Module 3

Animal Production

Learner guide

Course Name	National Certificate: Animal Production SAQA ID: 48979
Module Name	Module 3 Animal Production
Module Code	19300
Unit Standards	116281; 116285; 116282; 116308; 116318; 116300; 119471; 119462
NQF Level	4
Credits	163

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Dear Learner

This Learner Guide contains all the information to acquire all the knowledge and skills leading to the unit standard:

ID:	Unit standard title:
116281	Explain animal classification and natural history
116285	Explain functional animal anatomy and physiology
116282	Explain intermediate animal nutrition
116308	Implement animal health and bio-security programs
116318	Plan and maintain breeding systems
116300	Apply procedures to manage damage control in animals and victims
119471	(8979) Use language and communication in occupational learning programmes
119462	(8974) Engage in sustained oral/signed communication and evaluate spoken/signed texts

You will be assessed during the course of your study. This is called formative assessment. You will also be assessed on completion of this unit standard. This is called summative assessment. Before your assessment, your assessor will discuss the unit standard with you. It is your responsibility to complete all the exercises in the Assessor Guide. The facilitator will explain the requirements of each exercise with you. You will also be expected to sign a learner contract in your assessor guide. This contract explains responsibility and accountability by both parties.

On the document "Alignment to NQF", you will find information on which qualification this unit standard is linked to if you would like to build towards more credits against this qualification. Please contact our offices if you would like information with regards to career advising and mentoring services.

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Key to Icons

	Important Information
	Quotes
	Personal Reflection
	Individual Formative Exercise
	Group Formative Exercise
	Summative Exercise
	Activity

Alignment to NQF

Element of programme	
1. Name of programme	Animal Production
2. Purpose of the programme	Form part of the qualification to equip learners in Plant Production
3. Duration of the programme	5 days of facilitation; 270 notional hours
4. NQF level	4
5. NQF credits	27
6. Specific outcomes	See Unit Standard Guide
7. Assessment criteria	See Unit Standard Guide
8. Critical cross-field outcomes	See Unit Standard Guide
9. Learning assumed to be in place	See Unit Standard Guide
10. Essential embedded knowledge	See Unit Standard Guide
11. Range statement	See Unit Standard Guide
12. Recognition of Prior Learning (RPL)	RPL can be applied in two instances: Assessment of persons who wish to be accredited with the learning achievements Assessment of learners to establish their potential to enter onto the learning programme.
13. Learning Materials	Learner Guide, Assessor Guide with Model Answers, Facilitator Guide, Learner PoE Workbook
14. Links of the programme to registered unit standards, skills programmes, or qualifications	Registered qualification: Title: National Diploma: Plant Production ID: 48979 Credits: 163

Learning Unit 1: Animal Physiology

Unit Standard	
116281	Explain animal classification and natural history
Specific Outcomes	
SO 1: Describe the historical origin of the specific animal species, based on evidence. SO 2: Describe the geographical distribution of the specific animal species, based on its preferences. SO 3: Describe the specific animal species' position within the classification system of the animal kingdom. SO 4: Describe the historic, traditional and current use of the specific animal species by man. SO 5: Describe the basic biological and behavioural concepts that will illuminate the geographical, traditional and historical distribution and use of the animal.	
Learning Outcomes	
Identifying	Science
Organising	Communicating
Demonstrating	Contributing
Collecting	

ANIMAL CLASSIFICATION

Introduction

Broadly speaking, animals can be studied in two ways. We may concentrate our attention on the living machine and investigate the relationship of parts of the organism to each other and the relationship of its processes to the properties of non-living systems. We may also be interested in the differences between different kinds of animals, and investigate how these differences have arisen.

Though no two animals of the same sex are exactly alike, it is a matter of common observation that some are much more alike than others, and that individuals which are very much alike interbreed and in so doing preserve their common characteristics.

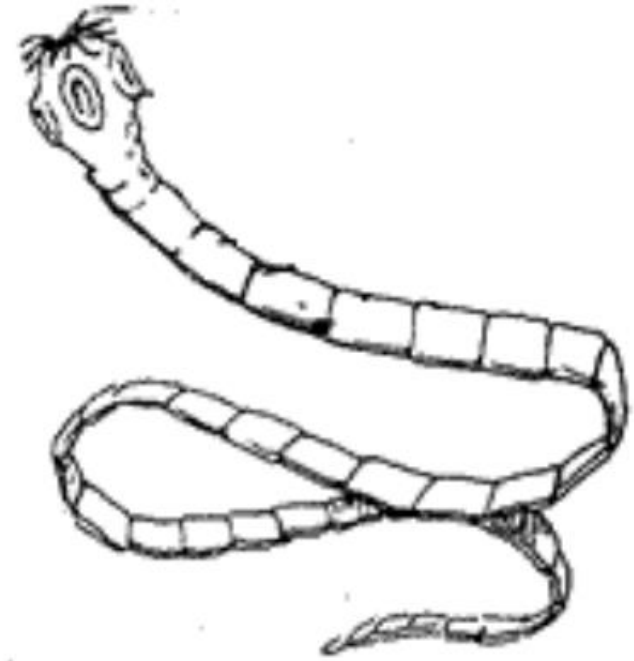
Individual animals, which preserve the common characteristics of their species through breeding, which distinguish them from other animals by only breeding among their own kind, are called species. Here nature supplies the barriers. When humans segregate them into different types they are called breeds, strains, races, domestic varieties or pure lines.

The historical origin of animal species

During the previous century scientific workers accepted the doctrine of evolution in its general sense. Evolution is the belief that species change over the course of time and that the immense variety of living animals have a common ancestry.

The first attempt to make a complete survey of available information concerning animal life is included in the *Systema Naturae*. This was published in the middle of the eighteenth century and originated from the practice of contemporary botanist Carolus Linnaeus. He adopted the convention of arranging animals in different grades of resemblance. Species are grouped into genera, genera into families, families into orders, and orders into classes.

Figure 1: Tapeworm



Each species has two descriptive names that describe the specie e.g., Cattle are called Bos taurus or Bos indicus. "Bos" indicating the genus.

The concept of evolution theorises those over millions of years, mutations in the genes of living organism generates variation. Some of the mutations may change the organisms to the benefit of the organism and make it more suitable to live in a certain environment. Other mutations may be the cause that the organism becomes extinct.

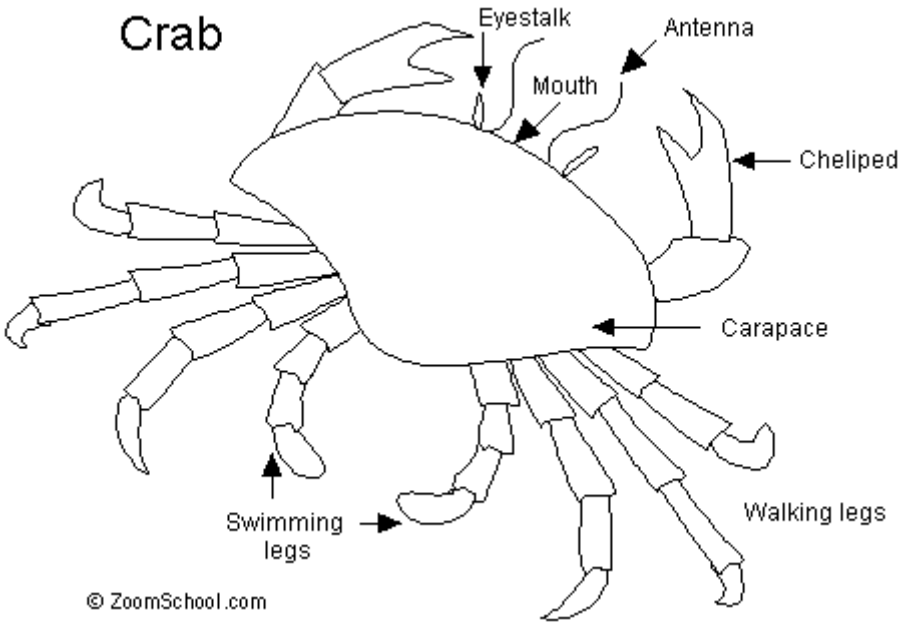
During the course of millions of years some organisms developed into what we classify today as animals. Animals can be very small, microscopic organisms with certain characteristics of more complex animals. A good example is the amoeba: a single cell organism. Some of the microscopic animals also contain chlorophyll which makes it difficult to decide whether they should be classed as animals or plants. The simplest animal of all consists of a single cell. They are called protozoa: from two Greek words meaning "first animals". A little more complex form of animals are the sponges which are multi-celled animals.

Progressing to the more advanced body system (or more complex life forms) are the parasitic animals like the tapeworms and flukes. They are called flatworms and consist of three layers.

They have no body cavity, respiratory system, or blood and only a rudimentary nervous system.

Their importance to a farmer is that they have a detrimental effect on their farm animals. As one progresses further in complexity into the Animal Kingdom, the animals gain a gut to digest their food. Later they develop segmented bodies. Segmentation is a comparatively advanced feature and is shared by arthropods (crustaceans, spiders, and insects). Each segment bears its own set of muscles, while major internal organs are suspended in a body cavity.

Figure 2: The Crab



The geographical origin of animal species

As species spread over a large area natural condition in different regions will favour the survival of some mutant combinations rather than others.

Definition:

Mutant combination – A chance that occur in the gene combination of the animals that might be detrimental or to the animal's advantage.

Over the course of time what was once a single specie will have broken up into several species. These species will also, over more time, do the same again. Some that are not adapted to the environment may die out.

Figure 3: The Cat

The differences among the progeny of ancestors, which were once recognised as a single species, will become more sharply defined, and the groups will lose their common family resemblance.

Environmental conditions such as climate and the abundance or lack of food over prolonged periods of time, continually impose on living organisms a process which forces the selection of new strains.

As the animals develop more they begin to develop specialized differentiated body parts to enable them to live in different environments.

The water dwelling animals develop body shapes, breathing apparatus and structures such as fins to be mobile and live-in water.

The land-living animals develop structures to adapt to land conditions. The land-living creatures migrate to different climates where they encounter different enemies and changing environments to which they need to adapt.

Over millions of years the animals differentiated into different species that are adapted to live in certain environments.

	**Individual Activity 1:**

THE GEOGRAPHICAL DISTRIBUTION OF ANIMAL SPECIES

Introduction

Animals are usually found in those respective environments where they are adapted. Even in the sea, different animals are adapted to and found in different areas of the sea. On land the climate and topographic environment plays a big role in the geographic spread of animals. However, farm animals have been domesticated. Farmers have taken them out of their natural environment and use them in environments to which they are not necessarily adapted. The farmer can then make alterations to the environment and farm with animals in these artificial environments.

The basic environmental preferences of animal species

Different animals survive (and very often thrive) in those environments to which they are specifically adapted. The adaptation of animals to different environments is very often a matter of general knowledge. Let's see if you can figure out which environment's different animals prefer by doing the following quiz.

	**Individual Activity 2:**

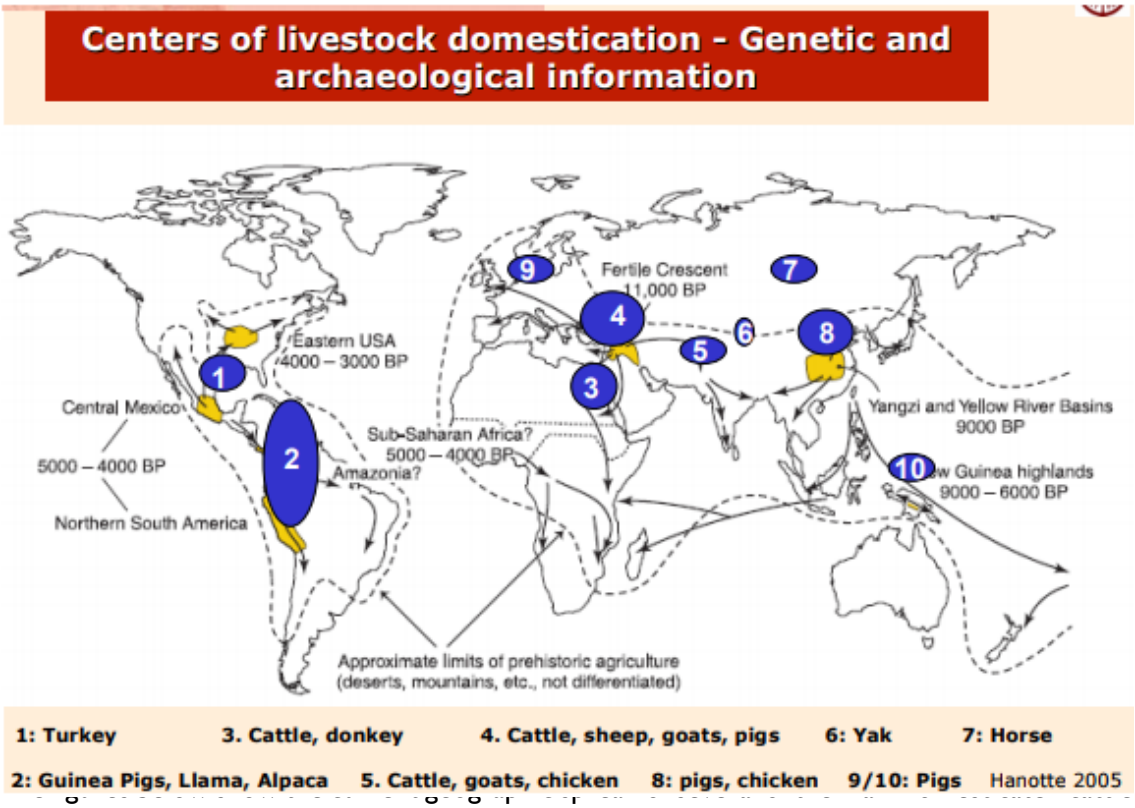
The current geographical distribution of specific animal species

Although species have, over millions of years, evolved by adapting to various different environments, the advent of man has changed this geographical distribution. In non-domesticated species this has meant that areas in which wild animals have thrived have come under pressure through agriculture or forestry or urbanisation. This has resulted in many species becoming extinct or limited in numbers or limited to small geographical locations in which they are now found.

In domesticated species, one can now find farm animals in areas in which they were not originally found. In other words, they live where man needs to use them. Often these are environments that they are not well adapted to, and man must intervene to ensure that they can survive and thrive in these environments.

The diagram below illustrates the main places of origin of most of the domesticated animal species.

Figure 4: The geographical origin of domesticated species



and goat breeds.

Figure 5: The current geographic spread of the Holstein and Charolais cattle breeds

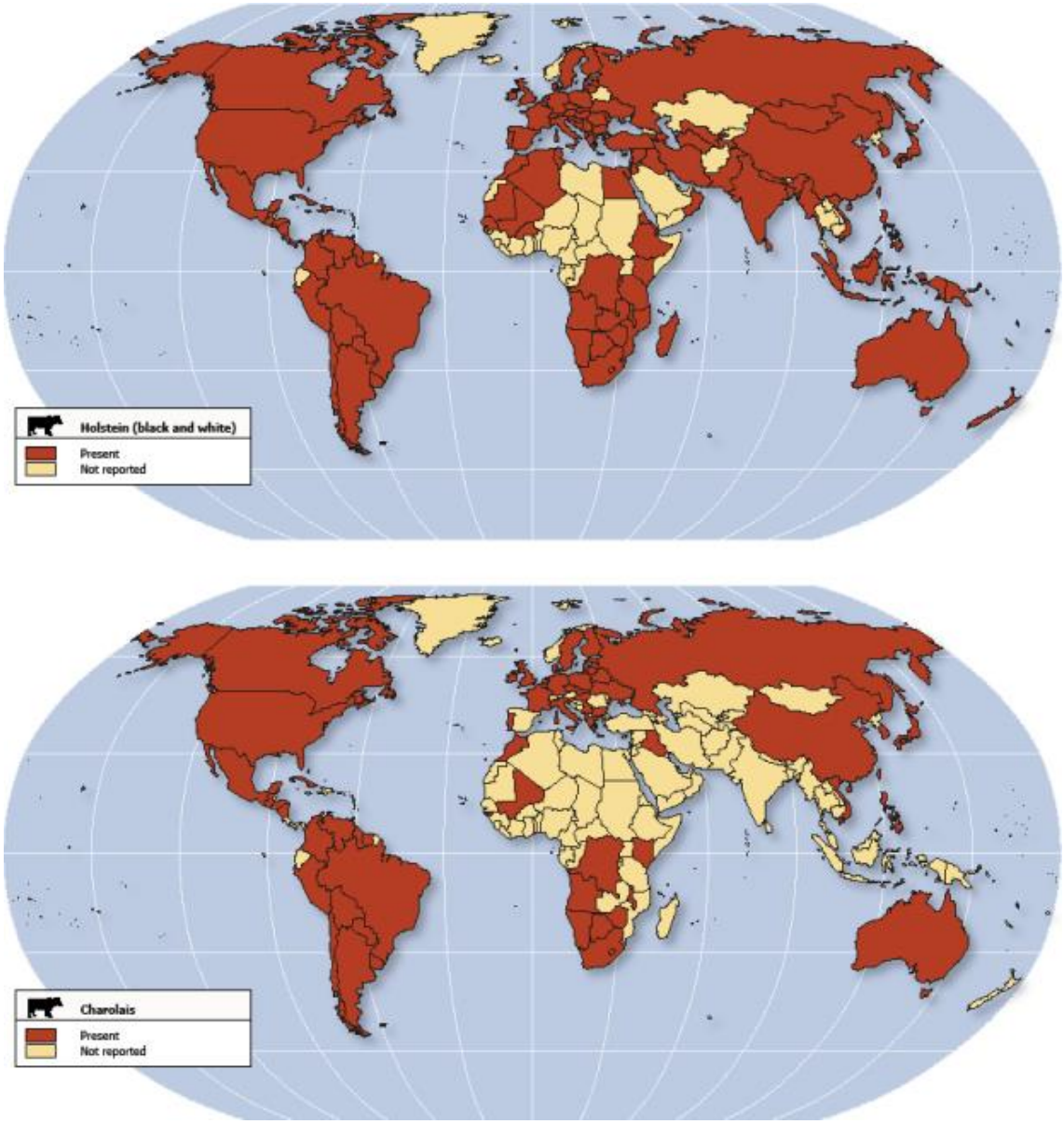
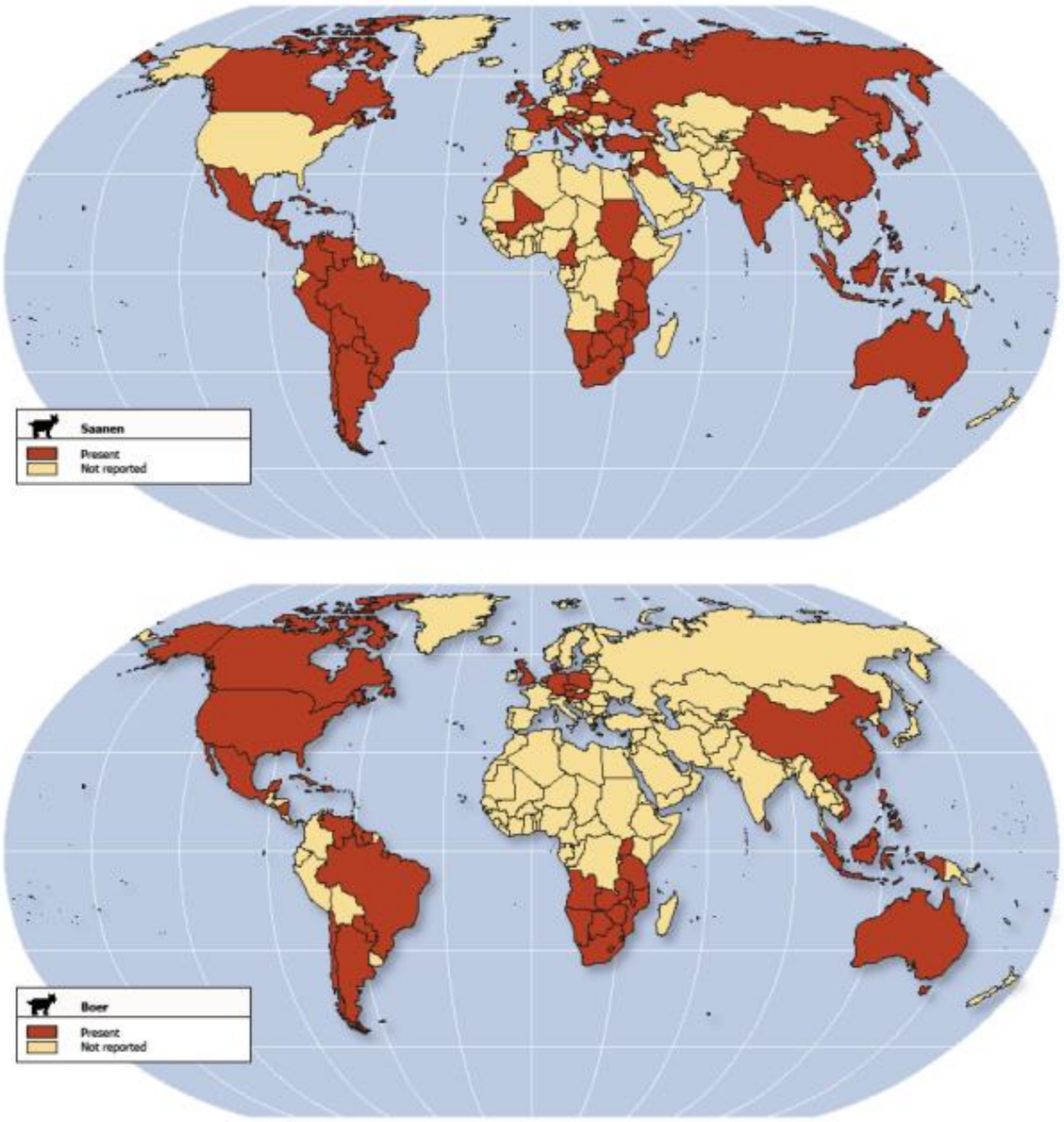


Figure 6: The current geographic spread of the Saanen and Boer goat breeds



The movement of domesticated animal species under human control

As the diagrams above illustrate, although certain domesticated species originated in very specific geographical locations, they have spread right across the world due to their association with humans.

Domesticated animals like cattle have migrated with humans over vast distances. Even through the tropics with all its diseases and pests. During even this short time with humans these cattle

have developed moveable and tick-resistant skins such as those now found in cattle breeds such as the Nguni and Afrikander cattle of South Africa. Those animals that did not adapt during these migrations succumbed in these harsh areas and only the strongest animals continued on their migrations with man to the more southern parts of Africa. Figure 7 below shows the possible migratory routes of cattle with man over the centuries.

