopped onions inside its stomach . In comparison , countries such as the U.S. consume only a pound or less (under 0 @. @ 5 kg) , with Americans eating 50 pounds (22 kg) of pork and 65 pounds (29 kg) of beef . In addition , such countries rarely eat mutton , and may favor the more expensive cuts of lamb : mostly lamb chops and leg of lamb .

Though sheep 's milk may be drunk rarely in fresh form , today it is used predominantly in cheese and yogurt making . Sheep have only two teats , and produce a far smaller volume of milk than cows . However , as sheep 's milk contains far more fat , solids , and minerals than cow 's milk , it is ideal for the cheese @-@ making process . It also resists contamination during cooling better because of its much higher calcium content . Well @-@ known cheeses made from sheep milk include the Feta of Bulgaria and Greece , Roquefort of France , Manchego from Spain , the Pecorino Romano (the Italian word for sheep is pecore) and Ricotta of Italy . Yogurts , especially some forms of strained yogurt , may also be made from sheep milk . Many of these products are now often made with cow 's milk , especially when produced outside their country of origin . Sheep milk contains 4 @. @ 8 % lactose , which may affect those who are intolerant .

As with other domestic animals , the meat of uncastrated males is inferior in quality , especially as they grow . A " bucky " lamb is a lamb which was not castrated early enough , or which was castrated improperly (resulting in one testicle being retained) . These lambs are worth less at market .

= = Science = =

Sheep are generally too large and reproduce too slowly to make ideal research subjects , and thus are not a common model organism . They have , however , played an influential role in some fields of science . In particular , the Roslin Institute of Edinburgh , Scotland used sheep for genetics research that produced groundbreaking results . In 1995 , two ewes named Megan and Morag were the first mammals cloned from differentiated cells . A year later , a Finnish Dorset sheep named Dolly , dubbed " the world 's most famous sheep " in Scientific American , was the first mammal to be cloned from an adult somatic cell . Following this , Polly and Molly were the first mammals to be simultaneously cloned and transgenic .

As of 2008 , the sheep genome has not been fully sequenced , although a detailed genetic map has been published , and a draft version of the complete genome produced by assembling sheep DNA sequences using information given by the genomes of other mammals . In 2012 , a transgenic sheep named " Peng Peng " was cloned by Chinese scientists , who spliced his genes with that of a roundworm (*C. elegans*) in order to increase production of fats healthier for human consumption .

In the study of natural selection , the population of Soay sheep that remain on the island of Hirta have been used to explore the relation of body size and coloration to reproductive success . Soay sheep come in several colors , and researchers investigated why the larger , darker sheep were in decline ; this occurrence contradicted the rule of thumb that larger members of a population tend to be more successful reproductively . The feral Soays on Hirta are especially useful subjects because they are isolated .

Sheep are one of the few animals where the molecular basis of the diversity of male sexual preferences has been examined . However , this research has been controversial , and much publicity has been produced by a study at the Oregon Health and Science University that

investigated the mechanisms that produce homosexuality in rams . Organizations such as PETA campaigned against the study , accusing scientists of trying to cure homosexuality in the sheep . OHSU and the involved scientists vehemently denied such accusations .

Domestic sheep are sometimes used in medical research , particularly for researching cardiovascular physiology , in areas such as hypertension and heart failure . Pregnant sheep are also a useful model for human pregnancy , and have been used to investigate the effects on fetal development of malnutrition and hypoxia . In behavioral sciences , sheep have been used in isolated cases for the study of facial recognition , as their mental process of recognition is qualitatively similar to humans .

= = Cultural impact = =

Sheep have had a strong presence in many cultures , especially in areas where they form the most common type of livestock . In the English language , to call someone a sheep or ovine may allude that they are timid and easily led . In contradiction to this image , male sheep are often used as symbols of virility and power ; the logos of the St. Louis Rams and the Dodge Ram allude to males of the bighorn sheep , *Ovis canadensis* .

Counting sheep is popularly said to be an aid to sleep , and some ancient systems of counting sheep persist today . Sheep also enter in colloquial sayings and idiom frequently with such phrases as " black sheep " . To call an individual a black sheep implies that they are an odd or disreputable member of a group . This usage derives from the recessive trait that causes an occasional black lamb to be born into an entirely white flock . These black sheep were considered undesirable by shepherds , as black wool is not as commercially viable as white wool . Citizens who accept overbearing governments have been referred to by the Portmanteau neologism of sheeple . Somewhat differently , the adjective " sheepish " is also used to describe embarrassment .

= = = Religion and folklore = = =

In antiquity , symbolism involving sheep cropped up in religions in the ancient Near East , the Mideast , and the Mediterranean area : Çatalhöyük , ancient Egyptian religion , the Canaanite and Phoenician tradition , Judaism , Greek religion , and others . Religious symbolism and ritual involving sheep began with some of the first known faiths : Skulls of rams (along with bulls) occupied central placement in shrines at the Çatalhöyük settlement in 8 @, @ 000 BCE . In Ancient Egyptian religion , the ram was the symbol of several gods : Khnum , Heryshaf and Amun (in his incarnation as a god of fertility) . Other deities occasionally shown with ram features include the goddess Ishtar , the Phoenician god Baal @-@ Hamon , and the Babylonian god Ea @-@ Oannes . In Madagascar , sheep were not eaten as they were believed to be incarnations of the souls of ancestors .

There are many ancient Greek references to sheep : that of Chrysomallos , the golden @-@ fleeced ram , continuing to be told through into the modern era . Astrologically , Aries , the ram , is the first sign of the classical Greek zodiac , and the sheep is the eighth of the twelve animals associated with the 12 @-@ year cycle of in the Chinese zodiac , related to the Chinese calendar . In Mongolia , shagai are an ancient form of dice made from the cuboid bones of sheep that are often used for fortunetelling purposes .

Sheep play an important role in all the Abrahamic faiths ; Abraham , Isaac , Jacob , Moses , King David and the Islamic prophet Muhammad were all shepherds . According to the Biblical story of the Binding of Isaac , a ram is sacrificed as a substitute for Isaac after an angel stays Abraham 's hand (in the Islamic tradition , Abraham was about to sacrifice Ishmael) . Eid al @-@ Adha is a major annual festival in Islam in which sheep (or other animals) are sacrificed in remembrance of this act . Sheep are occasionally sacrificed to commemorate important secular events in Islamic cultures . Greeks and Romans sacrificed sheep regularly in religious practice , and Judaism once sacrificed sheep as a Korban (sacrifice) , such as the Passover lamb . Ovine symbols ? such as the ceremonial blowing of a shofar ? still find a presence in modern Judaic traditions . Followers of

Christianity are collectively often referred to as a flock , with Christ as the Good Shepherd , and sheep are an element in the Christian iconography of the birth of Jesus . Some Christian saints are considered patrons of shepherds , and even of sheep themselves . Christ is also portrayed as the Sacrificial lamb of God (Agnus Dei) and Easter celebrations in Greece and Romania traditionally feature a meal of Paschal lamb . In many Christian traditions , a church leader is called the pastor , which is derived from the Latin word for shepherd .

Sheep are key symbols in fables and nursery rhymes like The Wolf in Sheep 's Clothing , Little Bo Peep , Baa , Baa , Black Sheep , and Mary Had a Little Lamb ; novels such as George Orwell 's Animal Farm and Haruki Murakami 's A Wild Sheep Chase ; songs such as Bach 's Sheep may safely graze (Schafe können sicher weiden) and Pink Floyd 's Sheep , and poems like William Blake 's " The Lamb " .