# Introduction

Humans have always been interested in animals and their behavior. During our early history, much of this interest was grounded in practical need. Animals provided an important source of food, so a thorough, working knowledge of how potential food items behaved was extremely important to successful hunting. Animals also assumed important roles in our early rituals and religious beliefs. Today, people are still drawn to animals-we surround ourselves with them. We keep them in our houses, we watch them for entertainment and recreation, we use them to do work, we raise them for food and clothing, we hunt them, we use them to test products, and we use them to answer questions in an attempt to improve the human condition.

Most people assume that animals are just like us, and so endow animals with human feelings and emotions. We say our dogs act "guilty" when we find them on our beds, or our cats are "jealous" of our children. We think of our pets as members of our families, and of wild animals as crafty or cruel or courageous. Although such interpretations of an animal's behavior are acceptable and even useful for most people, they also create some problems. Most of them boil down to one, which is the assumption that animals are "just like us." Why is that a problem? Because animals, like humans, are unique-they aren't "just like us." In some ways we are like other animals, and in other ways we are very different from them. A deeper understanding of animals requires us to think of them as organisms with their own attributes. Instead of assuming that animals "think like us" we must instead "think like them" if we're going to understand them. And, we must be willing to assume, at least for the moment, that animal "thinking" is very different from human thinking.

Some people dedicate their lives to understanding how and why animals do the things they do. Many are trained as veterinarians, but their interest is usually more medical than behavioral. Veterinarians try to ensure the health and safety of the animals in their charge. Usually, this involves yearly check-ups, or tending to sick or injured animals. Only occasionally does a vet become concerned with an animal's behavior, and then usually when the animal is doing something that its owner doesn't like. Animal breeders and trainers are also very interested in how and why animals do what they do. In some cases, knowledge of animal behavior helps breeders or trainers to do their jobs, and in others the job is really to make the animal do something in a certain way, or at a certain time. Professional hunters, naturalists, nature photographers, and wildlife artists must also understand animals, because animals are the subjects of their work.

A few people dedicate their lives to understanding animal behavior, not because they need to know about animals to do their jobs, but because it is their job to understand animals. These people use scientific methods to study the behavior of animals, and they are highly trained in specific fields such as biology, psychology, and anthropology. Although they go by various names (for example, ethologists, behavioral ecologists, comparative psychologists, and behavioral primatologists), we will refer to them as animal behaviorists, scientists who study the behavior of animals. Animal behaviorists are an extremely diverse lot-men and women of many different nationalities, races, and ethnic origins; scientists trained in many different fields of scientific inquiry, but they have one thing in common, an interest in and a curiosity about how and why animals do what they do.

We have all been exposed to their work, either directly or indirectly. For example, animals are increasingly becoming the subjects of movies and TV shows-some cable channels specialize in them. Sometimes these shows are inaccurate or excessively "anthropomorphic" (presenting animals as though they were human), but usually these shows are based on work done by animal behaviorists and sometimes they are produced by animal behaviorists. Some of the current practices of wildlife managers, zoo operators, and other animal keepers are grounded in sound principles taken from animal behavior. And, of course, some animal behaviorists, such as Jane Goodall and Diane Fosse, have become famous in our popular culture.

## The Study of Animal Behavior

**Aims of the course**

1. To understand the general concepts that governs the manner in which animals behave throughout their lives i.e. maximizing 'fitness' through essentially selfish actions.
2. To appreciate the range of mechanisms by which animals adapt to their environmental conditions using behavioural actions.
3. To achieve competence in the skills required to conduct scientifically meaningful studies of animal behaviour.

**Behaviour** can be defined as an expressed course of action produced in organisms in **response** to **stimulus** from a given situation. It could simply be considered as what the animal does. The fundamental explanation of behavioural activity must begin with a stimulus and end with a response.

**Stimulus**: Any change in the biotic and abiotic environments capable of eliciting or causing some sort of reaction or response in a living organism. For example, temperature, pressure, radiation, gravity, or activities of other organisms within the immediate environment.

**Approaches to behavioural studies**

**i. Vitalistic approach**

Behavioural activities are explained in terms of what animals are seen to do in relation to changes in the environment. It involves total rejection of any study of the animal outside its natural environment. The technique is non-scientific since all the observations relate to past events which cannot be tested experimentally.

**ii. Mechanistic approach**

It is an experimental approach and involves the study of particular aspects of behaviour under controlled conditions in a laboratory. It was pioneered by Pavlov and used extensively in psychological study. It may be criticized on the basis of the artificiality of the experimental conditions and the way in which results are interpreted.

**iii. Ethological approach**

**Ethology** is the scientific study of animal behaviour. It explains responses observed in the field in terms of stimuli eliciting the behaviour. This was pioneered by Lorenz, von Frisch and Tinbergen. Ethologists have so far tried to answer questions about animal behaviour from four major areas:

1. **The evolutionary history:**
    - How did various forms of behaviour evolved? i.e. (Innate/instinctive/genetic or learned?)
    - How does the behaviour compare with similar behaviour in related species?

2. **Development:**

- How does behaviour change with age?
- What are the early experiences necessary for the behaviour to expressed?
- e.g. How does courtship behaviour develop during the individuals's life?
- Does the male in domestic fowl learn the waltz dance?
- Does he practice dancing?
- Is he successful in directing the female?

3. **Causation:**

What are the stimuli that elicit the response?
How has it been modified by recent learning?

4. **Function:**

How does the behaviour impact on the animal's chances of survival and reproduction?

**I. Components (types) of Behaviour**

| **Nature/innate** | **Nurture/learned** |
|---|---|
| *Instinct or genes determine behaviour* | *Experience and learning influence behaviour* |

According to Niko Tinbergen, who won the 1972 Nobel Prize in Medicine along with fellow animal behaviorists Konrad Lorenz and Karl von Frisch, the scientific study of animal behavior has four components: causation, development, evolution, and function. We can describe these components in the form of four questions. (1) What causes an animal to perform a certain behavior? (2) How does the behavior change as an animal develops from conception through death, but especially during its early life? (3) What is the evolutionary history of the behavior? (4) How does the behavior help the animal to survive and reproduce successfully?