Figure 7: Origin and migration routes of domestic cattle in Africa

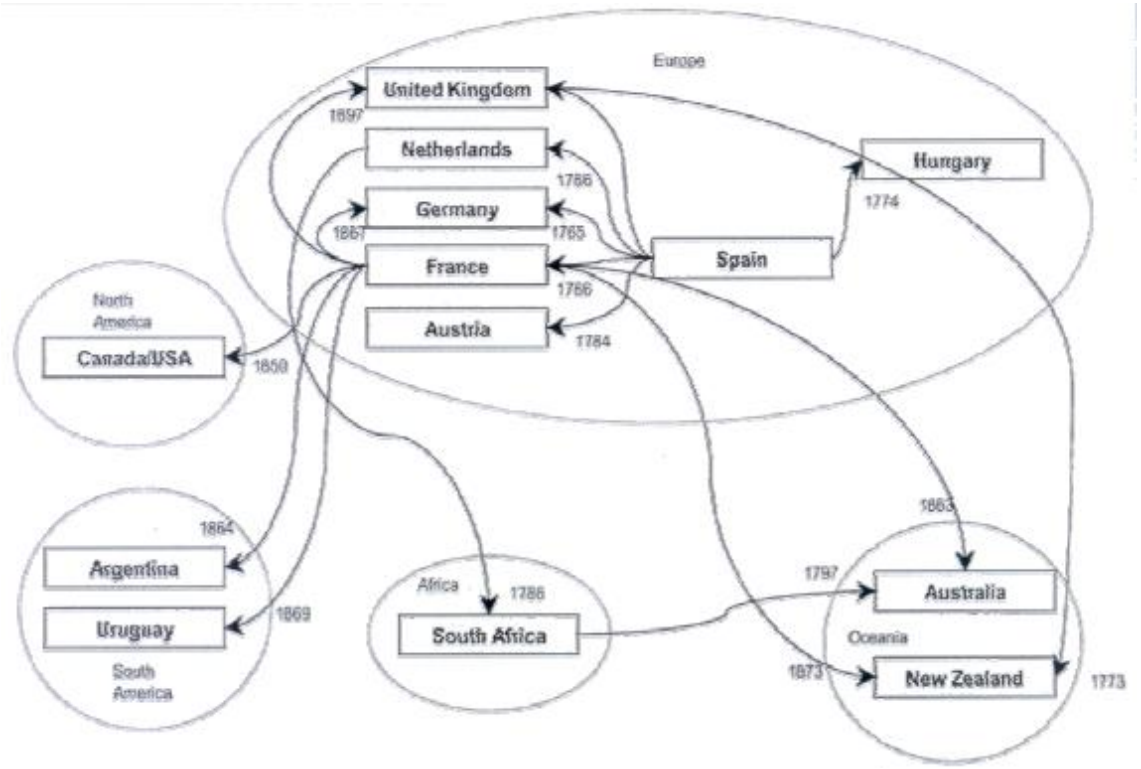
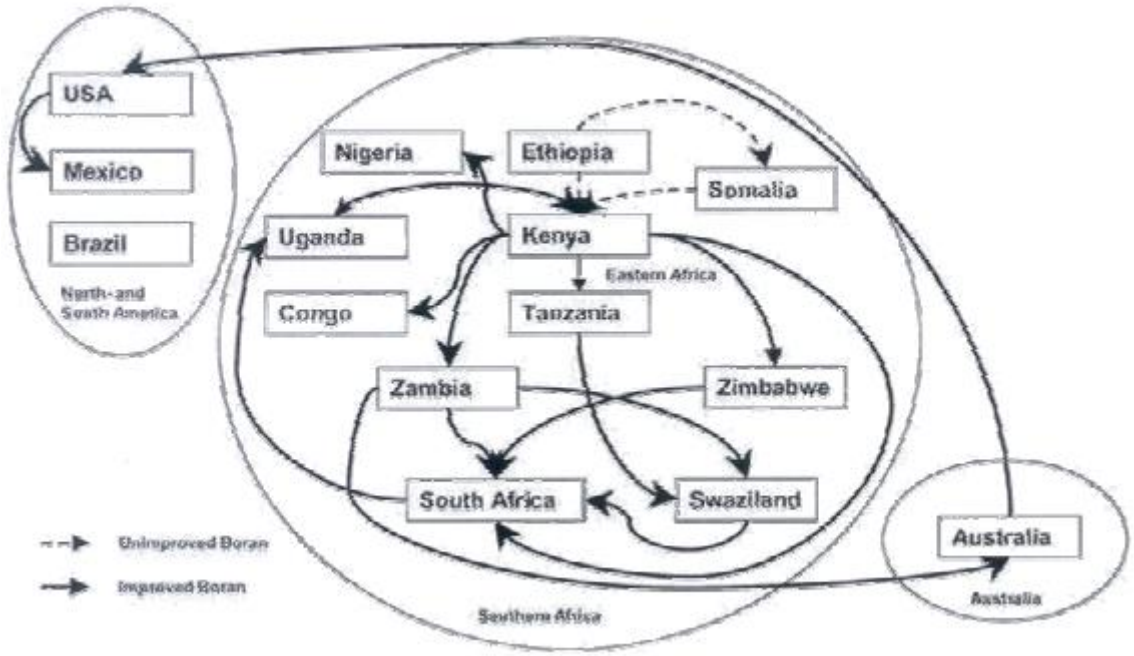


Figure 9: Transfers of improved and unimproved Boran Cattle



	**Individual Activity 3:**

SPECIFIC ANIMAL SPECIES POSITION WITHIN THE CLASSIFICATION SYSTEM OF THE ANIMAL KINGDOM

Introduction

Scientists (known as taxonomists) divide all the animals and plants and all other living organisms (including micro-organisms), into groups. This is done to allow comparisons to be made amongst like and unlike organisms. Knowing whether an organism is related to another makes it easier to study them.

The different groups of animals or plants are grouped together depending on certain physical or chemical characteristics that they have in common. Taxonomists historically, grouped organisms into five kingdoms. More recently, taxonomists made a new division and in modern Biology there are 6 kingdoms. We will be concentrating on the animal kingdom – properly known as Kingdom Anamalia – the multicellular animals.

Basic principles of taxonomy

In some ways the methods used in grouping organisms resemble the logical basis of any system of cataloguing of objects, whether of merchandise in a store or books in a library. Here the articles are carefully named and then arranged in a group, or sections, so that any particular article will have more features in common with other members of their group, than with those in other groups. Small groups can in turn be arranged into large groups and this placing together of like objects facilitates their identification by the user of the catalogue.

Usually, the needs of the user of the catalogue will determine the features, which are selected to form the basis of classification. This is true to some extent of the classification of organisms but in this instance, there is some difference of opinion as to the aims and objects involved. In order that the procedure in classification shall remain standardized throughout the world, an

international committee on Zoological Nomenclature has been established which has published a set of rules for the guidance of taxonomists.

The accepted scheme of classification is a development of that initiated by the Swedish Naturalist Carolus Linnaeus in his book *Systema Naturae* published in 1758. It was he who first devised the binominal system of nomenclature in which every species of animal (or plant) is given two names. One of these is the specific or trivial name and it differentiates the species from all others, whilst the other, the generic name (which is placed before the specific name), is shared by other related species, which are considered to be sufficiently similar to be grouped in the same genus. Both specific and generic names are always constructed in Latinised form (in the Latin language) and are always printed in italics (or underlined). The generic name having a capital and the specific name a small initial letter.

One of the most familiar animals to learners is the common frog. Scientifically, this animal is named Rana Temporaria, Rana being the generic name and Temporaria the specific name. Formerly, morphological features were the chief, if not the sole, criteria used in defining species, but now genetics, cytology, physiology, and other branches of zoology contribute their quarter of evidence to define each specie or even sub specie.

Once determined and listed, species can be arranged in larger groups, and it is in these that the chief differences in scheme of classification become apparent. Thus, as mentioned above, species having many attributes in common are placed in the same genus. So, the common frog, Rana Temporaria, belongs to the same genus as the larger, continental frog, Rana esculenta and, with other species of the same genus, is placed in the family Ranidae. Families with common characteristics constitute an order, and orders in turn are grouped into classes. The larger groups of the animal kingdom are the phyla, which contain, in some instances, very many classes.

The animals in each phylum, although displaying a wide range of form, have their bodies contracted on the same ground plan, but differences between phyla are very great when compared with these between the other categories.

To summarize the full systematic position of the common frog can therefore be given as:

Kingdom	Animalia	Organisms with cells having a cell membrane but lacking a cell wall
Sub-kingdom	Metozoa	Multi cellular animals capable of locomotion
Phylum	Chordata	Animals with a noto chord*
Sub Phylum	Craniata	Animals with skull and backbone
Class	Amphibia	Can live on land and in water
Order	Anura	Order of frogs
Family	Ranidae	True frog family
Genus	Rana	Genus name of frog
Species	temporania	Temporania

Overview of organization of information

The highest level of the classification system is the Kingdom. There are five Kingdoms into which all living organisms are classified. They include:

- Monera (the prokaryotic bacteria and blue-green algae – which do not have nuclear membranes or subcellular organelles).
- Protista (unicellular algae and protozoans – single celled organisms).
- Plantae (multicellular plants).
- Fungi (nonphotosynthetic plant like organism – e.g. Mushrooms).
- Animalia (multicellular animals).

The kingdom of interest to us in this course is Animalia – the multicellular animals

The next level of importance in the classification system is the Phylla. The major Phylla of the Animalia kingdom are:

- Porifera (for example sponges).
- Cnidaria (for example aquatic jellyfishes).
- Ctenophora (for example aquatic sea walnuts).
- Platyhelminthes (for example tapeworms and liver flukes).
- Aschelminthes (for example roundworms).
- Annelida (for example earthworms).
- Mollusca (for example snails).
- Arthropoda (for example insects, ticks and spiders).
- Echinodermata (for example starfishes).

- Chordata (animals with a backbone e.g., goats, sheep, elephants, dogs).

The phyllum chordata (animals with a backbone) can be divided into eight classes:

- Four of these Classes are aquatic and are popularly known as fish (Classes Agnatha – primitive jawless fish, Placodermi – extinct primitive jawed fish, Chondrichthyes – cartilaginous fishes and Osteichthyes – bony fishes).
- The Class Amphibia – Frogs, Toads, Salamanders.
- The Class Reptilia – Turtles, Lizards, Snakes, Crocodiles and Alligators.
- Class Aves – the birds
- Class Mammalia – the Mammals (Animals with back-bones that produce milk for their young – from their mammary glands). The class Mammalia is divided into subclasses.

Some subclasses include:

- Subclass Prototheria, order – Monotremes (egg-laying mammals – duckbilled platypus),
- Subclass Theria, infraclass – Metatheria, order - Marsupials - for example Possums and Koalas,
- Subclass Theria, Infraclass – Eutheria - Placentals Order: Chiroptera – for example Bats,
- Subclass Theria, Order – Primates – for example Apes,
- Subclass Theria, Order – Carnivora – for example lions,
- Subclass Theria, Order – Pinnipedia – an aquatic order
- Subclass Theria, Order Perissodactyla and Artiodactyla – the hooved animals
- Subclass Theria, Order Proboscidea (for example elephants)
- Subclass Theria, Order Cetacea – for example whales

The Orders of importance for domesticated animals are Perissodactyla (hooved animals with an odd number of toes) and Artiodactyla (hooved animals with an even number of toes)

Horses (family Equidae) and rhinoceroses have an odd number of hooved toes; thus they are Order Perissodactyla.

Pigs (family Suidae), hippopotamus (family Hippotamidae), camels and llamas (family Camelidae), giraffe (family Giraffidae), and cattle (family Bovidae), sheep (family Ovidae), goats (family Capridae) are all hollow-horned ruminants, which belong to the Order Artiodactyla because they have an even number of hooved toes.

The next levels of the taxonomic classification system are Genus and Species. Animals of the same species can interbreed.

Visit: http://en.wikipedia.org/wiki/sheep

Cattle

Cattle were originally identified by Carolus Linnaeus as three separate species. There were Bos Taurus, the European cattle including similar types from Africa and Asia; Bos indicus the zebu; and the extinct Bos primigenius, the aurocks. The aurocks are ancestral to both Zebu and European cattle. More recently these three have increasingly been grouped as one species, sometimes using the name Bos primigenius taurus and Bos primigenius indicus.

Friesian / Holstein cow

The following illustration shows the full classification of the Holstein Cow.

Kingdom	**Animalia**	**Animal**
Phyllum	**Chordata**	**Animal with a spinal cord**
Class	**Mammalia**	**Warm blooded animals that feed their young by means of milk-secreting glands (the mammary glands)**
Order	**Artiodactyla**	**Even-toed hooved animals**
Family	**Bovidae**	
Subfamily	**Bovinae**	**Sub family of 24 ungulates that include the water buffalo and cattle**
Genus	***Bos***	**Genus name for cattle**
Species	***B. taurus***	
Binomial name	***Bos taurus***	**Linnaeus, 1758**

Sheep

Sheep refers to the sheep genus. Some are domesticated, and some are wild. A sheep is an individual of any of the eight woolly mammal species that comprise the genus ovis. Sheep are members of the order Artiodactyla (even-toed hooved animals). All sheep are ovids (members of the family Ovidae). The domestic sheep is thought to descend from the wild Moufflon of

central and southwest Asia. In South Africa domesticated sheep breeds are very well adapted to the barren parts of the Subcontinent.

The following illustration gives the full scientific classification of the sheep genus: Dohne sheep

- Scientific classification

Kingdom	**Animalia**	**Animal**
Phyllum	**Chordata**	**Animal with a spinal cord**
Class	**Mammalia**	**Warm blooded animals that feed their young by means of milk secreting glands (the mammary glands)**
Order	**Artiodactyla**	**Even-toed hooved animals**
Family	**Ovidae**	
Genus	***Ovis***	**Sheep genus**
Binomial name	***Ovis aries***	**Linnaeus, 1758**

Here are examples of the sheep species:

	O. ammon	Mountain sheep (Argali)
	*O. aries*	Domestic sheep
	*O. canadensis*	Bighorn sheep
	*O. dalli*	Dall Sheep
	O. musimon	Mouflon (disputed scientific classification)
	O. nivicola	Snow sheep
	O. orientalis	
	O. vignei	Urial

The Goat

A goat is a mammal in the genus Capra which consists of nine species. The domestic goat (Capra aegagrus hircus) is a domesticated subspecies of the wild goat. Goats are members of the family Capridae and members of the Order Artiodactyla (even-toed hooved animals) just like cattle and sheep.

- The domestic goat: Scientific classification

Kingdom	Animalia	Animal
Phyllum	Chordata	Animal with a spinal cord
Class	Mammalia	Warm blooded animals that feed their young milk by means of milk secreting glands (the mammary glands)
Order	Artiodactyla	
Family	Capridae	
Genus	*Capra*	
Binomial name	*Capra hircus*	Linnaeus, 1758

There are other animals (species) of the genus Capra that are domesticated and used in farming.

Capra aegagrus creticus	Kri-kri (Cretan goat, Agrimi, Cretan ibex)
Capra caucasia	West Caucasian tur
Capra cylindricornis	East Caucasian tur

The pig

Pigs are native to Eurasia and are collectively grouped under the genus Sus within the Suidae family. They have been domesticated and raised as livestock by some people for meat as well as leather. Their bristle (hairs) are also traditionally used for brushes. Pigs are omnivores (they consume both plants and animals).

- The domestic pig: Scientific classification

Kingdom	**Animalia**	**Animal**
Phylum	**Chordata**	**Animal with a spinal cord**
Class	**Mammalia**	**Warm blooded animals that feed their young milk by means of milk secreting glands (the mammary glands)**
Order	**Artiodactyla**	**Even-toed hooved animals**
Family	**Suidae**	
Genus	***Sus***	**Genus name for pig**

Sus barbatus	**Bearded pig**
Sus bucculentus	**Worty pig (Vietnamese)**
Sus cebifrons	**Visay as Worty pig**
Sus celebensis	**Celebes worty pig**
Sus domesticus	**Domesticated pig**
Sus heureni	**Flores worty pig**
Sus philippensis	**Philippine Worty pig**
Sus salvanius	**Pigmy Hog**
Sus scrofa	**Domestic pig**
Sus timoriensis	**Timor Worty pig**
Sus verrucosus	**Javan pig**

The chicken

A chicken (Gallus gallus) is a domesticated bird. It is believed to be descended from the wild Asian Red Jungle fowl. Chickens are the most common bird in the world. The population in 2003 was 24 billion.

- Scientific classification

Kingdom	**Animalia**	**Animal**
Phylum	**Chordata**	**Animal with a spinal cord**
Class	**Aves**	
Order	**Galliformes**	
Family	**Phasianidae**	
Genus	***Gallus***	
Species	***gallus***	
Binomial name	***Gallus gallus***	

The Ostrich

The ostrich (Struthio camelus) is a flightless bird native to Africa. It is the only living species of its family, Struthionidae, and its genus, Struthio. They are distinct in their appearance, with a long neck and legs and the ability to run at speeds of about 65 km / hour. Ostriches are considered the largest living species of bird and are found all over the world. The scientific name for the ostrich is from Greek for "sparrow camel".

- Scientific classification

Kingdom	**Animalia**	**Animal**
Phylum	**Chordata**	**Animal with a spinal cord**
Class	**Aves**	
Order	**Struthioniformes**	
Family	**Struthionidae (Vigors, 1825)**	
Genus	***Struthio***	
Species	***S camelus***	
Binomial name	***Struthio camelus***	**Linnaeus, 1758**

The Dog

The dog is a canine mammal of the order Carnivore. Dogs were first domesticated from wolves at least 15 000 years ago. Below is the scientific classification of the breed the Labrador within the subspecie familiaris.

- Scientific classification

Kingdom	Animalia	Animal
Phylum	Chordata	Animal with a spinal cord
Class	Mammalia	Warm blooded animals that feed their young milk by means of milk secreting glands (the mammary glands)
Order	Carnivora	Flesh eating mammals
Family	Carnidae	Members of the dog family that walk on their toes
Genus	*Canis*	
Species	*C. lupus*	
Subspecies	C. l. familiaris	
Trinomial name	*Canis lupus familiaris*	

The cat

The cat, also called the domestic cat or house cat is a small feline carnivorous mammal of the subspecies Felis silvestris. Below is the scientific classification of the domesticated cat.

- Scientific classification

Kingdom	Animalia	Animal
Phylum	Chordata	Animal with a spinal cord
Class	Mammalia	Warm blooded animals that feed their young milk by means of milk secreting glands (the mammary glands)
Order	Carnivora	Flesh eating mammals
Family	Felidae	
Genus	*Felis*	
Species	*F. silvestris*	
Subspecies	*F. s. catus*	
Trinomial name	*Felis silvestris catus*	Linnaeus, 1758

The dove

There are about 308 species of doves in the order Columbiformes. The terms "dove" and "pigeon" are used interchangeably although smaller species are more likely to be called doves. Below is the Scientific classification of the Peaceful Dove (Geopelia placida). There are many species under the genus Columba.

The family is usually divided into five subfamilies. Each subfamily has several genus and specie names.

- Scientific classification

Kingdom	Animalia	Animal
Phylum	Chordata	Animal with a spinal cord
Class	Aves	
Order	Columbiformes	
Family	Columbiadae	
Subfamily	Columbinae, Otidiphabinae, Gourinae, Didunculinae, Treroninae	

The equidae

This is the Family of horse-like animals. It is sometimes known as the horse family. Apart from the horses, other equids include the donkey, the three Zebras and the Onager. These fall in the genus Equus. Below is the scientific classification of Equids.

- Scientific classification

Kingdom	Animalia	Animal
Phylum	Chordata	Animal with a spinal cord
Class	Mammalia	Warm blooded animals that feed their young milk by means of milk secreting glands (the mammary glands)
Order	Perissodactyla	Odd-toed hooved animals
Family	Equidae	
Genus	*Equus*	
Specie	*caballus*	
Binomial name	*Equus caballus*	Linnaeus, 1758

E. asinus	Donkey
E. africanus	African Wild Ass
E. caballus	Domestic Horse
E. ferus	Wild Horse
E. grevyi	Grevy's Zebra
E. hemionus	Onager
E. kiang	Kiang
E. quagga	Plains Zebra
E. zebra	Cape Mountain Zebra
E. hartmannae	Hartmann's Mountain zebra

Conclusion

The scientific classification system generally uses the external anatomy and morphology of the animal to differentiate between types of animals. It is therefore very important that the learner understand the basic method of scientific classification. They should be able to identify the

basic differences in the external anatomy of farm animals. Of particular importance for domesticated animals (apart from the birds) is the distinction between the even-toed and odd-toed hooved animals.

Some of the anatomical features which assist in the classification of animals include:

- Whether they have a backbone
- Whether they give birth to live young
- Whether they suckle their young
- What they eat (i.e., what type of stomach do they have)
- What type of covering they have on their bodies (hair or feathers)
- What their claws, nails or hooves look like
- What their teeth look like
- The posture of their feet when walking

	**Activity 4:**

THE USE OF ANIMALS TO THE BENEFIT OF MANKIND

Introduction

From very early years when single celled animals appeared on earth about 2 500 million years ago, the animal kingdom has evolved into million different species. Animals now inhabit every part of the globe. Many of these animals contribute to the well-being of mankind.

Each species has a very distinct form, colour and life cycle, designed to ensure that it survives in its environment and bears offspring. The survival of animals is linked to the animal's ability to evade predators and enemies and to find food. It is also very important for the animal to find a mate and rear its young and above all to adapt to change.

Use of animals by man

Mankind has made use of animals from the very early days of civilisation. Long before anything was known of genetics mankind was known to manipulate the breeding of animals. In the bible man's use of domesticated animals is mentioned many times.

As the years have passed, through natural as well as artificial selection by man, the different ways that animals can be used for the benefit of man has increased. Farmers developed ways to use animals that were adapted to certain areas. The animals adapted to the cold or extremely hot conditions for instance by developing thick hair or wool to protect their bodies. In turn, farmers learned to shear or comb these animals to make clothes for themselves.

Although micro-organisms and other small single celled animals also play a big role in modern farming, let us concentrate on the usefulness of insects, fish, birds and the mammals to man.

Insects like honeybees; birds like the ostrich and the chicken and fish such as the carp have been used for ages. People all over the world use these animals in one or other way.

	**Individual Activity 5:**

Ways how mankind make use of animals' abilities

Both behavioural and biological characteristics of animals can be harnessed to be of use to man. For example: dogs, originating out of the wild wolf are used for several different purposes. The keen sense of smell of dogs has led to its use to track fugitives, to find drugs and biological materials at airports. Dogs can also be trained to find explosives or to find people who have been trapped under the snow during avalanches. Dog breeds such as the Husky are strong and adapted to the cold. Because of these characteristics they are used to draw sleds in very cold areas. The obedience and loyalty of dogs has been used to assist the blind. Because of their excellent hearing and natural aggression, they are also used as guard dogs.

All the domesticated animals like cattle, sheep, and goats were once wild animals. These animals were tamed for domestic use as pets, for food or fibre, or as beasts of burden.

At first, they were used in their natural habitat. However, when weather conditions changed, humans migrated to other parts of the earth and took their animals with them. As humans moved around, their animals had to adapt to the new environments. Some animals obviously could not tolerate the new conditions and died. However, those animals that survived had some or other genetic characteristic which allowed them to adapt to the new environment. It was these animals with those special characteristics that were then used further by man.

Aside from adaptation to the environment, man has also applied "selection" pressure to animals to enable them to produce more of a certain product. For example: Milk cows were selected out of the animals used for meat. Every time a cow produced more milk, man would use that cow to produce offspring with the idea that her offspring would also produce more milk. In this way breeds were developed for different purposes. For example, milk breeds versus meat breeds.

Biological and behavioural concepts

Introduction

If it were not for specific biological and behavioural characteristics, then domesticated animals would have remained in the wild and not been domesticated. In fact, only a select number of animals have ever been domesticated. Many animals still only occur in the wild. What makes one animal more suitable to domestication than another?

Biological attributes of use to man

Firstly, the animal must have some use to mankind. For example, the class "Mammals" are particularly useful to man because they produce "milk". Thus, an animal that is a mammal has a biological attribute which makes it useful to man. However, not all domesticated animals are mammals. For example, a chicken is not a mammal, does not produce milk, but is still of use to humans. A different biological characteristic makes the chicken of use to man. This is its ability to lay eggs and the fact that it has a tasty and nutritious meat.

Sheep and goats that originated in mountainous areas in the northern hemisphere that receives snow in the winter (and sometimes all year round) developed thick coats of fibre to keep themselves warm. Man used this biological characteristic when he decided to cut the hair (shear it) and spin it to make yarn to use in clothes.

Behavioural patterns of use to man

Bees are a "non-mammal" that is useful to man. It does not even have a backbone like a chicken or a fish! Its useful characteristic is found not so much in its anatomy, but in its behaviour. Bees collect pollen from different plants (and in this way, pollinate fruit orchards – which is useful to man), and returns to a hive where it feeds this pollen to the young in the hive. This pollen is changed into honey which is used by man.

Other behavioural patterns that are useful to man is the docility of most of the farm animal species. When man first decided to use animals, it was those animals that he could approach and catch that he was able to domesticate. Even today it is impossible to get really close to a wild animal. Even if you do catch them, they will fight and kick and bite and constantly try and get out of an enclosure. These animals are not suitable for domestication since it is impossible to handle them without getting injured.

Changes in animal behaviour over time

An example of an animal that has exhibited a change in its behaviour due to its domestication by human, is the dog. The dog originated from the wild wolf. The wolf is an aggressive animal that hunts for its food. The domesticated dog of today is obedient, trustworthy, friendly and loyal (unless it is specifically bred to be aggressive).

	**Individual Activity 6:**
SUMMATIVE 1A	

Animal Anatomy and Physiology

Unit Standard	
116285	Explain functional animal anatomy and physiology
Specific Outcomes	
SO 1: Identify and understand in detail the processes active within the various anatomical systems in animals. SO 2: Identify and understand how anatomical systems within animals can influence production of various animal products. SO 3: Monitor and advise others on animal systems and production processes based on anatomical systems. SO 4: Understand how animal health and nutrition affects animal anatomical systems.	
Learning Outcomes	
Identifying	Science
Organising	Communicating
Demonstrating	Contributing
Collecting	Working

VARIOUS ANATOMICAL SYSTEMS IN ANIMALS

Introduction

This Session describes the processes involved within the various anatomical systems of the body, the interaction of the various systems of the body with each other, the biochemical substances that are produced within each of the systems and their purpose.

All activities taking place in living organisms are aimed at growth and reproduction. In order to grow the animal needs energy. The source of energy is food, which must be searched for the animal may supply itself or feed to the animal by its caretaker or parent. To be able to search for food the animal needs a locomotor system and also senses in order to smell, see and hear. To make the food available to the body it must first be broken down into more elementary

substances (e.g., proteins to amino acids, carbohydrates to glucose and fats to fatty acids). The digestive system, which includes all the structures and organs from the mouth to the anus, is necessary for this.

The digestive system removes the useful parts from food and discards the rest. For the absorbed nutrients (amino acids, glucose, and fatty acids) to be changed into energy and thus made available to the body it must first undergo a process, which is called metabolism. The liver plays the biggest role in this process. Before energy can be released from nutrients it must first be "burnt" by the body and oxygen is necessary for this. The respiratory system supplies this oxygen to the body. To transport oxygen from the respiratory organs (lungs) to the rest of the body and also for the distribution of nutrients through the body, the circulatory system is necessary.

The circulatory system also transports the waste products of metabolism to organs where it is excreted e.g., the kidneys which is part of the urinary system. To reproduce the animal needs a reproductive system. This complicated system is controlled by the endocrine system, consisting of ductless glands, which secrete their chemicals/fluids called hormones into the bloodstream for distribution to the whole body. When a hormone reaches its target organ, it will have the desired effect on that organ. This is called negative feedback. Production of hormones may be triggered by environmental factors or physiological changes in the animal's body. The endocrine glands control various involuntary processes in the body e.g., metabolism, growth, digestion, etc.

To synchronise and control all the systems a nervous system is necessary. The nervous system can be divided into two functional parts, namely, that which controls voluntary processes like walking, vision, hearing, smelling, etc. and that which controls the involuntary processes like heart rate, movement of the intestines etc.

A short preview of the anatomy of the different systems of the body will be given in order to know the anatomy of a normal healthy animal. For practical reasons the different systems will be dealt with separately, but it should always be borne in mind that the function of each system is dependent on that of others and that it is really impossible to study one without having a thorough knowledge of the rest.

The locomotor system

The locomotor system comprises of the skeleton with its joints, which give support to the different bones as well as the muscles and maintains the integrity of the body structure. When the muscles contract and relax under control of the nervous system it causes movement of the body. In addition, there are ligaments in and around joints and tendons, which serve to support and protect the muscles by preventing overstretching.

The Bones of the Body

The bones of the body can be divided into four categories:

- Long bones, e.g., the upper arm bone (humerus), thighbone (femur), etc.
- Flat bones. Examples are the cranial bones, ribs and scapula.
- Short bones such as those found in the carpus (wrist) and tarsus (ankle). These bones serve as shock absorbers.
- Irregular bones. An example is the vertebrae

The Skeleton

The skeleton is a framework of hard structures or bones, which supports and protects soft tissues. It consists of the different bones, cartilage and strictly speaking also ligaments.

Anatomically, the skeleton can be divided into two parts, the Axial skeleton, and the Appendicular skeleton.

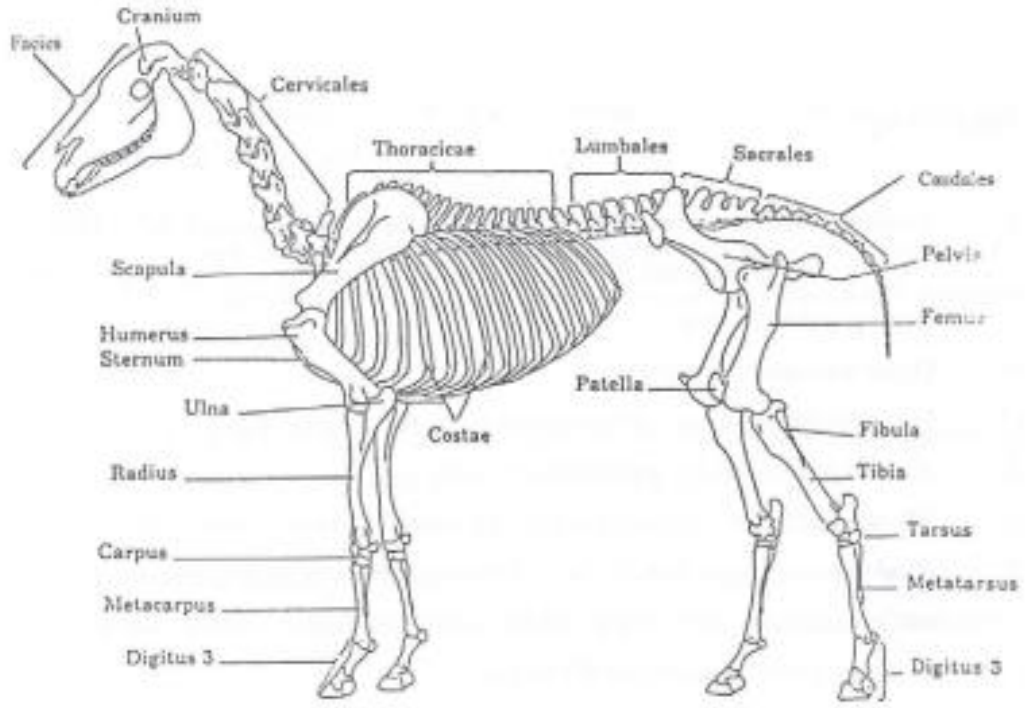
Axial skeleton. This part of the skeleton includes:

- The cranium
- The vertebral column
- The ribs and
- The breastbone (sternum)

Appendicular skeleton. This part of the skeleton compromises of:

- The pelvic girdle
- The hind limbs and
- The front limbs

Figure 1. Mammalian skeletal structure

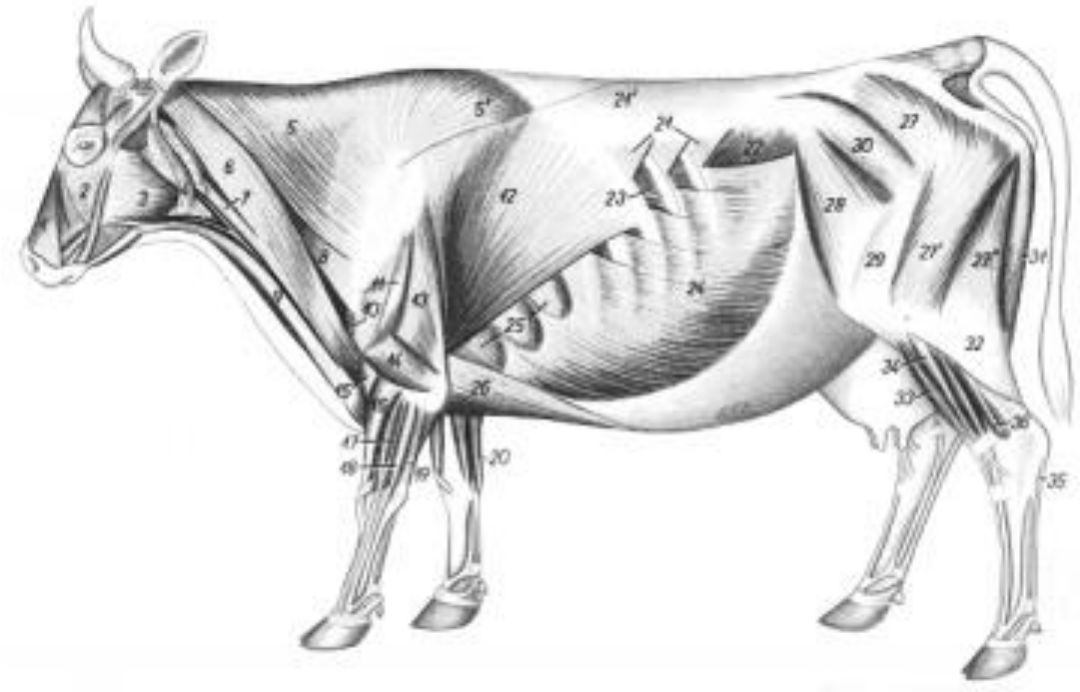


The Muscles of the body

The muscles of the body can be divided into three groups:

- Voluntary striated muscles: These include those of the neck, back and limbs and are under voluntary control i.e., the animal can contract these muscles at will. This is the "meat" of the animal.
- Involuntary smooth muscles This group includes muscles of the intestinal tract, urinary bladder, uterus etc. They are not under voluntary control of the animal, but controlled by the autonomic nervous system. There is also no sense of pain in smooth muscles. An abdominal operation can consequently be done on domestic animals and humans by the use of local anaesthesia only. Involuntary muscles, however, send out an impulse of pain when they are stretched excessively.
- Heart (cardiac) muscles (Involuntary muscles) Cardiac muscles are highly specialised muscle tissue, and although cross-striations are visible microscopically, they are involuntary muscles. The muscles also differ from striated muscles in that there are branches between fibres. The following diagram shows the matrix of muscles of a cow. Each number represents a specific muscle.

Figure 2: The muscles



The nervous system

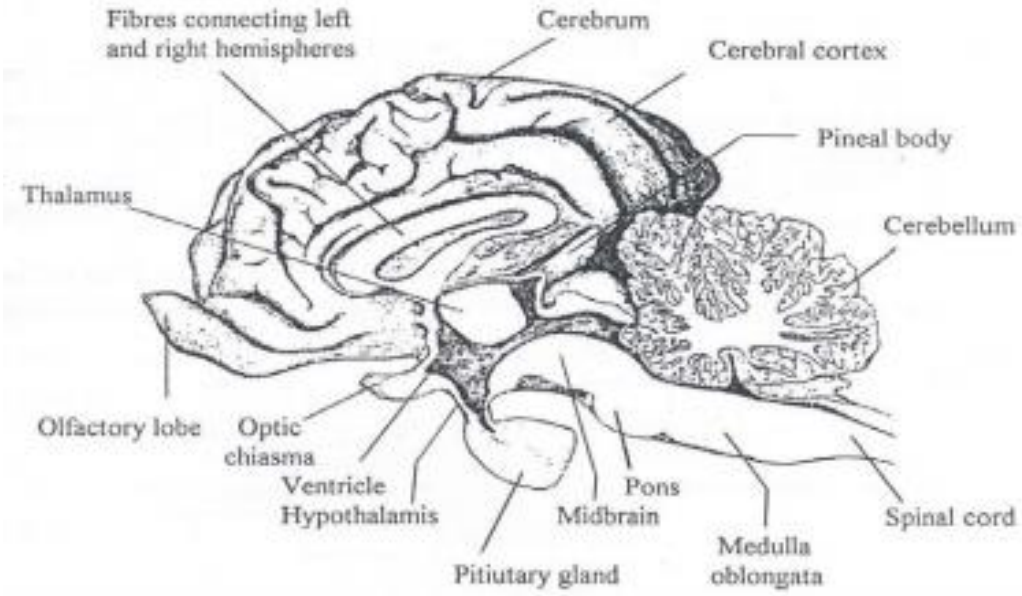
The nervous system as a whole is well protected by bones. When a nerve is injured the process of recovery, also called regeneration, can take a long time e.g., the facial nerve in the horse. Brain cells, however, cannot recover after injury. The nervous system consists of the following:

1. Central nervous system

- Brain
  - Cerebrum
  - Cerebellum
  - Medulla oblongata
- Spinal cord
- Peripheral nerves
  - Voluntary nerves
  - Motor nerve fibres
  - Sensory nerve fibres
  - Autonomic nerves also called involuntary nerves.
  - Sympathetic nerve fibres

- Parasympathetic nerve fibres

Figure 3: The brain forms part of the central nervous system



2. The brain

The brain serves to co-ordinate all the functions of the body. In humans and higher primates, it makes thinking and reasoning possible. It is, however, difficult to prove that other animals can or cannot think. There are also various centres in the brain which control certain functions involuntarily e.g., respiration, blood pressure, heartbeat etc.

3. The spinal cord

The spinal cord transmits the stimuli from the peripheral nerves to the brain and also from the brain back to the nerves branching from it. The voluntary nerves consist of a number of branching fibres running from the brain through the spinal cord to mainly the muscles and skin. Each branch consists of motor fibres carrying stimuli from the brain to an organ and sensory fibres, which carry stimuli from the organ to the brain i.e. the nerve fibres from the skin to the spinal cord, are sensory fibres and those from the spinal cord to the muscle are motor fibres. The sensory fibres relay stimuli from e.g. the skin to the brain where the animal takes note of them. The brain sends stimuli via the motor fibres to the muscles, which then react.

Furthermore, the spinal cord is also the reflex centre. Sometimes a speedy reaction on a stimulus e.g., to prevent tissue damage, is required. In this instance to get a more rapid reaction the stimulus takes a short cut via the sensory nerves through the spinal cord to the motor nerves

Without involving the brain. Only after the reaction has taken place does the individual become aware of it. This short cut is called a reflex arc. When, for instance, a hot object is touched, the hand is pulled back before one becomes aware of the heat.

4. The autonomic nervous system

The function of the **autonomic nervous system** is to control the organs, which fall outside the control of voluntary will. This includes control of the heart rate, intestinal peristalsis, etc. In some cases, the organs fall under control of the **autonomic nervous system** as well as the **endocrine** system resulting in a close co-operation between the two systems. The physical appearance of these nerves is identical to that of the voluntary system and the only way we are able to distinguish between the two is in the functions that they perform and the organs that they supply. Because the **autonomic nervous system** causes two different reactions in each organ it supplies, it is divided into two parts namely the **sympathetic** part, which has approximately the same action as the hormone **adrenalin**, and the **parasympathetic** part, which has basically the same action as the hormone **acetylcholine**.

The receptors of the nerves can be divided into two groups according to the sensations they induce:

- Those, which provide general sensations: These sensations, with the exception of pain, seldom penetrate the conscious mind.
- Those, which provide specific sensations: These differ from each other regarding their anatomical structure, the type of stimuli to which they react and the nature of the sensation which they provide.

Table I: the most common classification of receptors

Sense-organ	Nature of sensation
Skin	Touch, pain, heat, cold
Eye	Vision (light, colour, for and distance)
Ear	Hearing (pitch, intensity and direction)
Tongue	Taste (sour, sweet, salt, bitter)
Nose	Smell

Blood

Blood consists of two fractions namely:

- Plasma (fluid part)
- Blood cells

Blood Plasma – forms approximately 66 per cent of the total blood volume and consists of 92 percent water and 8 percent solids. The latter consists of Proteins and Serum albumin. Blood plasma is produced by the liver and plays an important role in stabilising the water content of the blood.

- Serum globulin – Is produced by the liver. Globulins play a very important role in the protection of the body against diseases.
- Fibrinogen – is produced in the liver and is important part in the clotting of blood.
- Inorganic salts – consist mainly of salts of sodium, calcium, magnesium, phosphorus, and others.
- Organic substances Examples are glucose, urea, fats, etc.
- Hormones and antibodies Apart from the plasma in blood there are also small quantities of plasma in the pericardium, thoracic and abdominal cavities.

Under certain disease conditions more plasma is excreted in the three cavities where it can coagulate and cause adhesions. When plasma coagulates, fibrin and serum are formed.

Cellular elements

- Red blood cells (Erythrocytes)

  Red blood cells are formed in the red bone marrow. The most important constituents of a red blood cell are protein and iron. Iron is not found in free form, but in combination with other proteins thus forming **haemoglobin**. Haemoglobin is the substance in the red blood cell that is responsible for the transport of gasses such as Oxygen and Carbon dioxide.

  Haemoglobin + Oxygen = Oxyhaemoglobin (A bright red colour)

  Haemoglobin + Carbon dioxide = Carboxyhaemoglobin (A reddish blue colour)

  Oxygen-rich blood thus has a bright red colour whilst blood poor in oxygen, in other words, carbon dioxide-rich blood, have a reddish-blue colour.

- White blood cells

  The white blood cells protect the body against pathogenic organisms. There are five different white blood cells found in most farm animals, and each with a specific defence mechanism to fight germs and foreign organisms that may cause disease.

- Blood platelets (Thrombocytes)

Blood platelets are formed in the bone marrow and play a role in the clotting of blood. The clotting ability of blood is of great importance to the body because it prevents the loss of blood from the body after damage to a blood vessel.

Lymphatic System

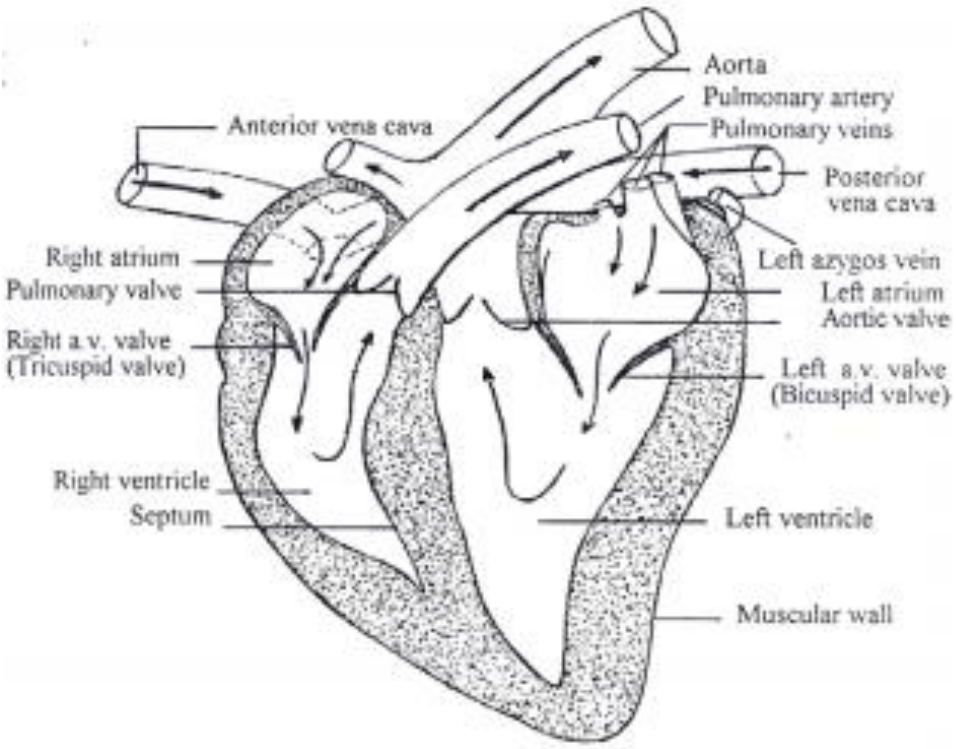
The process of re-absorption of the intercellular fluid into the blood stream does not take up all the excess intercellular fluid. This is then collected by small very thin-walled tubes, which are called **lymphatic vessels**.