**Causation of behavior**.-Answers to the question, "What causes an animal to perform a certain behavior?" can take many forms. An experimental psychologist might try to identify the stimuli (the events in the animal's external environment) that immediately precede the behavior, and then experiment with these stimuli and their components to understand the stimulus-response relationship of the behavior. A cognitive psychologist might try to understand the mental processes that are triggered by an appropriate stimulus and lead to the performance of the behavior. A neurobiologist might study the anatomy and physiology of single neurons (nerve cells) or of the entire neural pathway associated with the perception of the appropriate stimulus, its processing in the nervous system, and the production of the appropriate motor patterns (the behavior). An endocrinologist might study the role that hormones play in preparing an animal to respond, for example by organizing the nervous system during development and by priming it to respond rapidly. An ethologist might view causation in terms of systems of motivation, and construct conceptual "models" of different systems that identify the appropriate stimuli ("releasers") and the mechanism that produces the behavior ("action pattern"). In a sense, although each of these approaches uses different tools and concepts, all of them are concerned with the way in which a behavior is "triggered" or elicited. Animal behaviorists refer to such investigations as research on "proximate mechanisms" because these triggers are the most closely related to the behavior itself. At the simplest level, we

could study reflexes such as the "knee jerk," but usually animal behaviorists are interested in more complex behavior.

**Development of behavior**.-A different sort of proximate mechanism is one that enables the behavior to come into being as an animal develops from its earliest stages of growth. In many cases, behaviors must be learned and practiced before they are performed appropriately and correctly, so that a portion of the study of development is concerned with the kinds of experience that are necessary and whether the timing of that experience makes a difference in these "learned" behaviors. Animal behaviorists interested in learned behavior might study normal development to identify potentially important kinds of experience, and then experimentally withhold, alter, or shift in time that experience to see whether such manipulations alter normal development. In other cases, behaviors seem to appear rather suddenly, and seem to be correct and complete the first time they are performed. Prior experience seems to have little to do with the development of these "innate" behaviors, although clearly nervous and muscle systems must be properly developed if the behavior is to be performed at all. Such behaviors will develop normally even if animal behaviorists withhold the usual early experiences of young animals. Although animal behaviorists have sometimes made a big deal about the differences between innate and learned behaviors, most now think that they don't really represent completely different developmental processes. Instead, the development of behavior can be viewed as a range of different degrees of "innateness" or "learnedness." Although extremes do exist, most behaviors will fall somewhere between to two extremes.

**Evolution of behavior.**-At the opposite end of the spectrum of studies of animal behavior are attempts to identify the evolutionary history of a particular behavior. Because the process of evolution (descent with modification) occurs over long periods (sometimes millions of years), experimental manipulations cannot shed any light on evolutionary questions (at least not quickly enough for an animal behaviorist to learn the result). So, evolutionary questions about behavior are addressed by comparing the behaviors of different species of animals. Of course, this "comparative method" requires two things: (1) that the animals being compared are members of an evolutionary lineage, and (2) that we know what that lineage is. Fortunately for animal behaviorists, there are ways to get this information. Today, evolutionary biologists can take information on some aspect of a group of animals, say the structure of some organ, or the sequence of a particular bit of DNA, and with the help of computer programs, come up with an evolutionary "family tree" of these species. Such a "phylogeny" is a hypothesized evolutionary relationship, and if several different analyses based on different information (for example, different bits of DNA and different anatomical structures) all produce the same tree, then we can have some confidence that the proposed phylogeny is correct. If an animal behaviorist then looks at a particular behavior in these same species of animals, it may be possible to determine where the behavior arose (in which species of animal it first appeared) and how in evolved within the phylogeny (did it arise separately more than once, and was it passed on to descendant species). It is even possible for an evolutionary biologist to construct a phylogeny using behavioral characteristics alone, using the same methods and computer programs. Because the evolutionary history of a behavior is far removed from its performance by an individual animal, but is nevertheless an important aspect of that behavior, such analyses are called studies of "ultimate mechanisms."

**Function of behavior**.-Many students of animal behavior focus their attention on trying to determine whether and how a behavior affects an animal's ability to survive and reproduce. This approach is called the "functional" analysis of animal behavior, and also

is a study of ultimate mechanisms because the functions help to shape the evolutionary responses in subsequent generations. According to this approach, a particular behavior is examined to determine whether it enhances an animal's ability to survive and/or reproduce, and if it does, how it enhances survival and/or reproduction. Although this approach can become quite complex, for our purposes here, we will limit such considerations to advantages (functions) to individuals, that is, how the behavior helps those individuals who perform it to live longer, or get mates faster, or get more mates, or have more young, or enhance the survival of their young. If the behavior improves an individual's performance in any of these aspects of "reproductive success" when compared to individuals who don't perform the behavior, then the behavior is said to serve that particular function (for example, the behavior functions to improve survival).

## 5. Reproductive behaviour

Reproduction in many species consists of release of gametes into the environment. The only condition necessary for fertilization is the release of egg and sperm at approximately the same time. Reproductive behaviour may be summarized as:
1. *Synchronization*, whereby two animals come together and are physiologically ready to reproduce.
2. *Courtship*, whereby the two animals breakdown one another's tendency for physical avoidance and,
3. *Copulation*, whereby sex cells, usually sperms are transferred. Each step in the pattern of behaviour is essential for the succeeding step.