These vessels drain the whole body and then unite and open into a vein in the thoracic cavity. On their way to the thoracic cavity, they pass through various lymph glands, which serve as filters against infection. White blood cells and other cells in the lymph glands actively destroy germs.

The heart and the circulatory system

The mammalian heart has 4 chambers enclosed by muscular tissue. The top two chambers are called the atria (plural of atrium) and the lower two the ventricles. A septum completely separates the right and the left sides of the heart from each other. However, there is a free passage of blood between the atrium and the ventricle on the same side. The right side of the heart is the venous or lung part and the left side is the arterial or systemic part of the heart. The walls of the ventricles are much thicker than that of the atria and the wall of the left ventricle again is thicker than that of the right ventricle.

Figure 4: The Heart



The reasons for the difference in thickness of the heart-muscle are:

- The only work that the atria do, is to store the blood for short periods and then to force it into the ventricles, thus the walls are very thin.
- The left ventricle works against the resistance of the whole systemic vascular system, whilst the right ventricle only works against the vascular resistance of the lungs.

  The heart has four valves, two on each side. They serve to stop any backflow of blood. The valves between the atria and the ventricles are called the atrio-ventricular (AV) valves. The valve that stops the backflow of blood from the aorta to the left ventricle is called the aortic valve and the valve between the pulmonary artery and the right ventricle is called the pulmonary valve (Figure 4).

  Cardiac muscles are supplied with blood via the coronary arteries.

The respiratory system

Cavities of the body

The diaphragm divides the body into two cavities namely:

- The **thoracic cavity**, enclosed by the ribs, contains the heart, lungs, and part of the oesophagus and trachea.

- The **abdominal cavity** contains the stomach, intestines, liver, spleen, pancreas and kidneys. The posterior part of this cavity is called the pelvic area and contains the bladder and the uterus in the female.

Definition:
Diaphragm – A layer of muscle that separates the stomach from the chest and moves up and down when the animal breathes.
The Posterior part – The part pertaining to the rear of the animal.

The respiratory organs

The respiratory organs supply oxygen and remove carbon dioxide from the blood. The following organs are involved: nasal cavity, turbinate bones, larynx, trachea, lungs (consisting of bronchi, bronchiole and alveoli), the ribs, the thoracic muscles and the diaphragm.

The section from the nose to the bronchi not only serves as airways but also have hair on the mucous membranes, which trap, dust particles, etc. The mucous membrane secretes mucus for taking up particles of dust. The airways also supply heat and moisture to incoming air. Like the arterioles the bronchiole can also constrict or expand thus controlling the inflow of air.

The bronchiole eventually forms alveoli (plural of alveolus). Alveoli are thin-walled structures surrounded by capillary blood vessels. Two very thin membranes thus separate the air in the alveoli from the blood and the exchange of gasses (oxygen and carbon dioxide) takes place through these membranes (see next diagram).

Figure 5: The bronchiole and alveoli of the lungs

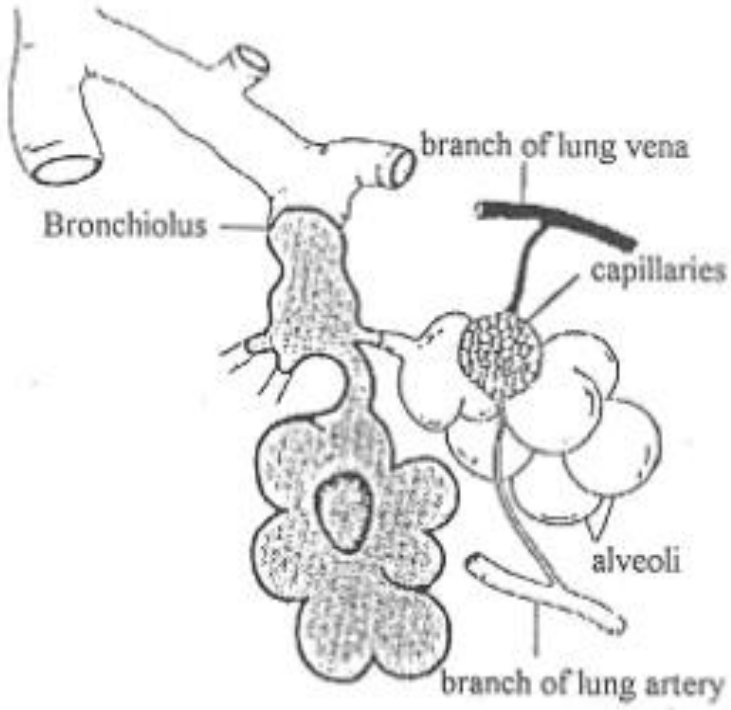
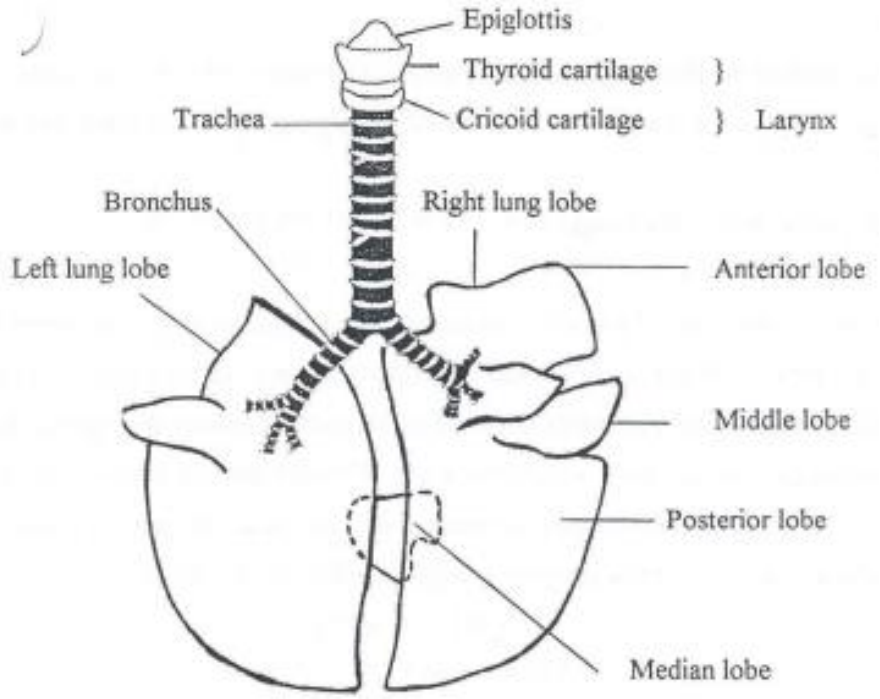


Figure 6: The lungs



The lungs are elastic organs, which hang in the thoracic cavity. They are divided into lobes, are spongy and soft, with a pink colour. When an animal is dead, the lung lobe on the lower side of the body will always be darker than the lobe lying above.

Lungs of animals with severe pneumonia as well as the lungs of unborn animals sink when dropped into water. The thoracic cavity is an airtight compartment and when it enlarges a vacuum develops in the thoracic cavity. The lungs are not closed but are in direct contact with the atmosphere through the airways. When the pressure in the thoracic cavity gets less than the atmospheric pressure (due to the enlargement of the cavity) the lungs will fill with as much air as their elasticity will allow. The chest cavity enlarges when the mussels between the ribs, pull the ribs forward. The diaphragm plays an important role in enlarging the thoracic cavity. It consists mainly of muscles and has a domed shaped form which projects into the thoracic cavity. When the muscles of the diaphragm contract the dome flattens and the thoracic cavity enlarges. As soon as the diaphragm and the intercostals muscles relax, the volume of the chest cavity decreases and due to the elasticity of the lungs, air is now expelled from the lungs

Definition:

Mucous membrane – Membrane that secretes a thick slimy liquid that protects the delicate tissues that line certain parts of the body of animals, for example, inside the nose.

Arterioles – A minute arterial branch.

Bronchiole – One of the finer (mm. or less) subdivisions of the branched bronchial tree of the lungs – having no cartilage plate.

The digestive system

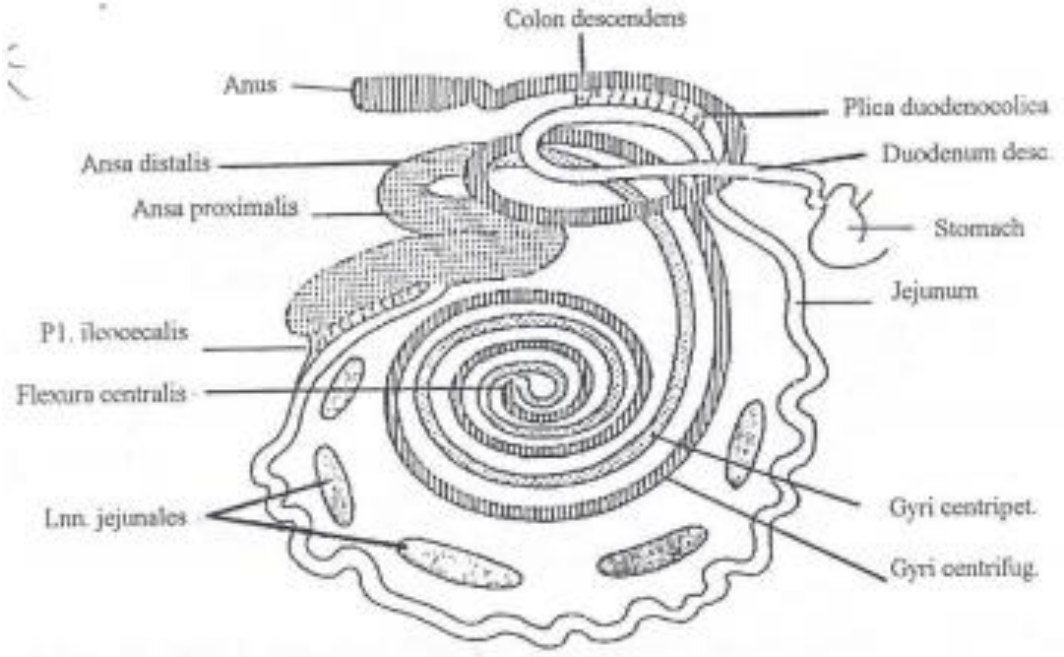
Types of digestive systems

Regarding the digestive system, the domestic animals are classified into two main groups:

- **Monogastric** ("one stomach")

  Monogastric (Non-ruminants) such as pigs, dogs and cats have a simple stomach, which can hold relatively little food, and they must therefore take in food in a concentrated form. The digestive process is totally dependent on acids and enzymes. They do not however, have an enzyme which can digest cellulose, so this substance cannot be utilised by these animals.

Figure 7: The stomach of a monogastric

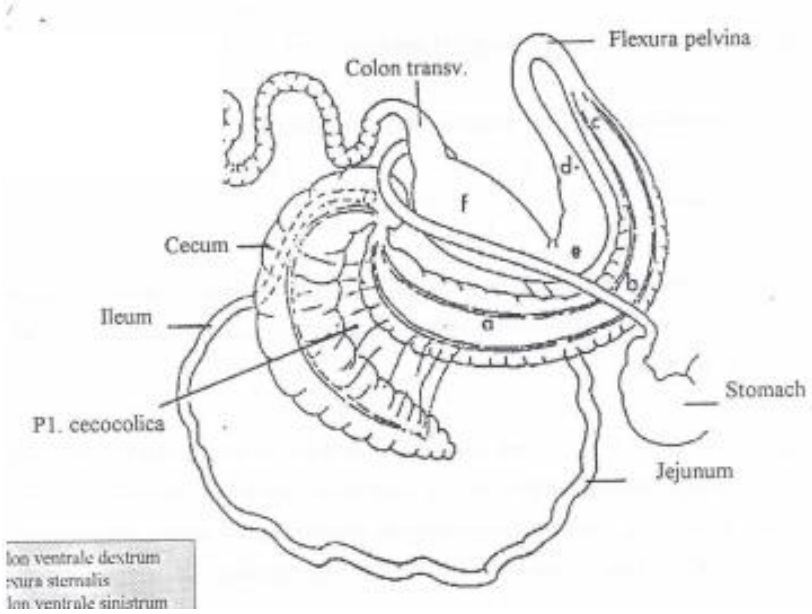


- **Herbivores**

  Non-ruminants e.g., the equine family

  The horse has a relatively small stomach, but its large intestine (caecum) can accommodate a large volume of food. Cellulose digestion takes place under the influence of micro-organisms in the caecum of the horse.

Figure 8: The digestive stomach and lower digestive tract of the horse



Ruminants e.g., cattle and sheep Food reaches the rumen where digestion takes place under the influence of micro-organisms.
The nutritive value of grass is relatively low so the herbivore is forced to take in large quantities of it. The end products of digestion by the micro-organisms are of great importance to these animals.

The organs and structures of the digestive tract

- **Lips and tongue In Horses**:
  The lips are strong, sensitive and mobile. During grazing the lips collect the grass, which is then cut by the incisor teeth. When feeding on concentrates the tongue is also utilised to collect the food.

  In Cattle: The lips have a very limited mobility. The tongue has hard protrusions pointing backwards on its dorsal surface. The tongue is curled around the grass and brought into the mouth where it is pressed against the dental pad by the incisors. The incisor teeth cut off the grass with a quick upward jerk of the head.

  In Sheep: Sheep have split upper lips, which make short grazing possible. The grass is taken between the incisors and dental plate and cut off with an upward jerk of the head. The upper lip of goats is not split but flexible to allow for browsing.

- **Teeth**
  The teeth are classified as follows:
  - Incisors
  - Canines
  - Premolars
  - Molars

The function of the incisors is to cut the food. In carnivores the canine teeth help to grip the food or to tear it off. The function of the molars and premolars is to chew food to a fine consistency. During grazing ruminants do not chew their food thoroughly but swallow it after a few cursory chews. Later, when chewing the cud (rumination), the molars and premolars are used. The mastication of food is necessary to:

- Expose a greater surface of the food to digestive enzymes in the stomach and small intestine to improve digestion.
- To thoroughly soak it with saliva and thus facilitate swallowing.

By examining the teeth of an animal, the age (in years and/or months) can be determined. It cannot, however, be determined with absolute accuracy. Various changeable factors influence the eruption of both temporary and permanent teeth as well as the wear of the teeth.

In general, the temporary deciduous incisor can be distinguished from the permanent incisors by the following. Each temporary incisor has:

- A definite neck
- Is smaller, smoother and whiter
- Various ridges and shallow grooves while the permanent incisors only have one or two clear grooves.

In the following table (Table II), the average age of teeth eruption in the various domestic animals is given.

Table II

Tooth	Horse	Cattle	Sheep, Goat	Pig	Dog
Di 1	Birth – 1 week	Before birth	Birth – 1 week	2-4 weeks	4-5 weeks
Di 2	4-6 weeks	Before birth	2 – 3 weeks	6-12 weeks	4-5 weeks
Di 3	6-9 months	Birth – 1 week	2 – 3 weeks	Before birth	5-6 weeks
Di 4	-	Birth – 2 weeks	3 – 4 weeks	-	-
I 1	2 ½ - 3 years	1,5 – 2 years	1 – 1,5 weeks	1 year	4-5 months
I 2	$3^1/_2$ years	2- 2,5 years	1,5 – 2 years	16-20 months	4-5 months
I 3	$4^1/_2$ years	3 years	2,5 – 3 years	-	-
I 4	-	3,5 – 4 years	3,5 – 4 years	-	-
Dc	Does not erupt	-	-	Before birth	3-4 weeks
C	3	-	-	6-10 months	5-6 months
Dp2	Birth – 2 weeks	Birth – 3 weeks	Birth – 4 weeks	5-7 weeks	4-6 weeks
Dp3	Birth – 2 weeks	Birth – 3 weeks	Birth – 4 weeks	1-4 weeks	4-6 weeks
Dp4	Birth – 2 weeks	Birth – 3 weeks	Birth – 4 weeks	1-4 weeks	6-8 weeks
P1	5-6 months	-	-	5 months	4-5 months
P2	2 ½ years	2 – 2,5 weeks	1,5 – 2 years	12 – 15 months	5-6 months
P4	4 years	2,5 – 3 years	1,5 – 2 years	12 - 15 months	5-6 months
M1	9-12 months	5 – 6 months	3 – 5 months	4 – 6 months	4-5 months
M2	2 years	1 – 1,5 years	9 – 12 months	8-12 months	5-6 months
M3	3 ½ - 4 years	2 – 2,5 years	1,5 – 2 years	18 – 20 months	6-7 months

Key:

Di = Deciduous incisor

I = Permanent incisor

Dc = Deciduous canine

C = Permanent canine

Dp = Deciduous premolar

P = Permanent premolar

M = Molar

- **Salivary glands**

  The salivary glands secrete the fluids, which mix with food during the mastication process, and this facilitates swallowing. Ruminants secrete large volumes of saliva (cattle approximately 55 litres per day). This saliva contains sodium bicarbonate which serves to neutralise the acids formed in the fore stomach. Saliva of humans and pigs contains the enzyme ptyalin, which breaks down carbohydrates to maltose. Because ptyalin is active only in an alkaline medium, its action is inhibited almost immediately in the acid medium of the stomach. This enzyme thus has limited significance to digestion.

- **Oesophagus**

  The oesophagus connects the mouth cavity and stomach. It is a tubular structure lined on the inside by a mucous membrane, which again is surrounded by involuntary muscle.

- **Stomach**

  Simple stomach

  The functions of the stomach are as follows:

  - Digestive processes under acid conditions.
  - Produces the "intrinsic factor" necessary for the absorption of vitamin B12 by the small intestines.

The stomach wall is lined with a membrane containing many small glands. These glands are responsible for the secretion of hydrochloric acid, which creates the acid conditions in the stomach. Other glands in the stomach wall secrete various digestive enzymes. by the small intestine.

Compound stomach (ruminants)

In the stomach of the ruminant four definite compartments occur i.e. the **rumen, reticulum, omasum and abomasum.** The first three develop as evaginations of the oesophagus whilst the abomasum can be likened to a simple stomach. Secretions of the abomasum also resemble that of the simple stomach.

Definition:

Evagination – An out-pouching of a layer or part of (in this case the oesophagus)

- **Small intestine**

  The ducts of the pancreas and gall bladder open into the small intestine near the junction of the stomach and small intestine. The small intestine consists of the duodenum, jejunum and ileum and goes over the large intestine at the ileo-caecal valve. As a rule, the length of the small intestine is approximately 7 metres long. In ruminants the small intestine can be much longer between 25 to 28 meters in sheep.

- **Large intestine**

  Except in the horse, in which cellulose digestion takes place in the large intestine, water, which is necessary for the digestive processes, is absorbed here mainly in the caecum. The function of the last part of the large intestine i.e. the rectum is mainly to collect faeces before it is passed out through the anus.

The digestion of food in an animal with a simple stomach

- **Digestion in the stomach**

  In farm animals with a simple stomach, such as the pig and dog the following enzymes help with the digestion of food:

  - **Pepsin:** The cells of the mucosa of the stomach secrete the enzyme pepsin for protein digestion. Before pepsin can have any proteolytic effect, it has to be activated by the presence of hydrochloric acid. The activated pepsin then breaks down proteins to peptides. Food does not, however, stay in the stomach long enough for this process to be completed and enzymes in the small intestine has to complete this process.
  - **Lipase**: Only small quantities are found in the stomach juices. This is an enzyme which breaks down fats to fatty acids.
  - **Hydrochloric acid** (HCl): Activates pepsin and rennin and curdles milk.

- Digestion in the small intestine
  - **Pancreatic juice:** The following enzymes are the most important ones formed/produced by the pancreas:
  - **Trypsinogen:** This is changed to trypsin by enterokinase, which is secreted by the small intestine. Trypsin breaks down protein to peptides and amino acids. Before trypsin can react, the medium in which it is dissolved must be alkaline and the proteins must be digested to a certain stage.

- **Pancreatic lipase:** This enzyme hydrolyses fats to fatty acids and glycerol. Most of the fat is absorbed in this form in the small intestine.
- **Pancreatic amylase**: This breaks down carbohydrates to maltose. The presence of bile possibly improves the action of amylase.
- **Intestinal juice:** Intestinal secretions also contain various enzymes, which, as is the case in the previous group, are responsible for the final steps in the digestion of:
  • Proteins and peptides to amino acids,
  • Compound sugars to glucose and fructose.

The digestion of food in a ruminant stomach

- The digestion of milk in the new-born ruminant

  Rennin: The enzyme rennin is found in the stomach juices of calves and possibly also in other young ruminants and causes milk to curdle. It is also activated by hydrochloric acid.

  In the new-born calf or lamb, digestion in the stomach is similar to that of the monogastric animal. By virtue of the oesophageal groove, milk consumed by-passes the rumen and reticulum and arrives directly in the abomasum. The milk is then coagulated by rennin and digested as in animals with a simple stomach. At the age of two weeks, calves and lambs will start to nibble and chew pieces of roughage. This intake of roughage is necessary for the development and functioning of the fore-stomachs i.e., rumen, reticulum and omasum.

- Digestion of cellulose:

  After thorough mixing of the food in the rumen the cellulose is broken down by ruminal organisms to fatty acids. These organisms have an optimal activity and multiply only at a pH of 5, 0 to 7, and 0. The fatty acids that are produced, of which acetic acid and butyric acid are the most important, are inclined to increase acidity (lower pH) of the rumen, which would have an adverse effect on the micro-organisms. The sodium bicarbonate secreted by the salivary glands act as a protective agent by neutralizing the acids and keeping the pH constant.

  The fatty acids thus formed are then:
  - Directly absorbed through the ruminal wall into the blood, or
  - Moved down to the abomasum and small intestine to be absorbed there, or

- Taken up by the ruminal organisms themselves.

Small quantities of sugar (2 percent) stimulate a more effective digestion of cellulose. When too much sugar is present this process is inhibited because the organisms would rather attack sugar than cellulose. If enough proteins are present, however, up to 6 percent of sugar can be fed with good results (Usually in the form of molasses or bagasse – derivatives of sugar cane).

Carbohydrates can be absorbed directly by the organisms for the production of glycogen or can undergo fermentation by yeast cells, which are one of the types of ruminal micro-organisms. Gasses, especially carbon dioxide (CO2), are formed by this process and they collect on top of the fluid layer in the rumen.

The yeast cells synthesize vitamins such as vitamin B1 (thiamine) and vitamin B12 so that these vitamins need not be included in ruminant rations.

- Digestion of proteins:
  The micro-organisms in the rumen of the ruminant can make use of two sources of nitrogen to build up their body protein. They either use free nitrogen in the form of non-protein nitrogen or protein nitrogen from their rations. Some micro-organisms have the ability to synthesise protein out of free nitrogen and build up their own systems with these proteins. The organisms are themselves later digested by the ruminant in the abomasum.

  The ruminant then utilizes the synthesized microbial protein to its own benefit. The ruminant cannot use nitrogen unless enough easily digestible sugar is available to convert it to protein. This is why urea, which is a good source of non-protein nitrogen, can be used successfully under the right conditions. In the absence of enough sugar, however, urea is converted to ammonia, which is very poisonous. Sugar as such need not be present in the ration. The ruminant can produce its own sugars if enough carbohydrate is present.

  The appetite of the ruminant is directly related to the activity of the ruminal microbes. Conditions, which might detrimentally affect these microbes, are:
  - Sudden changes in the ration

- Lack of green feed
- Lack of water • Changes in the pH of the rumen
- Poor quality feed e.g., during the winter
- Phosphate deficiency
- Dosing with antimicrobial drugs

Luminal movements and the activity of ruminal organisms are also interdependent. If there are not enough active organisms in the rumen, the ruminal movements will cease (rumen stasis). This condition is commonly known as "dry gall sickness".

Treatment for these conditions is:

- Sufficient water
- Acetic acid (vinegar) – to restore the pH of the rumen
- Sugar or glycerol – an energy source for the organisms
- Brewer's yeast – replacement of yeast cells in the rumen
- Fresh ruminal fluid can also be dosed A simple preventative measure is to make any change in the diet gradually so that the micro-organisms can adapt to the changes.

- Eructation

  The oesophageal opening is not situated at the highest point in the rumen so that the surface of the fluid layer lies above this opening. During the eructation movement of the rumen, the reticulum relaxes to take a greater volume of fluid. The height of the fluid is thus lowered, and it allows gas to escape.

The kidneys

The functions of the kidneys:

- The kidneys excrete substances, which are formed by metabolism, especially nitrogen- and sulphur-containing substances.
- Conserve the water equilibrium of the body, especially with respect to plasma volume.
- Regulate the acid-based equilibrium (pH) of the body by excretion of non-volatile acid and base radicals.
- Control blood pressure.
- Excrete poisonous substances and medicines, which had been taken in by animal.

- Form specific substances such as ammonia and hippuric acid. The following diagrams show the cross-sectional structure of the kidney and its internal structure.

Figure 9: The structure of the kidney

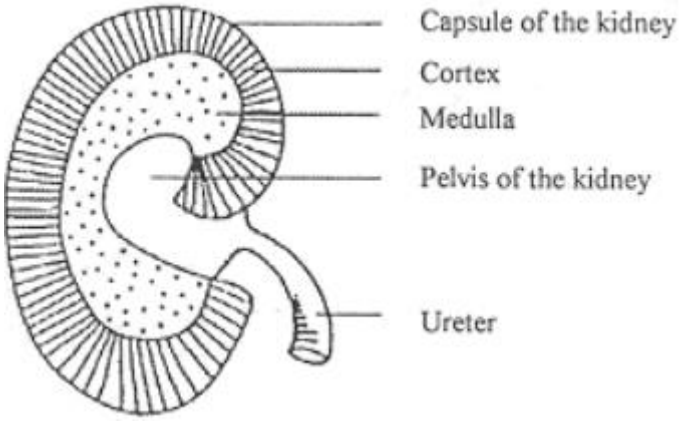
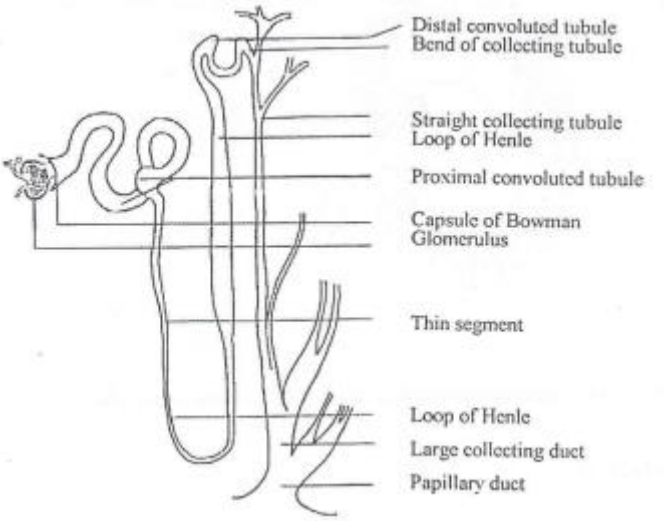


Figure 10: The microscopic structure of the kidney



The following could result from chronic kidney damage:

- Increase in the volume of urine
- Decrease in the concentration of urine
- Protein in the urine
- Presence of glucose and other substances in the urine
- Dehydration

Substances such as glucose can, however, be excreted in the absence of kidney damage e.g. in the case of diabetes mellitus in human beings. The reason for this is that blood glucose reaches such high levels that total resorption cannot take place.

The urine produced, leaves the kidneys through the urethras. The urethras join the bladder, where urine is stored, until passed out through the single urethra.

The endocrine system

The endocrine system is a system of ductless glands, which secrete chemical substances, called hormones, directly into the blood system. Via the blood circulatory system, they come into contact with the target organ(s) on which they have a specific effect.

Hormones have the following general characteristics:

- They regulate reactions rather than initiating them
- They are effective in minimal quantities
- Their levels fluctuate according to demand

The latter characteristic is necessary for integrated systems, which handle the different requirements of growth, sexual differentiation, reproduction and adaptation to environmental changes.

The hypothalamus and pituitary

The pituitary (hypothesis) and hypothalamus are morphologically and functionally intimately associated. They represent the centre of highest coordination between the endocrine and nervous systems. The hypothalamus is the control centre for the autonomic nervous system whilst the pituitary controls the endocrine system. Together they form a functional unit.

- Hypothalamus

  The hypothalamus is part of the brain, which lies just below the thalamus, forming the floor of the third ventricle. Numerous releasing hormones or factors are produced by the hypothalamus. These factors are transported to the pituitary where they stimulate the pituitary cells to release their respective hormones into the blood stream. The hypothalamus has a two-way connection with the cerebral cortex. A close association

thus exists between the nervous system (which affects rapid co-ordination) and the endocrine system, which is involved in the slower chemical co-ordination of the body.

- The Pituitary (Hypothesis) gland This small structure lies at the base of the brain and is connected to the hypothalamus by a small pedicle. The part of the pituitary that originates from the brain is called the posterior lobe (neurohypophysis) and the part originating from the upper palate is called the anterior lobe or adenohypophysis.

- Hormones of the anterior pituitary
  - Adreno-corticotropic hormone (ACTH). It is secreted by stimulus of the corticotrophin releasing factor (CTRF) from the hypothalamus. Adreno-corticotropic hormone (ACTH) stimulates the secretion of corticosteroids by the adrenal cortex. On the other hand, corticosteroids inhibit the secretion of ACTH, a process called" negative feedback".
  - Growth hormone (Somatotropin). Secretion is controlled by the growth hormone releasing factor (GHRF) from the hypothalamus. The growth hormone controls the general growth of the body (especially the longitudinal growth of the long bones).
  - Thyrotropic hormone (TTH). Secretion is controlled by thyrotropic releasing hormone (T-Rh). TTH stimulates growth of the thyroid gland. It controls the uptake of iodine by the thyroid and thus also the synthesis and release of the thyroid hormone.
  - Follicle stimulating hormone (FSH). The releasing hormone from the hypothalamus again stimulates the release of FSH by the anterior pituitary. FSH stimulates the development of the Graafian follicle in the ovary of the female. Oestrogen, which is formed in the follicle, on the other hand, inhibits the secretion of FSH when a certain level is reached.
  - Interstitial cell stimulating hormone (ICSH). ICSH stimulates the interstitial cells in the testis of the male to secrete testosterone (the male sex hormone).
  - Luteinizing hormone (LH). LH-RH causes release of LH, which is responsible for ovulation in the female animal. Ovulation takes place as soon as a specific balance between oestrogen from the follicle and LH from the anterior pituitary is reached. After ovulation LH also plays a role in the development of the corpus luteum (Yellow body).

- Prolactin. Prolactin is responsible for the maintenance of secretion of the corpus luteum and is also involved in lactation. In the male it stimulates the accessory sexual organs.

- Hormones of the posterior pituitary (Neurohypophysis)
  These hormones are formed in the brain and then transported to the posterior pituitary.
  - Antidiuretic Hormone (ADH). Antidiuretic hormone decreases the volume of urine by increasing water resorption from the filtration solution in the kidney.
  - Oxytocin. This hormone acts on the mammary gland. It stimulates the flow of milk through its action on the myo-epithelial cells and smooth muscle fibres in the mammary gland – the so-called "let-down reflex". Oxytocin is released as soon as the udder of the cow is stimulated e.g. by the pre-milk washing of the udder. The effect of the hormone only lasts for a few minutes and the cow must therefore be milked as soon as possible, otherwise there is no proper "let-down" of milk. During parturition (birth) it causes contractions of the uterus muscles and in the act of mating, it aids in the transport of spermatozoa and the ovum. The reaction of oxytocin is inhibited by adrenalin (and thus fear or stress).

The ductless glands of the body

- Thyroid
  The thyroid consists of two lobes, which are situated on both sides of the trachea, near the larynx. In most domestic animals the lobes are connected. The hormone of the thyroid contains large quantities of iodine, which is the active constituent in this case. The formation of the thyroid hormone is controlled by thyrotrophic hormone (TTH), which is secreted by the pituitary.

  Thyroid hormone, in turn, inhibits the formation of thyrotrophic hormone, and a balance is thus created between the two hormones in the blood stream. With a deficiency of iodine in the body the formation of thyrotrophic hormone is not inhibited, with the result that the continuous production of this hormone causes the thyroid to enlarge. This enlargement is known as goitre. Further symptoms of decreased production of thyroid hormone (or deficiency of iodine) are:
  - Obesity – sugars cannot be metabolised fully
  - Dwarfism – in young animals • Hairlessness or loss of hair – in iodine-deficient areas piglets are often born hairless

- Lowered fertility
- Lowered milk production

- Parathyroid

  The parathyroid consists of two pairs of glands on, or very near, the thyroid glands. They are much smaller than the thyroids. Parathyroid hormone controls the uptake of calcium by the intestine and resorption of calcium from the bones, as well as the excretion of phosphorus in the blood stream. The parathyroid plays a very important role in high calcium intake in dairy cows before the birth of a calf. If the gland's reaction is lazy, the blood-calcium levels will fall when milk secretion starts, and the cow can get milk fever.

- Adrenals

  The adrenals lie close to and at the cranial poles of the kidneys. Anatomically a cortex and medulla can be distinguished. Both these areas secrete different hormones.

  - Cortex. Under the influence of ACTH from the pituitary gland a series of hormones are formed. The following are the most important:

    • Mineral corticoid: Controls Na:K balance in the blood and the fluid balance in the body. Loss of minerals through impaired function of the adrenal cortex causes more water to be excreted by the body with resultant dehydration.

    • Gluco corticoids: Essential for the control of glucose metabolism (energy) and exert an anti-inflammatory effect.

  - Medulla. The hormone adrenalin is produced by the medulla and is responsible for:

    • Increased heart rate. More work is done by the cardiac muscles than normal.

    • Dilation of the blood vessels of the heart. As a result of the increase in the heart rate and with more forceful contractions a better blood supply is essential.

    • Increase in blood pressure. More blood per time unit is forced through the lungs to increase the rate of gas-exchange.

    • Increased respiration rate.

    • Constriction of blood vessels of the muscles.

    • Dilation of the blood vessels of the muscles.

    • Mucous- and salivary secretion decreases.

• Increase in blood sugar because more energy is used.

All the above prepare the body for action – the so-called "fight-or-flight" reaction.

- Pancreas
  In addition to the pancreatic enzymes, which are secreted via the pancreatic ducts into the small intestine, this organ also secretes the hormones **insulin** and **glucagon**.

  Impairment in the secretion of insulin causes diabetes mellitus. In this case an increase in blood sugar is present, the reason being that permeability of cell walls to blood sugar decreases in the absence of insulin, so that blood sugar cannot be made available to the tissues. Notwithstanding the fact that kidneys normally reabsorb 100 percent of the glucose in the urine, the blood sugar is so high that the kidneys are not capable of resorbing all the glucose, leading to the excretion of glucose in the urine. Glucagon opposes the action of insulin by raising blood glucose levels.

Definition:
Permeability The ability of the cell membrane to transport molecules through.

- Ovary
  The ovaries are the female reproductive organs that produce ova from the Graafian follicles. A Graafian follicle produces oestrogen. Apart from its role in ovulation (production of ovum) it also causes oestrus.

- Testis The testis is the male organ that produces the hormone testosterone and sperm cells. Testosterone is responsible for the development of the secondary male characteristics in the male animal and stimulates the sexual drive.

- Thymus The thymus is involved in the immune system of the body.

- Pineal body
  The pineal body regulates the sexual activity of seasonal breeders like sheep and horses. The onset of decreasing day length in autumn stimulates ewes to start cycling. The opposite is true for mares, where increased day length in spring starts the mare cycling.

The reproductive system

The female reproductive system

The female reproductive system consists of the vulva, vagina, cervix, uterus, fallopian tubes and the ovaries.

- Vulva
  The cleft like opening on the female reproductive system situated just beneath the anus.

- Vagina
  Continuous with the vulva and lies in the pelvic cavity. The last part of the large intestine (rectum) lies dorsal to it while the urinary bladder lies immediately ventral to it. There is no definite line of demarcation between the vulva and vagina.

- Cervix
  The cervix is the connection between the vagina and the uterus. The cervix is thick walled with a narrow tortuous lumen. In the pregnant animal it is sealed off by a mucous plug.

- Uterus The uterus consists of a body of varying length between species, and two uterine horns. The horns are attached to the pelvis by the broad ligaments.

  On the inside of the horns of the uteri of ruminants, the caruncles are found. Normally they are about the size of a pea, but during pregnancy they enlarge and then have a spongy appearance. These are the sites of attachment between the uterus and the placenta.

- Fallopian tubes
  The Fallopian tubes, which transport the fertilised ovum and where fertilisation takes place, are anterior extensions of the uterine horns. At the anterior end of the Fallopian tubes the ovaries are found. The free end of the tubes is funnel shaped, the so-called infundibula, which enfolds the ovary at ovulation.

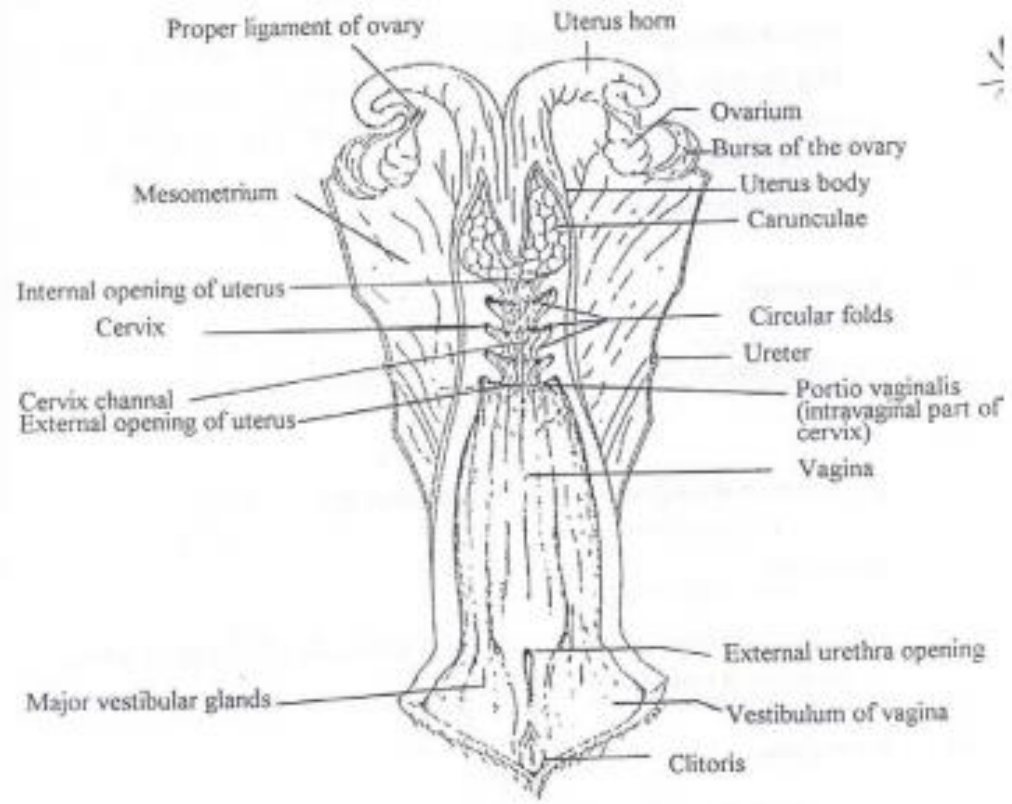
- Ovaries

  Each female animal has two of these organs, which produce ova. The Graafian follicle containing the ovum is formed in the ovary. When ovulation takes place, the ovum is collected by the infundibulum and moves through the Fallopian tube in the direction of the uterus. Inside the Fallopian tube the ovum is fertilised by the sperm cells and then moves on into the uterus where it develops into the embryo, later on becoming a foetus.

- Oestrus cycle

  The oestrus cycle of the female animal starts at puberty and is associated with distinct physiological changes. These changes, which occur rhythmically during the sexually active season is the only time that the female is fertile.

Figure 11: The structure of the female reproductive system



- The mammary gland (Udder)

  Anatomically, the mammary gland is a gland of the skin. In the following discussions the udder of the cow will be used as example. The bovine udder consists of four milk glands or quarters. Each quarter is a separate unit with its own duct system, teat cistern and teat. Where the teat canal goes over into the teat cistern there are a series of four to eight radial folds in the mucous membrane. In the mucous membrane of the teat cistern

there are numerous irregular circular and longitudinal folds. The openings of the teats are held closed by a sphincter of smooth muscle and elastic fibres.

Basically, the udder of the cow differs from that of other domestic animals as follows:

Anatomical characteristic	Cow	Sheep Goat	Mare	Sow	Bitch
Number of functional teats	4	2	2	10-14	8-12
Number of teat openings per teat	1	1	2-3	2	18-20

The following hormones have a direct or indirect influence on the development of the mammary gland.

- Thyrotrophic hormone, Growth hormone, ACTH, FSH, LH, and prolactin.
- From the posterior pituitary:
  - Oxytocin from the hypothalamus via the posterior pituitary plays a very important role in the "let-down" of milk by causing contraction of the smooth muscles and myo-epithelial cells of the mammary gland.
  - Oestrogen from the Graafian follicle also plays an important role in the development of the mammary gland.

The constituents of the milk are produced directly or indirectly from the blood. Although the osmotic pressure of milk and blood is the same, the constituents of these two fluids differ greatly. Milk contains more sugar, lipids, calcium, phosphorus, and potassium, but less proteins, sodium and chloride. The proteins in milk are mainly casein (with small quantities of albumins and globulins), while albumins and globulins are the most important proteins in blood.

The components of colostrum also differ from that of milk. In most animals, colostrum is the medium by which antibodies are transmitted from the mother to the new-born offspring.

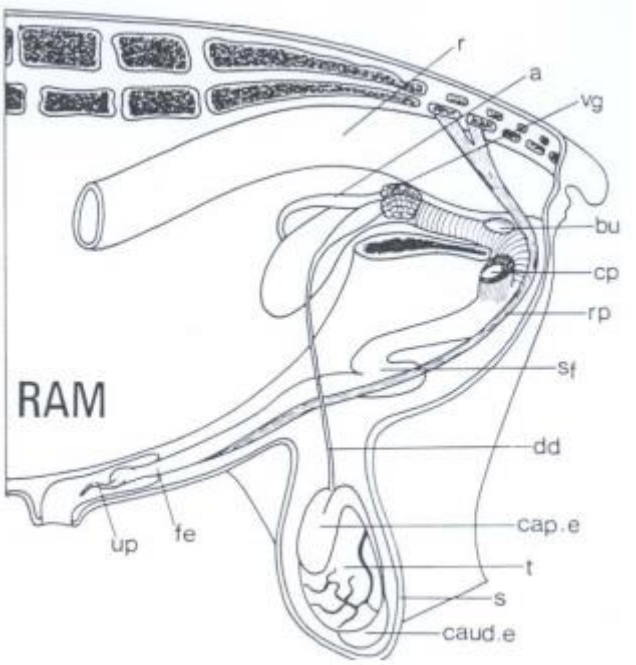
The male reproductive system

The male reproductive system consists of the testis, epididymis, vas deferens, ampullae's, urethra, penis and accessory sex glands.

- Testis

  The testes (two in normal males) are enclosed in the scrotum. The testis itself is oval shaped and the left and right testes are not always of exactly the same size. Most of the testis is made up of fine tubules in whose walls the spermatozoa are formed. By merging, the tubules become larger and eventually form the epididymis. Spermatozoa undergo their final maturation process in the epididymis and are also stored there.

Figure 12: The location of the parts of the male reproductive system



- Epididymis

  The epididymis is joined to each testis and consists of a head, body and tail. The head is attached to the dorsal part of the testis. The body, a continuation of the head, goes over into the tail, which lies at the base of the testis.

- Vas deferens T

  The vas deferens are paired ducts that carry semen from the tail of the epididymis, via the spermatic cord, to the ampullae's in the pelvic cavity.