***Why the need to study reproductive behaviour?***
An understanding of the sexual behaviour of livestock is one of the keys to maintaining productive herds and flocks in tropical countries for the following reasons:
1. Since only a few males are needed to inseminate large numbers of females, the sexual behaviour and fertility of male animals are of crucial importance to building a herd or flock.
2. Behavioural observation is the main method used to ascertain whether a female is in oestrus and will become pregnant if inseminated, since artificial insemination is now the norm in intensive dairy cow production system.
3. Under tropical conditions where mixed herd are run and breeding often uncontrolled, knowledge of sexual behaviour is useful in that animals that are sick or unproductive can be identified by their lack of normal behaviour and culled.

***Courtship and mating***
There are many elaborate and ritualistic species-specific behaviour patterns associated with courtship and mating. In birds, mammals and some fish, these two processes often follow the establishment of a territory by the male. ***Courtship*** is a complex behaviour pattern designed to stimulate organisms to sexual activity, and is associated with pair formation in those species where both sexes are involved in the rearing of offsprings.

Courtship behaviour is controlled primarily by *motivational* and *releasing stimuli* and leads to mating. During mating, the behavioural activities are initiated by releasing stimuli and ended by *terminating stimuli* associated with the release of gametes by the male. The motivational stimuli for courtship in most species are external, such as *photoperiod*, and lead to rising levels of reproductive *hormones* and the maturation of gonads. In most species, this produces striking changes in secondary sexual characteristics and other behavioural activities including colouration changes, increase in

size of parts of the body, as in the plumage of birds, mating calls as in nightingales, use of chemical sex attractants.

Of the variety of *signals* used in the *courtship* to attract members of the opposite sex, **sight**, **sound** and **smell** play important roles. Many insects (e.g. crickets), amphibian, birds and mammals use auditory signals in courtship. Substances called pheromones are secreted and released in small amounts by organisms, leading to specific physiological responses in other members of the same species for the purpose of courtship and mating. E.g. Mares, cows and bitches secrete pheromones while in heat.

***Mating systems***

1. *Monogamous mating system*
- Involves one male and one female.
- Includes those species where both sexes are involved in rearing of offprings. E.g. about 90% of avian species.

2. *Polygamous mating system*
- Involves one male and many females.
- Only the female is involved in rearing offspring. E.g. Most domestic livestock (ruminants, pig etc.)
- It is in the reproductive interest of the male to seek out and mate with more females.

***Courtship behaviour in domestic fowl***

Male domestic fowl typically have fleshy head ornaments such as comb and wattle and perform elaborate courtship displays. It is shown that behaviour of males changed after females were introduced into experimental pens. The frequency of behavioural display known as wing-flapping increased. Wing-flapping is typically performed by males during aggressive interactions with other males and when courting females. Females show preferences for socially dominant males with large combs and highest wing-flapping rate. Females use morphological traits or characteristics that will enhance their fitness. Males may provide high quality resources and or parental care both of which directly increase female's reproductive success. Having acquired a female, the male dances in a circular manner round her (waltz dance) with one wing trailing before pursuing to mate her.

***Nesting and laying behaviour***

In the wild, a hen usually moves away from the rest of the flock to find a secluded nesting place. Domestic hens tend to lay close to their flock mate rather than in isolation. Within the flock hierarchical structure, sub-ordinate hens are often bullied, particularly when seeking nest boxes. To reduce the impact of excessive aggression within a flock and to reduce floor laying, it is important that sufficient nest boxes are available. All hens show elements of typical nesting and laying behaviour sequence as follows: Separating from the flock, examining potential nest sites, scratching and pecking at nest material, building a nest or choosing on already formed nest, entering the nest, forming a hollow, laying an egg, rolling the egg under the body, lying on the egg, getting up, standing, leaving the nest and crackling. If no adequate nest site is available, hens will develop abnormal nesting and laying behaviour and possibly stereotyped activity patterns. The following provision must be made to address the animal's basic need: social housing, laying nest, elevated perches, natural light, area for pecking, scratching and dust/sand bathing.

***Brooding behaviour***

Broodiness is an instinctive type of behavioural characteristic exhibited by avian species. In essentially all avian speicies, one or both parents must incubate eggs until hatching and then provide some form of post hatching care.
A hen lays only one egg every day or two. She does not start to incubate them until the whole clutch is laid so that all the chicks will hatch at the same time. The physiology of a hen changes after she's laid her clutch. She will remain on them, with her wings slightly spread to help keep them warm, for 21 days. The hen makes muttering, growling sounds if disturbed, and may even peck or otherwise try to defend her nest. She will only leave the nest once a day to eat, drink and defecate. The hen should be allowed to do this at least every other day in order not to starve or get the eggs dirty with her droppings. Once the chicks start to hatch she will remain on the nest with them for 24-48 hours. Any eggs that is not hatched by then will be left behind when she takes the chicks for their first walk. At this time water and chick feed should be available for the chicks. It is best to move her to a protected nest once she has been sitting tightly for a few days. This protects her from being chased off the nest by more dominant hens, leaving the eggs to chill and die. Move her gently at night and keep the new nest dark for the next day.

A hen is also called *broody* when she is raising her chicks, protecting them, teaching them to find food, and hovering over them to keep them warm. The main *hormone* implicated in this type of behaviour is **prolactin**. Prolactin is highly correlated with display of incubation behaviour, brooding/feeding of young. A rise in prolactin may occur abruptly at the time of egg laying and incubation, or prolactin may rise more slowly and not peak until later in incubation. Prolactin levels often begin to decline only after the chicks achieve thermal independence and do not require constant brooding. Parental behaviour of galliform birds is atypical because the chicks are precocial (developed certain faculties earlier than normal), requiring relatively little parental attention and because the male provide little or no parental care.

Note that many breeds of chicken have had the instinct to go broody bred out of them so that they will produce more eggs. These include especially the Mediterranean breeds like the Leghorns which will never go broody. The Sex-linked hybrids and production strains of Rhode Island Red and Barred Rock also usually don't go broody.

**Reproductive behaviour on other domestic livestock species**
Following the attainment of sexual maturity in females, the sequence of reproductive events is cyclic in nature, mainly controlled by hormones. In the male, early secretion of foetal androgen regulates the hypothalamus, rendering the sex centre acyclic.

*Oestrus behaviour*
Oestrus is a behavioural strategy to ensure that the female is mated at the time of ovulation. Oestrus coincides with the greatest development of ovarian follicles brought about by follicle stimulating hormone. The psychological manifestation is brought about by oestrogen. The female in oestrus or heat becomes receptive to the advances of the male and may even actively seek out for him. Thus a tethered ewe in heat will be located and mated by a ram. Each mammalian species show oetrus behaviour at ovulation with one notable exception, the human.

*Oestrous cycle*
It is the period between one oestrus and the next. Oestrous cycle in females is nature's first priority in reproductive design. Cycles are only a consequence of infertility or failure

to conceive. They are nature's way of making another bid for pregnancy. Oestrous cycle lasts for 16-25 days in domestic mammals (Table 1) and varies between species as well as within individuals.

Table 1. Oestrus cycle, oestrus duration and ovulation time in some mammals

| Species | Length of oestrous cycle, days | Duration of oestrus | Time of ovulation |
|---|---|---|---|
| Ewe | 16-17 | 24-36 hours | 20-30 hrs from start of oestrus |
| Goat | 21 | 32-40 hours | 30-36 hrs from start of oestrus |
| Sow | 19-20 | 48-72 hours | 35-45 hrs from start of oestrus |
| Cow | 21-22 | 18-19 hours | 10-11 hrs after the end of oestrus |
| Mare | 19-25 | 4-8 days | 1-2 days before the end of oestrus |
| Rabbit | Reflex ovulator | - | 10-11 hours after corpulation |

***Heat detection in farm animals***

Heat detection is necessary for the following reasons:
- When animals are to be artificially inseminated,
- There is need to keep accurate breeding records, and
- There is need to check for absence of pregnancy after breeding.

There are behavioural signs of oestrus for each species:

1. **cow**
- Restless or nervous (hyperactive).
- Go off feed.
- Frequent bellowing (deep loud voice).
- Stands still to be mated by the male.
- Allows herself to be ridden by other cows in the presence of the male.
- Sometimes, vulva will be swollen and there will be mucus discharge (anatomical).

**Bulls** can detect a pro-oestrus cow two days before oestus and will remain close to her, trying to drive her from the herd. Alternatively, bulls can be attracted to an oestrus cow if she is being ridden by other cows. Periodically, the bull will smell and lick the cow's vulva and urine, often displaying the 'flehmen' or 'lip curling' response. i.e. curling of the upper lip combined with elevation of the head. This response helps the bull to evaluate chemosensory stimuli provided by the cow that will contribute to sexual arousal and will confirm her receptivity. As full oestrus approaches, tending becomes more marked and the bull will nudge the female's flank and rest his chin across the cow's back. The male will make several mounting attempts before the cow will stand for him. Once the female remain immobile, the bull mounts immediately. Ejaculation occurs within seconds of intromission and is accompanied by generalized muscular contractions. Most cows are mounted between 3 and 10 times by the bull during one oestrus period.

2. **Ewe**
- The most obvious sign is that they will stand to be mated by the male.
- Provocative urination in the presence of the male.

With sheep, **rams** will actively seek receptive ewes within the flock and will also spend a great deal of time sniffing the female's vulva and urine. 'Lip curling' is part of ram's sexual behaviour. Typically, the male will kick the female with its foreleg while flicking the tongue. The head is tilted and lowered while the shoulder is brought into contact with the flank of the ewe. The ram will simultaneously utter low-pitched calls. Several

mounting attempts will take place until mounting with intromission and ejaculation occurs. This is often followed by a resting period before the ram will show interest in the same or another ewe. A ram will copulate with a ewe several times during the receptive period.

3. **Doe**
- The most obvious sign is that they will stand to be mated by the male.
- Wagging of tail (also when you place your hands on the loins of the goat).
- Bleating, restless behaviour and jumping on the backs of other goats.
- Provocative urination in the presence of the male.
- Slightly red and swollen labia (vulva); This is anatomical and may not be obvious in all cases.

In general, the behaviour of **bucks** is very similar to that of rams, but they exhibit a unique behavioural feature of urinating on their own forelegs and beards during courtship. The function of this behaviour is not known. When courting the female, the buck produces a moaning sound and thrust his tongue in and out.

4. **Sow**
- She becomes restless.
- Irritable (easily annoyed).
- Frequent urination.
- Vocal emissions.
- Stands to be mated in the presence of the male.
- Immobility response to man.
- Swollen vulva and mucus secretion (anatomical).

**Boars** appear to identify the sexual stage of the female by random searching and once in contact with an oestrus female, the male will pursue her, attempting to nose her sides, flanks and vulva. During this phase of courtship, the boar will produce a series of soft grunts called 'courting song', which may encourage the female to stand. The boar will also emit urine rhythmically and the odour of the urine may further increase the female's willingness to stand. Several mounting attempts will be made until the female becomes immobile, after which intromission follows rapidly. Ejaculation takes place within 3 to 20 minutes.