- Ampullae's

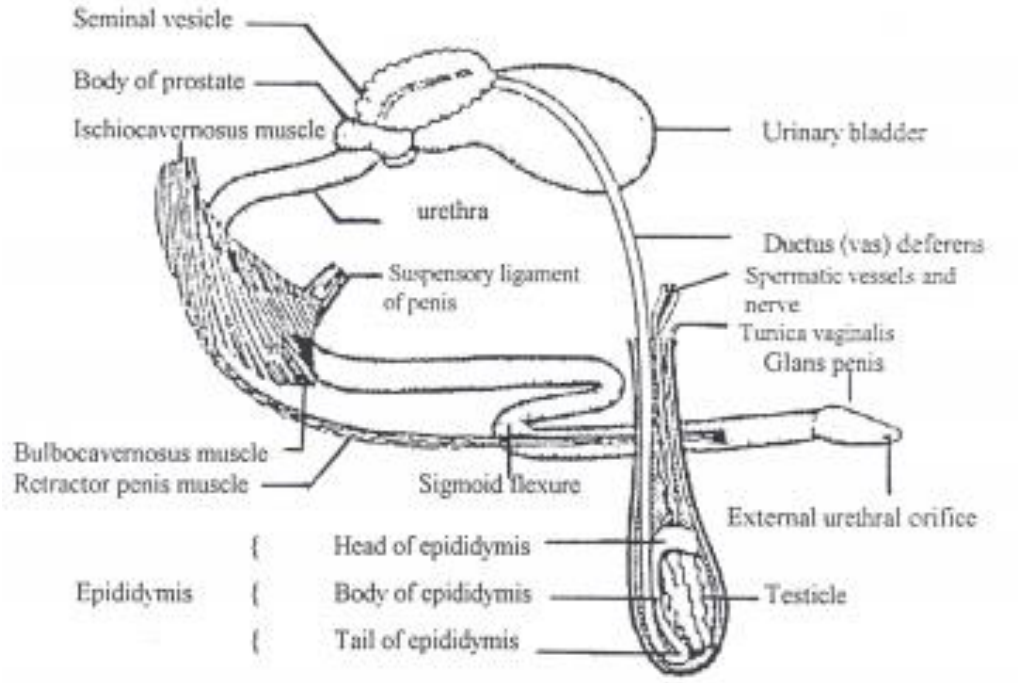
  Basically, these are thickenings of the last part of the vas deferens. Like the vas deferens, the function of the ampullae's is to transport semen, to store semen and to secrete

spermatic fluid. They contract forcefully to expel the semen during ejaculation. The ampullae's lie on top of the urinary bladder and open into the urethra.

- Urethra

  This single duct starts at the bladder and continues right through the length of the penis. In the male it transports both semen and urine.

Figure 13: The structure of the male reproductive system



- The penis

  The male sexual organ used for mating. It lies in an invagination of the skin called the sheath. The penis of a ruminant consists of strong connective and elastic tissue and has a characteristic sigmoid flexure. The penis of the horse is spongier. The tip of the penis is called the glans penis.

- Spermatic cord

  Consists of the cremaster muscles, blood vessels, nerves and vas deferens. The cavity of the scrotal sac is continuous with the abdominal cavity. A network of closely apposed blood vessels cools down the blood going to the testes. This is necessary because spermatogenesis occurs optimally at temperatures approximately 4 degrees Celsius below body temperature. Apposed Blood vessels packed next to one another to form a cooling network

- Accessory sex glands

  The functions of these glands are to give volume to the semen and supply nutrients and protection to the spermatozoa. They include the seminal vesicles, prostate and the bulbo-urethral glands.

	**Individual Activity 1:**

The influence of anatomical systems on production

Introduction

The previous section and the knowledge that you have obtained in Level 3 will enable you to understand the origin of animal products and how production of animal products are influenced by biochemical reactions. For the body to function well it needs enough of a well-balanced ration so that the body can maintain itself (known as maintenance nutrition) and also to produce enough products that the farmer can harvest.

	**Individual Activity 2:**

	**Individual Activity 3:**

	**Individual Activity 4:**

MONITORING AND ADVISE

Introduction

Knowledge of the anatomy and physiology of the farm animal will allow the farmer to recognise when animals are not doing well. It must be remembered that the farmer who spends a lot of time with his animals will know their habits and appearance better, and will be able to spot any unusual behaviour or anatomical differences, which could possibly indicate a sick animal.

In a natural, undisturbed state, some animals will usually be eating, some will be lying and chewing their cud, some will be sleeping, but if one or more are lying in a corner of the field, kicking and struggling, you can be sure that they are in some sort of trouble.

If a few goats lag behind the rest of the group while herding them to a new camp, a closer look should be taken at the slower ones. It is important to know the big picture here, because heavily pregnant animals have a tendency of lagging behind and that is normal.

- Compare the sick animal to the rest of the group – are the others in the same state as it or not. If one animal is in a poorer condition than the others, there may be a problem.
- Consider the conditions under which the animals are managed. What have they been eating? What season is it? How old are they? Are they pregnant? Are they nursing young?
- Animals are just as susceptible to external factors as humans. There are some situations which lend themselves to the identification of a sick animal in your flock, e.g.
  - Observing the flock in an undisturbed state
  - While herding the animals
  - During the regular inspections in the crush

Monitoring and evaluating the anatomy of an animal

An examination of an under-performing animal should be done systematically and thoroughly, e.g., from top to bottom, and then from left to right.

1. Look at the head of the animal. Does it have a nasal discharge? Are its eyes clear and alert? Are there cuts or injuries? Are there any swellings? Is the head held normally, or drooping or bent down? Are the eyes bright, clear, and shiny, or are they red, opaque, or weeping? Are the ears alert or drooping? Is there frothing at the mouth or an excess of saliva? Are the mucous membranes around the eye pale, yellow, blue, or dark red?
2. Examine the animal's neck. Are there any abscesses? Is there a swelling (oedema) under the jaw? Open wounds? Are the lymph nodes swollen?
3. The back. Is the back level and sturdy? Does it sag excessively? Is the coat in good condition? Shiny or dull? Does the animal have dandruff? Are there mites or lice? Are there bite marks or lick marks on the coat? Are there patches of hair missing? Is the skin loose or tight, soft or hard?
4. Rump. Are the hipbones sticking out excessively? Do a condition scoring.
5. Shoulder. Are there any cuts, bruises, etc?
6. Ribcage. Are the ribs well covered with flesh? Are they moving rapidly, shallowly, and hardly at all?
7. Rumen and intestines. Can you hear any rumen movement (gurgles)? When you palpate the rumen is it hard, or floppy? Is the rumen bloated?
8. Reproductive organs (male and female). Check for ticks around all reproductive organs. If a female: is there a vaginal discharge? Is the vulva swollen and red? Is the ewe in pain when she urinates? If a male: are the testicles the same size? Is the penis normal, does it have sores? Is the prepuce infected?
9. Front limbs. Are the legs stiff? Is the animal lame?
10. Hind limbs. Are the legs stiff? Is the animal lame?
11. Hooves. Are they the right length? Are there any ticks between the hooves? Does the animal have any infections between the hooves?
12. Is the animal by itself, or with the rest of the herd/flock? Is it alert, or dull and unresponsive? Is it breathing normally? Is it coughing? Is it shivering? Is it eating and drinking normally? Is it ruminating normally?
13. Is it standing up or lying down? Is it lying normally?

14. Examine the faeces and urine. Are the faeces normal or abnormal (is there diarrhoea, mucous or blood)? Is the urine pale yellow, brown or red? Does the animal strain to pass urine or faeces?
15. Recognise pain in the animal. Is the animal bellowing or bleating? Is the animal restless? Does it grind its teeth? Is it grunting? Is it licking a lot? Is it kicking itself, if so, where?
16. What to look for in lactating animals. Are either or both teats inflamed, swollen, and tender? Are the teats injured? Does the milk contain milk clots? Is the milk blood-stained? Has the milk yield fallen?

Performing a physical investigation of an animal

- Respiration rate

  Count the number of chest movements made per minute when the animal is at rest. Normal values for goats are 10 – 20 per minute. Young and old goats have slightly higher respiration rates than normal.

- Pulse

  Place a hand over the heart area, just under the left elbow, and count the heart beats: alternatively, there is an artery that can be felt on the inside surface of the thigh. Measurements must be taken when the animal is at rest. Normal values for goats are 60 – 80 per minute.

- Temperature

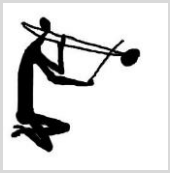
  The thermometer should be inserted through the anus into the rectum in a slightly upwards direction, and held for at least one minute. The normal temperature range for goats is 38.0 – 40.5 degrees Celsius.

- Mucous membranes

  Observe the lining inside the eyelids and mouth. If it is pale, the animal is anaemic, probably from gastrointestinal parasites or blood parasites. If it is yellow, there is a liver problem.

- Rumen contractions

  Place the palm of your hand firmly in the depression behind the last rib on the left and leave it for two minutes. Normal contractions can be felt at a rate of 1 – 2 per minute.

	**Individual Activity 5:**

ANIMAL HEALTH AND NUTRITION

Introduction

Farm animal products like meat, milk, wool, mohair, animal skins and eggs consist mostly of protein. Protein is built from different amino acids and to synthesise the proteins out of the amino acids, energy is needed in the process.

The amino acids and energy needed must be obtained from the food intake of the animal. The nutrients in the food must first be digested by the digestive system and the digested nutrients transported to the area where the nutrients (amino acids or energy) is needed by the circulatory system. In the process, other systems of the body, like the endocrine-, urinary- and many other systems might take part in the production process of the products produced by the animal.

The anatomical systems of the body are therefore not only responsible for the maintenance of the body but are also needed for the production of most farm products.

Stress

To maintain the health, vigour and productive ability of animals, a farmer needs to manage those factors which can challenge the health of the animal. There are four factors which need to be managed correctly to reduce the chance that diseases will occur.

- Poor nutrition: A well-fed animal has a much better chance of fighting off disease and can convert nutrients in excess of maintenance requirements into products.

- Stress: Any stress placed on an animal will make it more susceptible to disease (e.g. Pasteurella). Stress includes factors such as parturition, fatigue from walking or being

transported long distances, poor housing, excessive cold (especially when combined with damp), excessive heat, high humidity, and dehydration.

- Lack of tolerance: Animals in some areas are more tolerant to certain diseases because they have built up a resistance for those factors through being exposed to them for many generations. For example: Goats are browsers, and thus less susceptible to picking up internal parasites from grazing infected pastures. Thus, if you then put a goat onto pastures he will pick up internal parasites more easily.

- Lack of immunity: It is important to maintain an animal's immunity levels. There are two ways, one is allowing the new-born to receive colostrum in the first few days after birth, and the other is through vaccination.

  In general, long-term stress causes an increase in the production of cortisol by the adrenal cortex around the kidneys. Persistently elevated levels of cortisol in the blood cause the cells to develop a resistance to the function of insulin (which is to allow the entry of glucose into cells). Thus, glucose cannot enter cells and cannot be utilised by the cells to function normally, since glucose is the basic energy source for life. Elevated cortisol levels due to stress also cause reduction in levels of FSH, LH, growth hormone thus directly impairing reproduction and growth. Also, cortisol induces protein catabolism (breakdown) thus inducing muscle weakness.

Malnutrition

All processes within the body rely on the supply of nutrients. These nutrients include proteins, energy, vitamins, minerals and water in the correct quantities and ratios. If any of these elements are not supplied in the correct quantities, then malnutrition or starvation ensues. In some circumstances, where some nutrients are supplied in lieu (instead of) others the body may be able to manufacture the limiting nutrient. For example: an excess of protein can be converted into energy. However, when this occurs other organs and processes in the body can be negatively affected. For example: when an excess of protein and inefficient energy is supplied, the kidneys are placed under strain to excrete the excess amounts of urea.

Some vitamins, minerals, amino acids and fatty acids are considered "essential" or 'indispensable" and cannot be manufactured/synthesized by the body and must be ingested from an external source.

- Minerals

Mineral imbalances and deficiencies can cause sub-optimal production and reproduction even when there is an abundant feed supply. At least 15 mineral elements are nutritionally essential for ruminants. There are seven major or macro minerals (Ca, P, K, Na, Cl, Mg and S) and eight trace or micro minerals (Fe, I, Zn, Cu, Mn, Co, Mo and Se). An excess of Cu, F, Mn, Mo or Se can also cause toxicities. Toxicities can also occur where excess arsenic, lead, cadmium, mercury or aluminium, occurs.

- Vitamins

Animals require an external supply of all vitamins, except Vitamin K and the B vitamins. In other words, Vitamin K and the B vitamins can be synthesized in the animal body.

- Amino acids

Most amino acids necessary for protein synthesis can be synthesized by animals at rates rapid enough to ensure that the animal is not dependent on an external dietary supply. The "non-essential" amino acids include alanine, serine, aspartic acid, glutamic acid, glutamine, proline and hyroxyproline, cysteine, cystine and tyrosine. Sometimes the rates of synthesis are too slow to provide the amino acids in quantities required by the animal. Animals at different ages and in different physiological conditions are synthesizing particular proteins at different rates and this will create a requirement for increased supplies of different types of amino acids. In these cases, amino acids become "essential" because of the physiological stage of the animal. Thus, growing chickens may require extra glycine and extra histidine and arginine are required from growth of young. However, synthetic processes in the animal body cannot produce some amino acids. Such "essential" amino acids include lysine, phenylalanine, threonine, valine, isoleucine, leucine, methionine and tryptophan.

- Fatty acids

Several poly-unsaturated fatty acids, specifically linoleic, linolenic and arachidonic acid must be supplied in the diet. In the rat, dog, mouse, chick, and infant human their absence leads to a cessation of growth, presence of fatty liver, skin lesions, with increased water loss due to increased permeability of skin and abnormalities in pregnancy and lactation.

Metabolic diseases

Disease conditions that manifest themselves due to an imbalance of nutrient ratios are known as metabolic diseases. Some well-known metabolic diseases include:

- Milk fever

Characterised by muscle tremors, a staggering gait, and eventually paralysis and death. Occurs in heavily pregnant or lactating animals. It is caused when the calcium absorbed by the digestive tract or extracted from the bone is less than the calcium being supplied to the growing foetus in utero or to the udder for milk production. Can be reversed by supplying calcium borogluconate intravenously.

- Pregnancy toxaemia or ketosis (*domsiekte*)

Characterised by the animal being disinterested in her surroundings, is listless, has light muscle tremors, appears to be blind (there is not eye reflex), eventually kneels down and dies. This occurs in heavily pregnant animals. It is caused when the foetus takes up too much room and leaves too little room for the animal to consume the amount of energy necessary for itself and for the growth of the foetuses. This causes the animal to start breaking down stored fat to make up the deficiency in energy. Ketone bodies are formed which lead to blood acidosis. This condition can be reversed with the provision of intravenous glucose.

- Grass staggers

Characterised by convulsive seizures where the animal lies down and paddles wildly. Caused by magnesium deficiency. Can be reversed by intravenous administration of magnesium compounds.

	**Individual Activity 6:** **Individual Activity 7:** **Individual Activity 8:**
SUMMATIVE 1B	

Learning Unit 2: Animal Nutrition

Unit Standard	
116282	Explain Intermediate Animal Nutrition
Specific Outcomes	
SO 1: Describe the composition and functions of specific nutrient components and feed ingredients. SO 2: Interpret the nutrient requirements of different animal species and categories. SO 3: Perform the calibration and adjustment of feed manufacturing and processing equipment. SO 4: Explain the principles of feed preservation. SO 5: Apply quality control measures that affect feeds. SO 6: Apply the relevant standards of different purchased feed ingredients and complete feeds. SO 7: Interpret the effects of feed evaluation results towards feeding management decisions and future food selection. SO 8: Apply feed flow planning principles.	
Learning Outcomes	
Identifying	Science
Organising	Communicating
Demonstrating	Contributing
Collecting	Working

NUTRIENT COMPONENTS AND FEED INGREDIENTS

Introduction

You have already learned about the nutrients in animal feed. The most important requirements of animals are the supply of Energy and Protein. Protein is broken down and absorbed in the digestive tract of the animal in a simpler form, the amino acids. The amino acids are the building blocks of specific proteins and the DNA of a cell determines the ratio and quantities of amino acids that are needed to build each specific body protein. Before a protein can be built by a cell,

the correct quantities and ratios of amino acids must be available to that cell to build the protein. If one of the amino acids needed is not available, the protein will not be produced, and the remaining amino acids will be broken down and used as energy.

Protein

The micro-organisms in the rumen of the ruminant can make use of two sources of nitrogen to build up their body protein. They either use free nitrogen in the form of non-protein nitrogen or protein-nitrogen from their rations. Some micro-organisms have the ability to synthesise protein out of free nitrogen and build up their own systems with these proteins. The organisms are themselves later digested by the ruminant in the abomasum. The ruminant then utilizes the synthesized microbial protein to its own benefit.

Thus, Mono-gastric (single stomach) animals are dependent on feed rations with a good quality of protein and energy. This is because the digestive tract of a monogastric animal cannot digest cellulose. Therefore, feeds high in cellulose like Lucerne and other roughages cannot be utilized as effectively by mono-gastric animals as by ruminants.

In contrast, horses and rabbits make use of lower digestive tract fermentation, where microbial activities take place in the caecum of the large intestine.

Because of these differences in the ability to digest different types of food, monogastric animals and ruminants have different feed requirements. Furthermore, the nutrient requirements (quantity and quality) of different animals differ depending on:

- Their species
- Their breed
- Their age
- Their sex
- Their production potential
- Their stage of production
- Whether they are ill or healthy
- The product they produce (whether wool, meat, milk etc.)

Most of the products produced by farm animals contain high levels of proteins in their structure for example, milk, fibre and meat. These proteins are built up from certain amino acids in different combinations that will give the protein its specific characteristics.

Amino acids

All peptides and polypeptides are polymers of alpha-amino acids. There are 20 alpha-amino acids that are relevant to the makeup of mammalian proteins. Several other amino acids are found in the body free or in combined states. These nonprotein associated amino acids perform specialized functions. Several of the amino acids found in proteins also serve functions distinct from the formation of peptides and proteins for example tyrosine is important in the formation of thyroid hormones or glutamate acts as a neurotransmitter.

The alpha-amino acids in peptides and proteins (excluding proline) consist of a carboxylic acid (-COOH) and an amino (-NH2) functional group attached at the same tetrahedral carbon atom. This carbon atom is the alpha-carbon atom. Therefore. the twenty amino acids are called the alpha-amino acids (It is not necessary to know the structures of the amino acids.) The important aspect that must be known is that there are amino acids and that these amino acids are roughly classified into essential and non-essential amino acids.

Although there are more than 20 amino acids the important ones in the rations of animals are the ones needed to build the different proteins in the body or body structure, as well as the functions that build protein out of these amino acids.

Essential amino acids

These are the amino acids that mono-gastric animals need in their ration to satisfy the amino acid requirements of their diet. It is important that these amino acids be included in the correct ratios to make sure that the amino acid "building blocks" are available to build certain proteins. For instance, if a wool fibre is manufactured by the cell it needs the sulphur containing amino acid methionine as a building block. So, if the diet of the animal does not supply the amino acid then wool protein cannot be formed. The essential amino acids play an important role in the synthesis of several proteins and are needed in the correct quantities in the rations of monogastric animals.

However, although the ruminant has the same amino acid requirements, the way the ration of a ruminant is digested is different. The ruminant does not only make use of his or her own enzymes

for digestion but also uses microbial digestion. The microbes in the rumen can synthesize certain amino acids out of non-protein nitrogen sources. This enables the animal (ruminant) to be less dependent on external essential amino acids in their diet.

The essential amino acds are:

- Valine
- Leucine
- Isoleucine
- Threonine
- Methionine
- Arginine
- Lysine
- Histidine
- Phenylalanine
- Tryptophan

There are also two amino acids that some people consider as also essential or that may be essential for some animals and these are:

- Cysteine
- Tyrosine

Non-Essential amino acids

The other eight alpha-amino acids are:

- Glycine
- Alanine
- Serine
- Aspartic acid
- Asparagine
- Glutamic acid
- Glutamine
- Proline

These alpha amino acids are also important building blocks of proteins, but the body can modify the structure of the essential amino acids to form the non-essential amino acids. The feeds of

pigs, poultry and other mono-gastric animals are supplemented with the necessary amino acids when an imbalance or shortage is found in a mixed feed. Pure amino acids are expensive so the person compiling a ration will make use of natural protein rich feed sources and supplements for the initial balancing and will only supplement the pure amino acids in small quantities where it can play a big role. This is done merely to make the feed as inexpensive as possible (This is called "least cost" feed formulation). The amino acids that are supplemented will be small amounts and are mixed with the minerals and vitamins that are also small amounts.

Do you remember how to mix small amounts of feed ingredients into large amounts of mixed feed?

Protein concentrates

There are a lot of feeds that are considered "protein rich". However, they differ in quality. As a rule, you can consider any protein feed of animal origin such as fishmeal, carcass meal and blood meal as protein supplements with a high-quality protein. The presence of essential amino acids in them is good. Dry milk powder is also a protein supplement with a good quality protein.

Definition:

Protein A good quality protein can be defined as a protein that is a good source of protein and it will supply the essential amino acids in the correct ratios.

Protein supplements of animal origin are more expensive and also less abundant.

There are also very good protein supplements available of plant origin. In the processing of certain grains and plant seeds for oil a by-product is produced that is a good protein supplement. These plant protein sources are mostly cheaper and more available than animal protein supplements. Examples include:

- Soya bean oil cake meal;
- Peanut oil cake meal;
- Sunflower oil cake meal;
- Canola oil cake meal; and
- Other oilcake meals like cottonseed oil cake meal.

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There are also other by-products with protein content higher than 10 % but these have a lower quality protein. These include the by-products of the milling companies such as wheaten bran and pollard.

Protein Feeds for Ruminants

Ruminants do not need such high-quality protein feeds. The micro-organisms in the rumen will degrade the feed protein and built it into their own bodies. Therefore, if you feed high quality protein feeds to ruminants you must protect these protein sources from the micro-organisms in the rumen, allowing them to pass undigested into the abomasum where they will be digested by enzymes followed by absorption of these amino acids in the small intestine.

Usually, the ration of a ruminant will be balanced with protein supplements that are cheaper or with inexpensive non-protein supplements such as urea.

Non-protein Nitrogen (NPN)

The micro-organisms in the rumen of ruminants have the ability to synthesize amino acids and therefore, proteins out of non-protein nitrogen sources such as urea. Urea supplies the nitrogen needed by the micro-organisms to synthesize amino acids. Only small amounts of urea should be added to a mixed ration since there are limits to the amount of protein that can be replaced by non-protein nitrogen. Also, urea can be poisonous if too much is used in the ration and also if the ration gets wet in rainstorms. The urea in the ration can dissolve very easily in the water and if the animal drinks the water it may die of urea poisoning. Due to the action of the ruminal microbes, ruminants are efficient at utilizing the protein within high quality roughages such as Lucerne and other legume roughages. Most of their protein requirements can be met through such roughage rations.

Alternative Protein Sources

Chicken litter is sometimes used as a protein source for ruminants because of its high urea content. However, this practise is not recommended unless the feed is sterilized, and the ruminant herd has been vaccinated against botulism.

The supplementation of amino acids for dairy cows

In modern ruminant rations for high producing dairy cows the nutritionist includes amino acids in the ration. This is because the high producing dairy cow is not able to ingest enough of certain amino acids via her normal ration because the requirements for her production are very high

and her body is physically not large enough to eat more. Because all the cows do not all produce such high yields of milk, it would be a waste to also supplement the lower producers with expensive supplementary amino acids. This creates a feed management problem in that different cows need to be fed different feeds. One way to manage this is to break the whole herd into smaller groups of cows with similar production yields. In this way the farmer can then feed the different groups of cows feed according to their production.