***Factors affecting oestrus behaviour***

1. *Genetic factors*: Different cattle breeds show considerable differences in the expression of oestrus behaviour in terms of duration and intensity. E.g. Zebu cows exhibit oestrus for a shorter period of time with less intensity than breeds of temperate origin.
2. *Nutritional factors*: Weight loss has an effect on cyclic ovarian activity, which ceases when cows lose 25-30% of their mature body weight. Cows fed on a supplement of groundnut meal are twice as fertile as those receiving no supplement.
3. *Social environment*: If ewes, does and sows are kept in a separate herd or flock from the males, their oestrus behaviour will be affected and it may be more difficult to detect oestrus. This is less of a problem with cattle. Overcrowding cows for an extended period can delay puberty and may also result in irregular oestrous cycles.
4. *Photoperiod and ambient temperature*: Climatic stress tends to reduce the rate of weight gain in all livestock species and this in turn will delay the onset of sexual maturity and therefore shorten the animal's breeding life. Hot ambient temperatures also adversely

affect breeding sows, which are very prone to heat stress since they cannot pant or sweat. Hence an external source of cooling is essential in hot climates.
5. *Disease*: Female livestock suffering from raised body temperature resulting from an infection are unlikely to exhibit normal sexual behaviour. Several specific diseases associated with reproduction can also affect sexual behaviour. E.g. Cystic ovarian disease in cows, where raised levels of oestrogen affect the animal's behaviour patterns during the oestrous cycle. They may become restless and paw the ground and all signs of oestrus may be suppressed.

***Factors affecting male libido and mating ability***

1. *Genetic factors*: Different breeds show differences in their sexual behaviour. E.g. Low libido is sometimes seen more frequently in Landrace than Large White boars.
2. *Social behaviour*: Rank order or dominance hierarchy of males can have a marked effect on sexual behaviour, with dominant males achieving the most copulations. It is possible for the dominant male to be infertile, with drastic consequences on the herd fecundity. If large numbers of cows return to service within the herd, the dominant bull should be removed.
3. *Photoperiod and temperature*: Some domestic species such as sheep and goats show seasonal breeding in temperate and cold climates and seasonal fluctuations are widely observed in the libido of rams and bucks. These are caused by changes in day-length.
4. *Frequency of use*: E.g. it is recommended that young boars (less than 10 months of age) should copulate once a week whereas adult boars can mount twice every 5 days. Longer periods of sexual activity may decrease libido.
5. *Disease*: Infectious diseases that cause lameness, and painful condition in the penis and prepuce such as balanoposthitis may reduce sexual performance. Hence, males must be properly examined on regular basis to ensure that only healthy males are allowed for breeding.

## Maternal and neonatal behaviour

Maternal and neonatal behaviour greatly affect the growth and survival of the young. Human supervision of parturition can often improve the range of neonatal survival.

### 1. Pre-parturient behaviour

***Cattle***

Changes in behaviour can be observed as early as six weeks before parturition when the cow starts to avoid aggressive interactions with herd mates. Cows may be restless for up to 2 weeks before calving and this intensifies during the last 2 days. They will frequently and alternately lie and stand and eating patterns may be interrupted. Anorexia usually develops during the last day before parturition. The cow is likely to seek isolation from herd's mates and may stay apart from the herd for between three days and one week. Maternal interest in the newborn of other females may occur in cows and one cow may 'adopt' the calf of another cow.

***Sheep and goats***

Pre-parturient behaviour includes restlessness, interest in the newborn lambs and amniotic fluids of other ewes and isolation from the flock. Restlessness indicates that parturition will take place in the next one or two hours. Restlessness refers to walking in

circles, alternately standing and lying, and pawing the ground. Some ewes may also lick their lips or stick their tongues out. Pre-lambing maternal interest may include attempts to foster another ewe's lamb and sometimes, it may result in the death of the lamb since the ewe will lose interest in the alien lamb when her own lamb is born. Alternatively, she may neglect her own lambs. Stealing of alien lambs generally occurs where there is a high density of parturient ewes, either due to high stocking rates or to synchronized lambing. **Isolation of the ewe from the flock increases the chance of lamb survival because it promotes the establishment of a selective bond between the ewe and her lamb(s) shortly after birth and avoids interference from other parturient females.*

As parturition approaches, **goats** will leave the herd and seek a sheltered place to give birth, often near a vertical object. Shortly before parturition, the doe appears nervous, paws the ground, lies down and stands up repeatedly with signs of straining, and kicks and licks her back. Birth is usually completed within one hour of the first behavioural signs of impending parturition.

***Pigs***

The pre-parturient behaviour of the sow includes intermittent grunting and rapid breathing. When given the opportunity, domestic sows perform an elaborate nesting behaviour that is very similar to that of wild boar, the ancestor of the domestic pig. The sow seeks an appropriate site for building nest 15-24 hour before farrowing and then prepares the nest by rooting and pawing the ground. These actions are caused by hormonal changes mainly **prolactin.** The sows collects and moulds nesting material, including grass, straw, branches or any other dry material that is available. Note that normal pre-farrowing behaviour cannot be performed when sows are confined and this may cause the sows to become stressed which could interfere with piglet survival. **Sows should be allowed to exercise as much as possible of their normal behavioural pattern by providing nesting material (straw or grass).*

**2. Parturient and post parturient behaviour of domestic livestock**

In all species, the process of giving birth is divided into 3 stages: dilation of the cervix, expulsion of the foetus and passage of the afterbirth. During the first stage of parturition, the dam shows restlessness and occasionally abdominal straining. Some may show signs of abdominal pain although these signs are often absent in older females. During the second stage, intense abdominal straining occurs. The amniotic sac breaks and a straw-coloured liquid is passed out. The *cow* may stand at first but during the passage of the calf's head, she usually lies down until the calf is born. The second stage ends with the expulsion of the foetus. Expulsion of the foetal membranes usually takes place about 4-6 hours later, but it may be delayed for up to 12 hours in cows. Both *sheep and goats* usually lie down during labour, although females of both species may stand during the final stages of expulsion. Most females stand and start licking their young within few minutes of birth. Licking is driven by an attraction to birth fluids and results in the young being licked dry; The sow rarely licks her young unlike the ruminants. Cattle, goats and sows usually eat the afterbirth but sheep rarely does so.

Some sows kept in commercial conditions (confined in crates or housed on bare concrete floors) remain restless throughout most of the farrowing period which is in contrast with the beheviour of sows kept under natural conditions. Restlessness of sows probably contributes to the crushing of piglets and reduces their intake of colostrums, leading to mortality. *Provision of bedding materials and avoidance of disturbance is desirable and will reduce piglet mortality and maximize productivity.*

**3. Neonatal behaviour and nursing**

The period of time following parturition is critical for maternal bonding. Therefore, *if contact between the newborn and its mother is prevented during the first few hours of post-partum, a rapid decline in maternal interest is likely to occur.*

Most *calves* are able to stand within 30-60 minutes of birth and up to 50% of calves may take more than 6 hours to find a teat. The time to first suckling depends on the vigour of the calf and maternal responsiveness. Suckling occurs at a frequency of 4 to 10 times a day, with each suckling lasting for about 8 to 10 minutes. Calves do not immediately follow their dams, but remain hidden while the cow grazes. After a few days, the calf will begin to follow the cow, but groups of calves of about the same age (nurseries) will be found lying together for much of the day during when cows need to travel several kilometers in search of food. One or two cows will stay with the calves probably to protect them from predators.

*Lambs and kids* are born in a relatively advanced state of development and most are able to stand and suckle within one hour of birth. Heavier ones tend to be more vigorous. They keep close to their mothers after birth and suckle with great frequency, sometimes more than once per hour. Sucking periods last for as long as three minutes during the first few days of lactation, but later the duration falls to 20-30 seconds. It is the **ewe** that keeps her lamb close to her side early in the lamb's life, whereas later, the lamb plays an increasing important role in maintaining the mother-lamb attachment. Later on, visual signals become more important and if the physical appearance of the lamb is changed particularly that of the head, the ewe may fail to identify it. *Auditory* signals are also important in ewe-lamb recognition.

After birth, the **doe** licks her kid for a period of 2-4 hours. There appears to be a critical period of about one hour that ensures the kid will be accepted. Thus if the kid is removed at birth and presented to doe more that one hour later, it may be rejected. Recognition of the kid is based on *olfactory signals* and there is some evidence that if the odour of the kid changes, the doe may reject it. Kids stand shortly after birth, often within 20 minutes and suckle within the first hour. Towards the end of the first day of life, kids move away from their mothers to hide and remain concealed for several days. Females will either stay in the proximity of the kid or rejoin the herd, returning to the kid only to suckle it.

*Piglets* move around shortly after birth, usually taking 5-40 minutes to locate the udder and 20-60 minutes to suckle on a teat. Piglets failing to ingest colostrum within 20 hours post-partum will die. The sow lies on her side during nursing, although some may stand. Each suckling period is often preceded by a period of jostling between the piglets.

**Management techniques to reduce neonatal mortality**

1. *Nutrition*

The nutrition of dam particularly during the last trimester of pregnancy has a major effect on birth weight and survival of the young. Supplementary feeding should be provided during late pregnancy.

2. *Supervision of parturition*

Supervision during parturition should aim to detect animals with dystocia and to provide assistance. Close supervision immediately after birth should help to ensure proper mothering.

3. *Housing and provision of shelter*

When animals are given the opportunity to give birth in separate cubicles or pens, dams will stay closer to their young and experience less interference from others. Provide shelter from the sun as well as feed and water close to the area of parturition especially for sheep and goats.

One of the main requirements of farrowing accommodation is an optimal thermal environment for the piglets since newborn piglets need an ambient temperature of at least $35^{o}$C. This is achieved by designing a creep area that can be heated and insulated. Farrowing crates can be used to reduce the risk of piglets being crushed.

4. *Fostering*

This is useful for orphans and when dams fail to show appropriate maternal behaviour, has too many young, or is unable to produce milk. Fostering is easy shortly after an animal delivers her young because she will readily accept any alien young that provide similar olfactory cues or signals. Breeds and individuals differ in their readiness to foster alien offspring. Several approaches to encourage the fostering process include:

- In sheep, provide a common odour to the foster lamb and the ewe's lamb. Wool wax and vegetable oil may be used.
- Confinement – placing a dam with alien off-spring in close confinement for some time may result in fostering.
- Skinning – If the dam's own offspring dies, the skin can be removed and tied onto an alien offspring to encourage fostering.

In *pigs*, fostering has two main purposes: 1.To move piglets in excess of the number of functional teats onto sows with spare rearing capacity. 2. To even out the size of litters by birth weight, thus avoiding smaller piglets suffering poor growth rates or high mortality due to competition with stronger litter mates. Fostering is useful when sow is ill or die at farrowing. Sows will readily accept alien piglets. It is desirable to mix the foster piglets with the sow's own litter for approximately 30 minutes in the creep area before introducing them to sow.

6. *Genetic selection*

- Individuals vary in their mothering ability and in the vigour of their young and these differences are partly genetic. For example, some strains of Merinos are notoriously poor mothers, particularly young dams giving birth to multiple young. Such differences allow for the possibility of genetic selection to reduce neonatal losses.
- Selection of breeding gilts according to teat conformation and number can be useful, since bad teat conformation is one of the main reasons why a sow will rear fewer piglets than desirable.

## 6. Maintenance behaviours

1. **Feeding behaviour**

Understanding feeding behaviour of livestock helps the stock owner maximize the productivity of his animals despite the limitations imposed by the available feed. Feeding behaviour of animals depends on the nature of their main feed source and it is therefore convenient to divide domestic livestock into ruminants (herbivores) and omnivores (pigs and poultry).

i. ***Feeding behaviour of ruminants***

Cattle, sheep and goats are ruminants and ruminating behaviour (repeated chewing of feed) takes a considerable proportion of their time, about 6-8 hours daily in cattle. The extent of rumination depends on the fibre content. Animals that are disturbed or stressed will temporarily cease rumination. Cattle, sheep and goats show different features of feeding behaviour, particularly in the degree of selectivity, preference for grazing or

browsing and water consumption. Differences in feeding behaviour between species partly explain the benefits of mixed grazing. The combination of several grazing species usually results in a greater production per unit area than when only one species is grazed. This is because different species eat different forage. E.g. large unselective feeders (cattle) graze coarse forage and render the range more acceptable to smaller more selective species (sheep and goats).
*Grazing ruminants* tend to show a diurnal rhythm, grazing mainly during daylight hours with two peaks of grazing activity – one close to dawn and the other in the late afternoon. When day length is short, the two periods merge. In the *tropics*, overnight grazing may be more important particularly if day time temperatures are high.