Another modern method of feeding individual cows is an automated system where the individual cows ration is mixed by a computer just before the milking process starts. The cow's individual body mass and production is measured twice a day and the computer determines the mixture required. This feed is mixed as soon as the cow enters the milking stall, and is delivered to the feed bin in the milking stall while the cow is being milked. Although such systems are highly effective, they are also very costly.

Energy

Carbohydrates, fats and lipids are the main sources of energy of farm animals. The animal needs energy for maintenance, growth and production functions.

Carbohydrates

Carbohydrates are found in very small quantities in animals. Most animals store carbohydrates in the cells of the liver in the form of glycogen. Plants however are a very rich source of carbohydrates. The most common place where a lot of carbohydrates are found is in the seeds of the plants in the form of starch. Some plants like sugar cane, sugar beet and even the sweet maize plant contain high quantities of sugars in their stems. Carbohydrates include:

- Starch
- Glycogen
- Cellulose
- Hemicellulose
- Sugars
    - Mono-saccharides (glucose, fructose, galactose)
    - Di-saccharides (sucrose, maltose, lactose)
    - Poly-saccharides (hexose, pentose)

Cellulose and hemicellulose are resistant to digestive processes and their energy content is locked up and can only be utilized by animals that use microbes to help them with their digestion. Fermentation in the rumen of ruminants and the caecum and colon of horses' and rabbits' results in the production of short-chain fatty acids (acetate, propionate, and butyrate). These end products also result from the fermentation of sugars and polysaccharides. Fatty acids are absorbed by the reticulo-ruminal epithelium (stomach lining). Acetic acid is absorbed most rapidly, followed by propionic and butyric acids. Volatile fatty acids contribute approximately 60% of all the energy metabolised by the ruminant animal. The volatile fatty acids enter into the metabolism in various ways. Propionic acid is converted into glucose and stored as glycogen. Acetic acid may be formed into body fat, oxidised to provide energy, or converted to glucose and stored as glycogen. Butyric acid and acetic acid are important sources of milk fat.

The sugars and starches also supply energy to the farm animal (Less than 5% of the metabolizable energy is derived from these sources). As mentioned above, sugars and starches are also broken down in the rumen by microbial fermentation and volatile fatty acids are formed.

Since the microbes are responsible for digestion in the rumen, it should be remembered that it is actually the micro-organisms that are being fed rather than the animal. This is often forgotten in the feeding management of ruminants. When changes in the feed occur, the microbial population in the rumen changes. Some micro-organisms increase in number if the feed source that they prefer is provided while others will decrease in number since their feed source is not being supplied. Because of this continuous adaptation of the microbial population to the feed provided, it should be remembered that new feeds should be introduced to ruminants over a week to two-week period. This allows the microbial population time to adapt to the new feed source. If sudden complete shifts are made in the diet, the microbial population will die.

Acidosis is a disease condition resulting from poor feed management. Lactic acid bacteria occur in the rumen naturally but in very small numbers (about 0.01% of all the rumen bacteria). If a large amount of a concentrate feed (such as maize) is fed suddenly, then the lactic acid bacteria multiply very rapidly, reaching numbers as high as 30% of the total rumen microbial population. This leads to the production of excesses of lactic acid and reduces the pH in the rumen to less than 5. This massive increase in acidity leads to several metabolic disturbances in the animal such as dehydration, acidic body fluids, rumen stasis, the death of all the other rumen microorganisms,

damage to the rumen wall and haemorrhaging, abscesses in the liver, formation of endotoxins, and inflammation of the intestinal tract.

The monosaccharides are readily absorbed by simple diffusion in the small intestine. The amylase enzymes are responsible for hydrolysing the more complex sugars to their simple free derivatives. Thus, the disaccharide sucrose is converted to fructose and glucose, maltose is converted to glucose, and lactose is converted to galactose and glucose. The amylase enzymes found throughout the digestive tract digest the polysaccharides such as starch and glycogen. However, as mentioned above, cellulose and hemicellulose have beta-linked glucose units or pentose and hexose units, respectively, but no animal secretes the enzyme which can hydrolyse these beta-linkages. Thus, digestion of cellulose and hemicellulose in ruminants is dependent on microbial action.

Fats

Fat digestion begins in the duodenum (small intestine) when the triglycerides come into contact with pancreatic lipase and bile-salts. Triglycerides (the most abundant of the dietary lipids) are emulsified to glycerol and monoglycerides, free fatty acids and diglycerides. The monoglycerides and fatty acids combine with bile salts and sodium ions to form a micellar solution in the lumen of the small intestine. The lipid micelles enter the inter-microvillar spaces of the intestinal tract allowing the monoglycerides and fatty acids to enter the cells. Once inside the intestinal mucosal cells, the long chain free fatty acids and monoglycerides are re-esterified back into triglycerides. They are then coated with a layer of lipoprotein, cholesterol and phospholipid to form chylomicrons which are carried away by the lymph system. Short-chain fatty acids merely pass from the mucosal cells directly into the portal blood where they are transported to the liver as free fatty acids.

Definition:

Hydrolysed – the breaking of a chemical bond by addition of a water molecule.

	**Individual Activity 1:**

Minerals and vitamins

Mineral imbalances and deficiencies can cause sub-optimal production and reproduction even when there is an abundant feed supply. At least 15 mineral elements are nutritionally essential for ruminants. There are seven major or macro minerals (Ca, P, K, Na, Cl, Mg and S) and eight trace or micro minerals (Fe, I, Zn, Cu, Mn, Co, Mo and Se). An excess of Cu, F, Mn, Mo or Se can also cause toxicities. Toxicities can also occur where excess arsenic, lead, cadmium, mercury or aluminium, occurs.

The macro elements like calcium, phosphorus and magnesium forms the structural part of the skeleton of an animal. Phosphorus also has a central role in the energy metabolism of the animal. Copper is essential for the functioning of a wide variety of enzymes and a shortage thereof results in symptoms that vary from anaemia to a lowering of fertility to a loss of crimp in wool. Cobalt forms part of Vitamin B12 which is essential for the utilization of propionic acid.

	**Group Activity 2:**

The following is a list of the essential minerals and their approximate concentrations in the body:

Macro Elements		Micro Trace Elements	
Calcium	1,55%	Iron	20 - 80 ppm
Phosphorus	1,00%	Zinc	10 - 50 ppm
Potassium	0,20%	Copper	1 - 5 ppm
Sodium	0,16%	Manganese	0.2 - 0.5 ppm
Chlorine	0,11%	Iodine	0.3 - 0.6 ppm
Sulphur	0,15%	Cobalt	0.02 - 0.1 ppm
Magnesium	0,04%	Molybdenum	1 - 4 ppm
		Selenium	

Some vitamins play a major role in mineral metabolism. For example, Vitamin D is important for the mineralization of calcium into the bone structure.

Phosphorus plays an important role in the transfer of energy in the body. It is also a very important part of the skeleton and along with calcium forms the main mineral components of bone.

The following is a list of the important known vitamins. They are divided into two groups:

Fat soluble vitamins	Water soluble vitamins
Vit A	Vit B1 (Thiamine)
Vit D	Vit B2 (Riboflavin)
Vit E	Vit B6 (Pyridoxine)
Vit K	Niacin
	Pentatonic acid
	Biotin
	Folic acid
	Vit 12 (siano cobalimine)
	Inositol
	Vit C (Ascorbic acid)

The animal body can synthesize some vitamins. These include Vitamin K and the B vitamins. All other vitamins need to be supplied via external sources. Humans, apes, other primates and guinea pigs especially have an important Vitamin C requirement, which if left unchecked can lead to a condition called scurvy.

Metabolic diseases

Disease conditions that manifest themselves due to an imbalance of nutrient ratios are known as metabolic diseases. Some well-known metabolic diseases include:

Milk fever

Characterised by muscle tremors, a staggering gait, and eventually paralysis and death. Occurs in heavily pregnant or lactating animals. It is caused when the calcium absorbed by the digestive tract or extracted from the bone is less than the calcium being supplied to the growing foetus in utero or to the udder for milk production. Can be reversed by supplying calcium borogluconate intravenously.

Pregnancy toxaemia or ketosis (*domsiekte*)

Characterised by the animal being disinterested in her surroundings, is listless, has light muscle tremors, appears to be blind (there is not eye reflex), eventually kneels down and dies. This occurs in heavily pregnant animals. It is caused when the foetus takes up too much room and leaves too little room for the animal to consume the amount of energy necessary for itself and for the growth of the foetuses. This causes the animal to start breaking down stored fat to make up the deficiency in energy. Ketone bodies are formed which lead to blood acidosis. This condition can be reversed with the provision of intravenous glucose.

Grass staggers

Characterised by convulsive seizures where the animal lies down and paddles wildly. Caused by magnesium deficiency. Can be reversed by intravenous administration of magnesium compounds.

Nutrient requirements of different animal species

Introduction

The nutrient requirements (quantity and quality) of different animals differ depending on:

- Their species
- Their breed
- Their age
- Their sex
- Their production potential
- Their stage of production
- Whether they are ill or healthy
- The product they produce (whether wool, meat, milk etc.)

These factors will influence the nutrient requirements of animals throughout their lives.

Nutrient requirements

In general, nutrient requirement tables indicate the nutrient requirements of different age animals for their maintenance requirements as well as for different levels of production. Production indices could include growth, milk production, gestation (pregnancy) or fibre production.

Definition:

A maintenance ration: provides sufficient nutrients for the maintenance of the essential processes of life. The animal will remain in good health without a decrease or increase in body mass. Maintenance requirements are mainly dictated by the body mass of the animal.

A production ration: provides nutrients over and above the maintenance ration to ensure the production of a certain product. Products include growth (meat), milk, young and fibre.

Various "Nutrient Requirement" tables are available (Table 1 of Appendix A contains the NRC Nutrient Requirement table for sheep). These differ mainly in the manner in which the nutrient requirements of the various animals were determined, but are essentially the same. The feeding standards presently used include the:

- National Research Council (NRC) USA.
- Agricultural Research Council (ARC) Britain.

To interpret the tables, the farmer needs to know how old the animal is, how much it weighs, and its stage of production. For example, the animal in question may be a mature ewe, weighing 60kg, with twins in the first 8 weeks of gestation.

The tables will provide the nutrients (dry material, metabolizable energy, and crude protein) required by the animal at the specific stage of production. The required nutrients may be given as:

- Quantity per animal per day.
- Percentage of the total ration.
- Quantity per kg of the ration.

While reading and interpreting Nutrient Requirement tables is an important skill, a farmer should inherently know that there are certain periods of an animal's life when improved nutrition is required. Such periods include:

- During mating - In order to obtain a high conception rate or increased multiple offspring the female should be in good condition during the mating season. Flush feeding assists to increase the ovulation rate (multiple ova are released).
- The last six weeks of gestation - The nutritional requirements of the female increase drastically during this period because most of the development of the foetus occurs during this time. Poor nutrition during this period may lead to metabolic disturbances

such as ketosis (*domsiekte*) in the female or the birth of small lambs/calves which are weaker.

- The first eight weeks of lactation - The female has the greatest nutrient requirements during this time since the young is almost totally dependent on the female during this period.
- Active growth stage of the young animal - A high quality feed should be fed to young animals because the requirements for growth are high and the rumen capacity at this stage is still a limiting factor. Poor nutrition during this stage can lead to permanent stunting of the animal. Differences of nearly 20 percent in mature body mass were obtained as a result of differences in nutritional treatment prior to four months of age. Also, the influence of pre- and postnatal treatments was additive. This means that if the mother is fed well in the last few weeks of pregnancy, and the young that are born are strong, then, if the young are also fed well up to weaning, the final result will be even stronger and healthier offspring.

Although it may seem logical that some periods of an animal's life have lower nutrient requirements, do not be fooled! For example, during the dry period a pregnant dairy cow needs to build up reserves in the form of fat, muscle, tissue and bone for the stressful high production period to follow. Also, although the production of fibre does not necessarily require increased nutrient supply, feed provision/nutrient supply should be constant to avoid breakages or weak areas in the fibre. Since sudden changes in weather can negatively affect feed intake, fibre producing animals should be fed slightly above maintenance requirements to ensure a buffer for sudden stressful periods which may negatively influence fibre quality.

Definition:

Pre- and Postnatal: Pre- and postnatal means before birth and just after birth.

Non-Degradable Protein: Non-degradable proteins are proteins that are not attacked by the micro-organisms of the rumen. Thus, they pass, unaffected into the abomasum and are digested by the acids there.

Nutrient imbalances

To maintain the health, vigour and productive ability of animals, a farmer needs to manage those factors which can challenge the health of the animal. There are four factors which need to be managed correctly to reduce the chance that diseases will occur.

- Poor nutrition: A well-fed animal has a much better chance of fighting off disease and can convert nutrients in excess of maintenance requirements into products.
- Stress: Any stress placed on an animal will make it more susceptible to disease (e.g. Pasteurella). Stress includes factors such as parturition, fatigue from walking or being transported long distances, poor housing, excessive cold (especially when combined with damp), excessive heat, high humidity, and dehydration.
- Lack of tolerance: Animals in some areas are more tolerant to certain diseases because they have built up a resistance for those factors through being exposed to them for many generations. For example: Goats are browsers, and thus less susceptible to picking up internal parasites from grazing infected pastures. Thus, if you then put a goat onto pastures he will pick up internal parasites more easily.
- Lack of immunity: It is important to maintain an animal's immunity levels. There are two ways, one is allowing the new-born to receive colostrum in the first few days after birth, and the other is through vaccination.

In general, long-term stress causes an increase in the production of cortisol by the adrenal cortex around the kidneys. Persistently elevated levels of cortisol in the blood causes the cells to develop a resistance to the function of insulin (which is to allow the entry of glucose into cells). Thus, glucose cannot enter cells and cannot be utilised by the cells to function normally, since glucose is the basic energy source for life. Elevated cortisol levels due to stress also cause reduction in levels of FSH, LH, growth hormone thus directly impairing reproduction and growth. Also, cortisol induces protein catabolism (breakdown) thus inducing muscle weakness.

Malnutrition

All processes within the body rely on the supply of nutrients. These nutrients include proteins, energy, vitamins, minerals and water in the correct quantities and ratios. If any of these elements are not supplied in the correct quantities, then malnutrition or starvation ensues. In some circumstances, where some nutrients are supplied in lieu (instead of) others the body may be able to manufacture the limiting nutrient. For example: an excess of protein can be converted into energy. However, when this occurs other organs and processes in the body can be negatively affected. For example: when an excess of protein and inefficient energy is supplied, the kidneys are placed under strain to excrete the excess amounts of urea.

Some vitamins, minerals, amino acids and fatty acids are considered "essential" or 'indispensable" and cannot be manufactured/synthesized by the body and must be ingested from an external source.

- Minerals

Mineral imbalances and deficiencies can cause sub-optimal production and reproduction even when there is an abundant feed supply. At least 15 mineral elements are nutritionally essential for ruminants. There are seven major or macro-minerals (Ca, P, K, Na, Cl, Mg and S) and eight trace or micro-minerals (Fe, I, Zn, Cu, Mn, Co, Mo and Se). An excess of Cu, F, Mn, Mo or Se can also cause toxicities. Toxicities can also occur where excess arsenic, lead, cadmium, mercury or aluminium, occurs.

- Vitamins

An external supply of all vitamins, except Vitamin K and the B vitamins, are required by animals. In other words, Vitamin K and the B vitamins can be synthesized in the animal body.

- Amino acids

Most amino acids necessary for protein synthesis can be synthesized by animals at rates rapid enough to ensure that the animal is not dependent on an external dietary supply. The "non-essential" amino acids include alanine, serine, aspartic acid, glutamic acid, glutamine, proline and hydroxyproline, cysteine, cystine and tyrosine. Sometimes the rates of synthesis are too slow to provide the amino acids in quantities required by the animal. Animals at different ages and in different physiological conditions are synthesizing particular proteins at different rates and this will create a requirement for increased supplies of different types of amino acids. In these cases, amino acids become "essential" because of the physiological stage of the animal. Thus, extra glycine may be required by growing chickens and extra histidine and arginine are required from growth of young. However, some amino acids cannot be produced by synthetic processes in the animal body. Such "essential" amino acids include lysine, phenylalanine, threonine, valine, isoleucine, leucine, methionine and tryptophan.

- Fatty acids

Several poly-unsaturated fatty acids, specifically linoleic, linolenic and arachidonic acid must be supplied in the diet. In the rat, dog, mouse, chick, and infant human their absence leads to a cessation of growth, presence of fatty liver, skin lesions, with increased water loss due to increased permeability of skin and abnormalities in pregnancy and lactation.

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Feed formulation

The cost of feed generally makes up approximately 70% of the costs of a livestock operation. Whether the farmer is producing the feed on the farm or purchasing the feed from outside sources, feed provision to the herd carries a cost. Feed formulation is the process whereby the farmer estimates the nutrient requirements of his animals, and then determines which feeds are required to provide for those requirements at the least possible cost. To do this the farmer will obviously need to know:

- What feeds he currently has available?
- The quantity and quality of the available feeds.
- The nutrient requirements of his/her animals.
- The stage of production and level of production of his/her animals (high milk producers vs. low milk producers or dams carrying singles or dams carrying twins).
- The shortages in nutrients that may occur.
- Which feed resources can be used to supplement the shortages?
- The costs of feed production, mixing, supplementation or outright purchase (including costs of transport and storage).
- The seasonality of feed production and seasonality of feed purchase.

Since feed is the greatest input cost in a livestock operation, one of the main management functions of a livestock farmer is to manage, control and monitor the management of feed to ensure efficient utilisation with little wastage at minimum cost and highest production. Feed management is not a once off event but a daily management task on the livestock operation. To effectively control the costs of this input every farming enterprise should have a well-designed feed flow program in place.

In Nutrient Requirement Tables the Units for Protein and Energy are expressed as follows:

- Crude Protein

Crude Protein is an estimate of the percentage of protein that is contained in a feed based on the analysis of N contained therein.

Some tables also present protein as Digestible Protein. That is the part of the ration that is assimilated by the animal when the food is digested. This value will usually be lower than the estimate of Crude protein, since some protein may not be nutritionally available to the animal, although it is present in the feed. Digestible protein is of particular importance to dairy farmers

who need more accurate estimates of a feed's protein content, since milk production is dependent on adequate protein provision.

- Energy

Energy values of food are presented as either total digestible nutrients (TDN) or Metabolisable Energy ME. The TDN is expressed as a percentage of the ration. Energy is expressed in (ME) Mega Joules per kilogram of metabolisable energy.

Ration balancing for sheep

The following calculation shows how to balance a ration for sheep by utilising low quality roughage and a high protein concentrate. We are interested in formulating a ration for an ewe that is in her first eight weeks of lactation with a single born.

Definition:

HPC - HPC stands for High protein concentrate

For the purposes of the calculation presented here a number is provided (in brackets) associated with each value. Let the facilitator help you with that when you do the activity.

The ration should include HPC40 if the preliminary ration does not include at least 60% of a legume roughage (see tip for selecting of preliminary ration).

Utilise Table 1, The Nutrient Requirements of sheep, provided in Appendix A and Table 2 Composition of Feedstuffs.

Appendix A: Feed Tables

Table 1: Daily nutritional requirements of sheep, NRC standards (1975)

Body mass (Kg)	Increase or Decrease (g/d)	Dry material intake (kg)	Crude protein (%)	TDN (%)	Metabolizable energy (ME)(MJ/kg)
Ewes Maintenance					
50	10	1.0	8.9	55	8.2
60	10	1.1	8.9	55	8.2
70	10	1.2	8.9	55	8.2
80	10	1.3	8.9	55	8.2
Non-lactating and first 15 weeks of pregnancy					
50	30	1.1	9.0	55	8.2
60	30	1.3	9.0	55	8.2
70	30	1.4	9.0	55	8.2
80	30	1.5	9.0	55	8.2
Last 6 weeks of pregnancy or last 8 weeks of lactation of ewes with one lamb (1)					
50	175	1.7	9.3	58	8.7
60	(+45)	1.9	9.3	58	8.7
70	180	2.1	9.3	58	8.7
80	(+45)	2.2	9.3	58	8.7
	185 (+45)				
	190 (+45)				
First 8 weeks of lactation of single lamb ewes or last 8 weeks of lactation for ewes with multiple lambs (2)					
50	-25 (+80)	2.1	10.4	65	9.7
60	-25 (+80)	2.3	10.4	65	9.7
70	-25 (+80)	2.5	10.4	65	9.7
80	-25 (+80)	2.6	10.4	65	9.7
First 8 weeks of lactation for ewes with multiple lambs					
50	-60	2.4	11.5	65	9.7
60	-60	2.6	11.5	65	9.7
70	-60	2.8	11.5	65	9.7
80	-60	3.0	11.5	65	9.7

(1) In brackets is applicable to last 8 weeks of lactation of single lamb ewes

(2) In brackets is applicable to last 8 weeks of lactation for multiple lamb ewes

Table 2: Composition of feedstuffs

Feedstuffs	Crude Protein (%)	TDN (%)	ME MJ (%)
Babala Silage (Poor)	8	57	8.5
Babala Silage (Good)	12	58	8.7
Babala Grazing	7	52	7.8
Buckwheat (Grain)	10	68	10.2
Buckwheat (Hulls)	3	41	6.1
Buckwheat (Straw)	4	38	5.7
Columbus grass hay	10	53	7.9
Eragrostis curvula hay	6	55	8.2
Eragrostis curvula hay (fertilized)	12	55	8.2
	11	61	9.1
Eragrostis curvula grazing	12	66	9.9
Barley green feed	8	50	7.5
Barley hay	10	78	11.7
Barley	10	75	11.2
Crushed maize (hominy chop)	8	70	10.4
Grain Sorghum ears	7	50	7.5
Grain Sorghum hay (with ears)	8	42	6.3
	30	70	10.4
Grain Sorghum Silage	10	80	11.9
Grain Sorghum Malt	6	56	8.4
Grain Sorghum Seed	13	63	9.4
Peanut Hay (Poor)	45	80	11.9
Peanut Hay (Good)	13	71	10.6
Peanut-Oilcake Meal	40	60	9.0
Peanut (Plants & Pods)	60	35	5.3
HPC 40 (Urea free)	14	70	10.4
HPC 60 (with urea)	5	58	8.7
Oat pastures	9	68	10.2
Oat hay	4	50	7.5
Oats	14 – 30	50	7.5
Oat straw	16	60	9.0
Chicken manure	4	44	6.6
Italian Rye grass	41	76	11.4

Cotton Seed Hulls	13	50	7.5
Cotton Seed Oil Cake	11	65	9.7
Kikuyu Hay	18	80	11.9
Kikuyu Pastures	9	75	11.2
Wheat Pastures (Young)	13	80	11.9
Wheat Pastures (5 months)	15	67	10.0
Wheat	4	45	6.7
Wheat Bran	42	85	12.7
Wheat Straw	24	70	10.4
Lupine Seed	21	60	9.0
Lucerne (Green)	11	45	6.7
Lucerne Leaves	19	55	8.4
Lucerne Hay Poor	10	45	6.7
Lucerne Hay Good	4	54	8.1
Lucerne Stems	7	69	10.3
Molasses (Cane)	13	58	8.7
Maize Cob Meal	13	78	11.7
Maize Hay (without cobs)	3	53	7.9
Maize Gluten meal	8	65	9.7
Maize Cob leaves	9	84	12.5
Maize silage (good)	6	63	9.4
Maize meal	13	56	8.4
Maize plants (with cobs)	7	45	6.7
Maize plants (dried)			
Maize plants (stook)			
Maize bran	12	65	9.7
Maize stover	4	60	7.5
Pollards	17	67	10.0
Rye Green feed	12	60	9.0
Rye Seed	13	76	11.4
Rooigras Hay (Poor)	4	50	7.5
Rooigras Hay (Good)	7	56	8.4
Sweetgrass Hay (Poor)	3	45	6.7
Sweetgrass Hay (Good)	9	56	8.4
Sweet Sioux	9	48	7.2

Sweet Sudan	7	50	7.5
Soyabean Hay (Poor)	8	42	7.8
Soyabean Hay (Good)	17	64	9.6
Soyabean Oil Cake Meal	44	78	11.6
Soyabean Seed	38	88	13.1
Sunflower Hulls	2	40	6.0
Sunflower Oil Cake Meal	38	76	11.4
Sunflower Heads	11	74	11.0
Sunflower Seed	17	80	11.9
Teff Hay (Poor)	6	50	7.5
Teff Hay (Good)	9	54	8.1
Prickly Pear leaves	2	56	8.4
Urea (NPN)	280	0	0
Veld Hay (Poor)	3	36	5.4
Veld Hay (Good)	9	59	8.8
Veld Grazing (Poor)	3	45	6.7
Veld Grazing (Good)	10	57	8.5
Fish meal	64	72	10.8
Voermol Molasses Meal	5	60	9.0

Table 3: Maximum percentage low energy roughage (7.5 MJ/Kg ME) in ration when the ration more or less provides in the energy requirements

Energy Requirement	
ME MJ/KG	PERCENTAGE ROUGHAGE
7.5	100
7.75	95
8.0	90
8.25	85
8.5	80
8.75	75
9.0	70
9.25	65
9.5	60
9.75	55
10.0	50
10.25	45
10.5	40
10.75	35
11.0	30
11.25	25
11.5	20

When using higher energy roughage e.g., Eragrostis hay, use 5% more roughage in the ration.