**Cattle** are relatively unselective when grazing and are among the most developed of all domestic herbivores. If cattle are given the choice, they will graze annual grasses rather than perennial ones as they find these more palatable. Cattle will browse (feed on twigs, leaves and crop residues) only when grass is in short supply or has low nutritive value. Browse (tree legumes) is an important source of feed in the tropics, especially when grass is in short supply. More commonly, cattle and sheep will graze on standing hay or crop residues during the dry season. They lose weight during this period and gain it during the rainy season when the grass grows again. Bush encroachment may occur if cattle are sole grazers.

**Sheep** and **goats** are more selective than cattle and both species will graze or browse depending on the availability of each type of forage. In general, sheep prefer to graze and goats prefer to browse. Goats also have the peculiarity of adopting the bipedal stance when feeding and they will even climb trees or onto cars parked under trees. They browse on species not eaten by other animals since they have a higher tolerance for tannins than other ruminants. Hence, goats do not lose body weight during the dry season. Sheep and goats are adapted to arid regions and need considerably less water than cattle.

ii. ***Feeding behaviour of pigs and poultry***
**Pigs** are omnivorous feeders and will consume a wide range of feeds of both animal and plant origin. Pigs are very opportunistic in their feeding habits. Free ranging pigs have a strong drive to forage over long periods of time. They spend over 50% of their day foraging, with rooting behaviour forming an essential part of this activity. Pigs cannot perform their natural behaviour when they are housed in intensive units, where they are often kept on solid floors with no beddings, and the full day's ration is provided in a trough and consumed in about 20 minutes. It often leads to behavioural problems such as tail biting. In the tropics, pigs tend to concentrate their feeding in the morning, when temperatures are lower.

**Poultry** in free range forage mainly by scratching at the ground to expose small feed items such as seeds, fruits, herbage and invertebrates. Young birds usually eat a higher proportion of invertebrates than adults, possibly because they require a higher protein diet. Geese may consume large quantities of grass. Under natural conditions, domestic poultry spend a large proportion of their time foraging, with peaks of activity in the morning and the evening. Intensive production systems that prevent the birds from performing such behaviour may result in behaviour problems such as feather pecking.

*Imprinting behaviour* in ducks is used by farmers in S.E. Asia who take their ducks to graze as a flock. The tendency of ducks to group together especially in S.E. Asia is used to advantage. The ducks kept together scavenge on the fields from which rice has

recently been harvested. They glean rice that has been shed in the harvesting process and consume insects and worms living in the rice paddies.

**Water availability and feeding behaviour**

Water is essential for life and can be supplied to livestock as drinking water, water in feed and as metabolic water produced by oxidation of organic nutrients. Cattle that are deprived of water rapidly lose their appetite, and if they are subjected to extended period of inadequate water supply, their growth rate will suffer.

***Factors affecting water requirements and feeding behaviour of farm animals***

Water requirements of livestock are affected by several factors which include: specie, physiological state of the animal, type of diet, dry matter intake, climatic conditions, water temperature and salinity. It is therefore difficult to list water requirements with any accuracy.

i. *Specie and physiological state*

Requirements for drinking water can be very high, and lactating dairy cows have the highest water needs of all domestic livestock. Most cattle need to be watered everyday. Water requirements of sheep and goats are less accurately known. They have more efficient system of water metabolism than cattle and produce much more concentrated urine. They can live in temperate climates without drinking at all if the pasture is not too dry, whereas cattle must have water to drink even under cool conditions. Water needs of pigs in the tropics range from 3.5-8 litres per day for pregnant sows and 20 to 35 litres per day for boars and lactating sows, the highest requirements being for lactating sows with large litters. Adult domestic chickens drink between 150 and 400 ml of water daily in temperate and tropical climates.

ii. *Climatic conditions*

In the temperate climates, dairy cows need to drink between two and three litres per litre of milk produced. In the tropics, they need at least twice as much water as dairy cows living in the temperate zone. Exposure to direct sunlight/lack of shade will further increase a cow's water requirements as well as other livestock species.

iii. *Water temperature and salinity*

Water temperature and salinity may affect water intake and therefore feed intake. Under hot conditions, water intake increases when water temperature is below ambient temperature. It is therefore advisable to place drinkers or water troughs in the shade. Water with high salt content is usually unpalatable to animals, but it is difficult to estimate the maximum acceptable salinity of drinking water because there is great variation between and within species in their salt tolerance. Sheep and goats have greater tolerance to salinity than cattle, and lactating animals require a lower salt content than non-lactating animals. It is suggested that maximum concentration of total salts in drinking water should not exceed 1.3% for sheep, 1% for beef cattle, 0.7% for dairy cattle and 0.5% for pigs.

iv. *Type of diet*

Composition of feed with high salt content increases the animal's intake of water, and when water is in limited supply, animals tend to reduce their intake of salty feed to a greater extend than their intake of low-salt feed. A constant water supply is therefore very important in saline areas, where plants tend to have a high salt content. Animal fed on high protein diet tends to require more water.

v. ***Homeostasis***

Homeostasis is the maintenance of equilibrium, or constant conditions, in a biological system by means of automatic mechanisms that counteract influences tending toward disequilibrium. The concentrations of oxygen, carbon dioxide, nutrients, hormones, organic and inorganic substances in body fluid remain unchanged, within limits, despite changes in the external environment. Homeostasis in organisms is exemplified by the operations of the endocrine system. The hormone-synthesizing activities of the endocrine glands are regulated by events occurring in the systems that the hormones regulate. For example, a rise of blood-glucose levels stimulates the pancreas to secrete insulin, which acts to accelerate the removal of glucose from the blood by conversion into glycogen and fat. *The sensations of **hunger** and **thirst** are also homeostatic mechanisms which help the organism maintain optimum levels of energy, nutrients, and water.*

Homeostasis alone does not control the drive to feed due to the following factors:

1. *Presence of other animals*. E.g. a pig will eat more in company of other pigs than when single. Motivation to feed therefore over-rides homeostatic principles.
2. *Palatability of the feed*: Feeding behaviour is strongly influenced by positive and negative reinforcement from the palatability of the feed.

2. **Eliminative behaviour**

Cattle, goat, sheep and poultry pass out feaces at random at any point whenever need arises while pigs tend to defecate on specific locations. Pigs tend to keep their bedding area clean and dry from excreta and urine when housed individually. Under crowded conditions, it is difficult for a group of pigs to maintain an organized eliminative behaviour. Horses, particularly stallion also show a careful and deliberate effort in selecting particular areas for defecation. The volume of feaces and number of times taken to defecate depends on the nature and quantity of feed ingested.

3. **Rest and sleep**

Clinically healthy animals are expected to lie down at least once in a day, either to rest or sleep, which are necessary for restoration, metabolic recoveries and conservation of energy. Horses spend approximately 2.5 hours a day resting, mainly in a standing position (fixed stance). They hardly spend more than 30 minutes sleeping. Cattle spend about 5 hours a day in a drowsy or sitting position while ruminating and about one hour sleeping. They may also stand or lie without ruminating. Rest and sleep are affected by diet. Time of sleeping decreases with increase in percentage of roughage in the diet.

**Nutrient Intake and Utilization**

Ruminants optimize forage consumption to meet their nutrient requirements if no physical or metabolic restrictions are imposed. *Voluntary intake* of forage is the amount consumed by the animal when its accessibility to forage is unrestricted. In such a case, regulation of intake is dependent only on endogenous mechanisms triggered either within the animal or by some characteristic(s) of the forage. **Forage (nutrient) intake** under grazing conditions is a modified expression of voluntary intake and is influenced by forage quality, forage availability, forage harvestability, environmental stress and management. Environmental stress and nutrient intake are included because foraging for nutrients demands movement over long distances. Diurnal and seasonal thermal fluctuations and predator avoidance are more pronounced under free-grazing than controlled feeding conditions.

Forage intake of grazing ruminants is usually controlled by distension of the reticulum and cranial sac of the rumen. Distension of this sensory region is decreased by digesta passage to the lower tract and/or by reducing ingesta volume and mass through mastication and fermentation. Mastication, primary and secondary, is the major means of particle size reduction resulting in more dense, less bulky digesta and more rapid fermentation and passage.

**Animal Factors Affecting Nutrient Intake**

Voluntary intake may decrease before, and increase after, parturition in both sheep and cattle. Decreased intake during late gestation is attributed to decreased reticulorumen capacity caused by a combination of rapid fetal growth and/or increased deposition of abdominal fat and hormonal mechanisms. The extent to which these mechanisms ultimately control voluntary intake is not known. Voluntary intake increases post partum, but lags behind increased energy requirements for lactation by 2-6 weeks, apparently because of the time required for the rumen to increase in size and re-establish maximum volume.

There is no clearly defined relationship between body condition (fatness) and nutrient intake in cattle and sheep. The general consensus is that abdominal fat restricts voluntary intake 3-30%, although various effects of fatness have been reported. Conversely animals in a depleted state, consume greater quantities of moderate to high quality forages (**compensatory intake**).

Beef cattle and sheep of different genetic backgrounds exhibit markedly different voluntary intakes and efficiencies of production. Maintenance requirements of beef cattle account for 70-75% of the ME requirements through a production cycle, under pen fed conditions. While limited quantitative data are available the maintenance energy costs of free-ranging cattle are estimated to be 20-50% greater than under pen fed conditions. Therefore, the mature size and milk production capability of cows could have a marked effect on their efficiency of production under grazing conditions. Metabolizable energy intake increases as mature size and milk production increases. Similarly, voluntary intake of 3/4 Simmental cows was greater than Hereford cattle under free ranging conditions. Under conditions of low forage quantity and/or quality the production potential of 3/4 Simmental cattle was not achieved.

Animal genotype and phenotype can have marked effects on voluntary intake and efficiency of production. Dairy cattle breeds have higher maintenance and lactation energy requirements and intake per unit weight than beef breeds. These are attributed to differences in physiological prioritization of tissue growth and maintenance. Dairy breeds have a higher proportion soft tissue organ mass having high maintenance requirements. Additionally, dairy breeds store a larger proportion of fat internally than beef breeds, thereby decreasing insulatory capacity. *Bos indicus* cattle (Brahman type) have been found to exhibit lower maximum intakes of moderate quality diets, under minimal stress, than *Bos taurus*. Lower intake may be the result of *B. indicus* having a smaller digestive tract; however, on poor quality tropical grasses, *B. indicus* digests forages more completely and still exhibits greater voluntary intake than *B. taurus* (Hunter and Siebert 1985a, 1985b). Voluntary intake of moderate to high quality forages is greater for *B. taurus* than for *B. indicus*. When low quality tropical grass diets are supplemented with nitrogen, voluntary intake of *B. taurus* is greater than *B. indicus* indicating *B. indicus* may have a greater capacity to recycle nitrogen. Adaptability of these cattle species to the thermal environment also influences intake patterns. Based upon these findings for domestic ruminants, selecting genotypes suited to a particular range setting is an important management consideration.