Step 1: What are the nutrient requirements of this sheep? Look in Table 1. Nutrient requirements of sheep.

A sheep of 50 kg in her first 8 weeks of lactation with a single lamb requires:

Crude protein requirement = 10,4 % **(1)

Energy requirement = 9,7 MJ/KG ME **(2)

Step 2: Look at the nutritive value of feedstuffs (Table 2)

Feedstuff	Crude protein content	Energy Content MJ/KG ME
Maize Stover (roughage 1)	4 ** (3)	7.5 (4)
Maize Stover (roughage 2)	- (5)	0.0 (6)
HPC (with urea) 60	60 (7)	5.3 (8)
Maize meal	9 (9)	12.5 (10)
HPC (without urea) 40	40 (11)	9.0 (12)

Step 3: Select a preliminary ration and determine its nutritive value

Total roughage content of preliminary ration (See Table 3: App A) 50%

Ratio of roughage 1: 50 % (13)

Ratio of roughage 2: -- % (14)

Ratio of HPC (6,5 of 10%)*: 6.5% (15)

Ratio of maize meal: 100 – (50(13) + .?. (14) + 6.5(15)) 43,5% (16)

Composition and nutritive value of preliminary ration A

Feedstuff		% CP
Maize Stover (roughage 1) HPC 1 60 Maize meal Total	50 (13) ÷ 100 x 4 (3) - (14) ÷ 100 X – (5) 6.5 (15) ÷ 100 X 60 (7) OR (11) 43.5 (16) ÷ 100 x 9	2.0 (17) 0.0 (19) 3.9 (21) 3.92 (23)
		9.82 (25)

Feedstuff		ME MJ/KG
Maize Stover (roughage 1)	50 (13) ÷ 100 x 7.5 (4)	3.75 (18)
HPC 1 60	- (14) ÷ 100 X – (6)	0.0 (20)
Maize meal	6.5 (15) ÷ 100 X 5.3 (8) OR (12)	0.34 (22)
energy		5.44 (24)
Metabolisable		9.53 (26)

Deficit

Crude protein deficit 10.4 (1) - 9.82 (25) = 0.58% (27)

Energy deficit 9.7 (2) - 9.53 (26) = 0.17% (28)

Step 4: Correct energy deficit of preliminary ration and test its nutritive Value %

Maize Meal replacing roughage with lowest energy content:

0.17 (28) x 100 ÷ (12.5 – 7.5 (4)) = 3.4% (29)

Quantity roughage with lower energy content 50.0 (13) – 3.4 (29) = 46.6% (30)

Quantity maize meal 43.5 (16) + 3.4 (29) = 46.9% (31)

Nutritive value of preliminary ration B

Feedstuff		% CP
Maize Stover (roughage 1)	46.6 (30) ÷ 100 x 4 (3)	1.86 (32)
Maize Stover (roughage 2)	- (14) ÷ 100 X – (5)	0.0 (19)
HPC 1 60	6.5(15)	3.90 (21)
Maize meal	46.9 (31) ÷ 100 x 9	4.22 (34)
Total		9.98 (36)
Feedstuff		ME MJ/KG
Maize Stover (roughage 1)	46.6 (30) ÷ 100 x 7.5 (4)	3.50 (33)
Maize Stover (roughage 2)	- (14) ÷ 100 X – (6)	0.0 (20)
HPC 1 60	6.5(15)	0.34 (22)
Maize meal	46.9 (31) ÷ 100 x 12.5	5.86 (35)
Total		9.70 (37)

Deficit

Crude protein deficit 10.4 (1) -9.98 (36) = 0.42% (38)

Energy deficit 9.7 (2) -9.70 (37) = 0 MJ/KG (39)

Step 5: Correct the protein of the preliminary ration and test its nutritive value % Urea free HPC replacing roughage with lowest energy content

0.42 (38) x 100 ÷ (40 (11) – 4 (3)) = 1.2% (40)

Quantity roughage with lower energy content 46.6 (30) – 1.2 (40) = 45.4% (41)

Composition and nutritive value of final ration

Feedstuff		% CP
Maize Stover (roughage 1)	45.5 (41) ÷ 100 x 4 (3)	1.82
Maize Stover (roughage 2)	- (14) ÷ 100 X – (5)	0.0 (19)
HPC 1 60	6.5(15)	3.90 (21)
Maize meal	46.9 (31)	4.22 (34)
HPC 2 (Urea free)	1.2 (40) ÷ 100 x 40 (11)	0.48
Total		10.42
Feedstuff		ME MJ/KG
Maize Stover (roughage 1)	45.5 (41) ÷ 100 x 7.5 (4)	3.41
Maize Stover (roughage 2)	- (14) ÷ 100 X – (6)	0.0 (20)
HPC 1 60	6.5(15)	0.34 (22)
Maize meal	46.9 (31)	5.86 (35)
HPC 2 (Urea free)	1.2 (40) ÷ 100 x 9 (12)	0.11
Total		9.72

Tips for the selection of a preliminary ration

Legume hay have more than 50% of roughage: Leave HPC from preliminary ration.

Legume hay only source of protein:

- Legume hay should then constitute at least 60% of the roughage.
- Legume hay replaces urea free HPC in step 5. Add calculations 14 and 40.

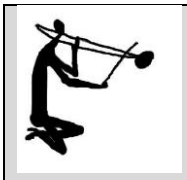
Hay other than legume hay:

- Include HPC in preliminary ration.
- HPC with urea, use a maximum of 6.5% HPC.
- HPC without urea, use 10% HPC.

  Preliminary estimation of energy in ration: Table shows the low energy content roughage (7.5 MJ/kg ME) in the ration with corresponding expected energy content of the ration.

- When HPC 60 is used, use 5% less roughage.
  - When higher energy content roughage (8.1 + MJ/kg ME) is used, use 5% more roughage.
  - Prevent disturbances: Roughage should preferably be not less than 40% and definitely not below 20%.
  - Protein and energy should rather be slightly over supplied rather than under supplied.

- When silage is given to sheep:
  - Calculate the ration on a dry basis.
  - Multiply the quantity (%) by three to get it on an as fed basis.
  - The ratios will then be in kg and not percentage.
  - Silage should preferably not be more than 40% of the roughage on a dry basis.

	**Individual Activity 3:**

FEED MANUFACTURING AND PROCESSING

Introduction

The principal objective in feed mixing is to assure that an animal receives all of its formulated nutrient allowances every day. Uniformity of particle size and number of particles per unit weight are important considerations for assessing mixing accuracies of the various micro ingredients. Many of the micro ingredients (particularly feed additives) are expensive and elevated levels may be toxic. Thus, a small uniform particle size is a very important criterion in the selection of micro ingredients.

Adjustments required for mixing feeds

Many of the problems in feed mixing are due to differences among feed ingredients in particle shape, size, and density. Feed ingredients with similar sizes and densities tend to blend easily and quickly. For example, ground or cracked grains have densities similar to that of the oilseed meals. Consequently, there is usually very little difficulty in obtaining a uniform blend of these feed ingredients. Minerals on the other hand have densities which are vastly greater than that of grains and oilseed meals. Feed additives have intermediate densities, but very fine particle sizes. Forages have low densities, and highly varied particle shapes and sizes. This diversity of physical form and density of individual feed ingredients complicates the preparation of uniform feed mixes.

Feed additives and vitamins pose a special problem for obtaining a uniform feed mix. Their densities are more similar to that of ground grain and oilseed meals. Thus, uniform mixing should not be so problematic. However, they are included in the mix at very low levels.

This presents a unique problem with respect to spatial distribution. Following a few simple guidelines in feed formulation can minimize the risk of inadequate special distribution of critical micro ingredients.

Guidelines for mixing feed

- Premix

Premix micro ingredients such as feed additives, vitamins, and trace minerals with a suitable diluent prior to their inclusion in a supplement. Diluents serve to dilute the micro ingredient and thereby facilitate the rate of mixing.

Examples of suitable diluents include the macro minerals typically incorporated in a feed mix (i.e., salt, limestone, di-calcium phosphate, magnesium oxide). Diluents should be dry in order to permit a more uniform dispersion of individual micro ingredient particles. Moisture must be avoided as it may cause entrainment and clumping (hygroscopic compounds such as urea are not suitable diluents). The premix (micro ingredients plus diluent) should represent 3%, by weight, of the supplement. Premixing may be done by hand in a large container. However, it can be performed more easily and efficiently by means of a small portable cylinder mixer (cement mixer). Protective clothing, gloves and dust mask should be worn when handling micro ingredients.

- Supplement

Prepare a supplement. This supplement will contain the premix, a suitable carrier, and the remaining minor dry ingredients in the diet including minerals, urea, and supplemental protein sources.

Carriers are feed ingredients, which combine, with the micro ingredients in the premix to alter their physical characteristics. By adsorbing to the carrier, the very fine particles of the micro ingredients are allowed to move more rapidly and uniformly through the mix. This rapid movement of micro ingredients through the mix is important to assure adequate distribution prior to addition of molasses.

Carriers should have physical properties comparable to ground grain or oilseed meals. Indeed, both of these may be used as carriers. However, the adsorptive properties of ground grain and oilseed meals are low. This limitation may be overcome by first combining 2% fat to the ground grain or oilseed meal before blending with the premix. The thin film of fat covering the carrier will facilitate adsorption of the micro ingredients in the premix.

Excellent carriers for micro ingredients include poultry litter, rice hulls, wheat bran, vermiculite, alfalfa meal, ground maize cobs, and beet pulp. The amount of carrier to include in the supplement will depend on the "space" available in the diet formulation. The supplement should comprise a minimum of 3% by weight of the finished feed.

In preparing the supplement, first add the carrier, and then add other major ingredients until they reach the central shaft line, then add the premix and other minor ingredients, and finally add the remaining major ingredients. Mixing volume and mixing time will depend on the specifications of the particular mixer being used. Although some mixers will mix feed very efficiently at low volumes, most do not. Review the literature regarding your mixer and then see that the volume of feed being mixed, and mixing times are optimal for the mixer. Be careful not to under fill or overfill the mixer.

- Finished feed

Finished feed may be prepared as follows:

- Add the grain portion of the diet to the mixer;
- Add the dry supplement (remember that the supplement should comprise a minimum of 3% of the finished feed) to the centre of the mixer (if possible, add supplement on the opposite end of the mixer to where the feed is discharged);
- Allow feed to mix for a minimum of 1 minute;
- Add forage component of the diet;
- Add fat component of the diet;
- Add molasses or liquid component of the diet;
- Allow to mix for the time specified for the mixer (usually not less than 8 minutes).

Note: As previously explained, the reason that the supplement is added to the grain portion of the diet prior to the addition of forage is because the grain and supplement have similar particle size and densities. Accordingly, the supplement will distribute itself quickly through the grain.

This increased dilution of the supplement prior to the addition of forage and liquid feeds will enhance the spatial distribution of micro ingredients in the complete feed while shortening mixing time.

- Adding molasses

Molasses is a common ingredient in diet formulations. However, it is highly viscous, and this presents several problems in feed mixing. Indeed, if added to the diet improperly it can cause marked increases in the variation of the equal distribution the micro ingredients through the feed mix.

Molasses should be added to the mixer as the last step in formulation. If the molasses is added to the mixture before the supplement has had a chance to mix with the other major ingredients in the diet it may result in entrainment of sequestering of the micro ingredients. This will increase what is called the "Poisson Error" or the variance associated with decreased spatial distribution of micro ingredient particles.

Furthermore, if molasses is added to the mixer before it is adequately filled, it will come in contact with the mixer itself, adhering to the sides of the mixer and moving parts, thereby decreasing mixer efficiency and, necessitating more frequent cleaning. Whereas the obvious challenge with molasses addition to the mix is the formation of feed balls or clumps, the more real problem in terms of animal performance is the potential increase in poor distribution of the micro ingredients if the molasses is not added in the proper order.

Black strap molasses (standardized at 80E Brix) is particularly viscous. The efficiency of mixing black strap molasses with other dietary ingredients will be enhanced if it is first diluted with water (i.e. dilute to 70E Brix).

The viscosity of molasses is markedly reduced by heating. For example, raising the temperature of molasses from 23E C to 27E C (an increase of only 4%) will reduce the viscosity of molasses 50%. Molasses should not be heated to temperatures in excess of 43E C, except for very short periods of time, as this may cause caramelisation.

The operation of feed manufacturing equipment

Good mixing begins with an understanding of the equipment used. Feed mixing equipment can be divided into two broad types: continuous and batch. The continuous mixing systems used on swine farms are metering mills. These mills meter ingredients into a mixing auger in set proportions. Batch mixing systems mix a set amount depending on their capacity. Most continuous systems are stationary, while batch systems can be stationary or portable. Mixing procedures are totally different for batch and continuous systems.

Continuous Mixing Systems

The big advantage of a continuous mixing system is its automatic operation. Once you start the mill, it mixes until it runs out of ingredients, fills a finished feed bin, or is turned off. The main unit of this system is the proportioner, which controls the volume of each ingredient added. This proportioner must be routinely calibrated for the proper mix. Changes in ingredient density (that is, changes in test weight) will change the proportions by weight and therefore the nutrient content of the mix. For example, if you calibrate a mill for maize weighing 56 kg per bag, and the next load of maize weighs only 54 kg per bag, the diet that should have 1,700 kg of maize only contains 1,640 kg.

These mills are calibrated by two simple methods. The first method consists of weighing the amounts of each of the ingredients being metered in simultaneously. Place a weighed container under each ingredient auger. Divert the ingredients into the container, and then run the mill. When you collect an ample supply of the least ingredient (2 to 5 kg), turn the mill off. Weigh each ingredient, and then subtract the weight of the containers. Add the weights of each ingredient together, and then divide that number into 2,000. This gives a factor to use in correcting the amounts collected to a ton basis. Multiply this correction factor by the weight of each ingredient collected. The resulting number is the amount of that ingredient being added to a ton of feed.

Example:

Amounts collected:	5 kilograms of base mix
	55 kilograms of maize
	40 kilograms of soybean meal
Total collected =	100 kilograms

The feed formula is for 2,000 kilograms, so divide 2,000 by 100 for a conversion factor of 20. Multiply the weight of each ingredient collected times 20 to get the amount per ton:

5 base mix x 20 =	100 kilograms of base mix
55 maize x 20 =	1,100 kilograms of maize
40 soybean meal x 20 =	800 kilograms of soybean meal
TOTAL =	2,000 kilograms

eeded adjustments.

The second method works best when there is a wide range in ingredient levels. Run each ingredient for the same length of time. When each ingredient has been collected, determine the weight of the ingredient less the weight of the container. Add the ingredient weights and divide into 2,000 (same correction factor as above). Multiply each weight by the correction factor. This gives the diet formula in kilograms per ton.

In both cases, the adjustments depend on the make and model of the machine. The adjustments needed are in the owner's manual. If one is not on the farm, contact the equipment dealer or company representative.

Continuous mixing systems are only as good as the operator. Every part of the system must be working properly to produce quality feed. You must carefully calibrate the mill, analyse samples of mixed feed, and frequently check the system to produce quality swine feed.

Batch Mixing Systems

Batch systems take more time but generally are more accurate because each ingredient is weighed. Vertical mixers are more popular than horizontal mixers because they take less space. Horizontal mixers typically provide a better mix and have a shorter mixing time. Some stationary systems combine both a horizontal mixer for combining ingredients used in small amounts and a vertical mixer for mixing the complete feed. The mixing accuracy of a horizontal mixer is because of its mixing action. Horizontal mixers have one of two mixing mechanisms--a ribbon (Figure 1) or paddle (Figure 2). Both will provide a good mix, but the ribbon provides a more uniform final mix.

Figure 1. Horizontal mill with ribbon mixing

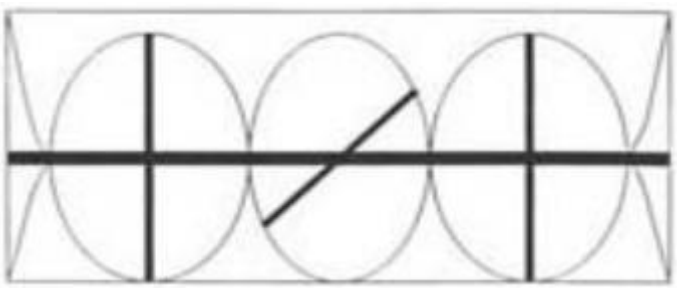
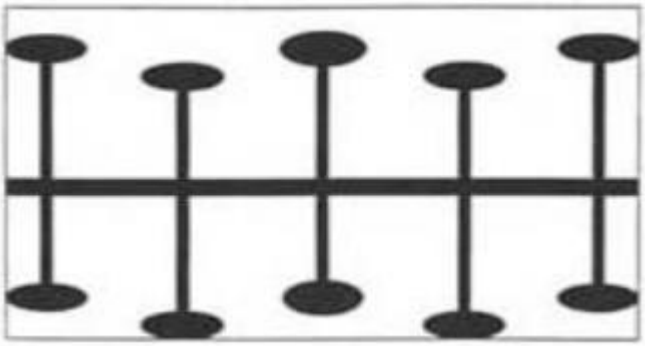


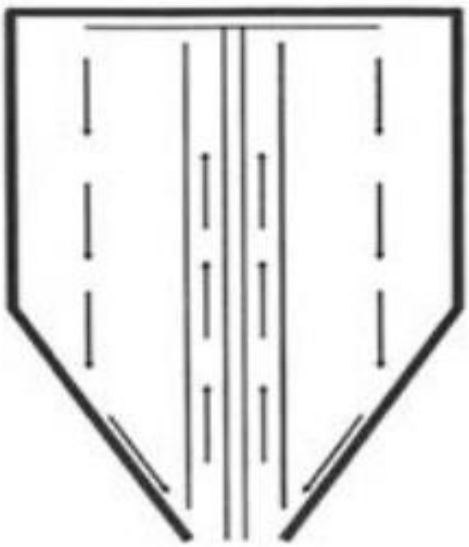
Figure 2. Horizontal mill with paddle mixing



Ribbon and auger mixers operate most efficiently if they are filled to 70 to 90% of capacity. With paddle mixers, satisfactory mixing may be obtained at much lower levels of loading (25% of capacity). However, the application of fat and/or molasses to mixers that are not adequately loaded may cause coating of the sides of the mixer and mixer bars, resulting in decreased mixer efficiency and contamination. The mixer should not be overloaded. Overloading the mixer will cause some of the feed to float above the mix and not blend properly. With paddle and ribbon mixers the mixer bars should rise at least 12 cm above the level of the mix.

Improper mixing can also occur if the tolerances between the mixer bars and the sides of the mixer are not set properly. Mixers are factory-set with an agitator clearance of .3 to .9 cm. If that clearance increases to 1.3 cm, mixer efficiency will be impaired. Mixers should be visually inspected periodically. Establish a set schedule for inspecting the mixer. Worn paddles and ribbons should be replaced.

Figure 3. Mixing action of a vertical feed mill



The chances for mixing errors are usually greater when using vertical mixers. Figure 3 is a simplified drawing of a vertical mixer at work. Ingredients enter the mixer, are carried to the top, and then dropped into the mixing area. This action makes it difficult to properly mix ingredients added in small amounts (40 kilograms per ton or less). Blend these ingredients with another ingredient (grain, soybean meal) before mixing.

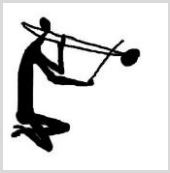
Because of the design, 10 to 20 kilograms of the first ingredient added to the mixer may never be mixed because the mixing auger never picks it up. Two additional steps to the process solve this problem. First, avoid adding ingredients used at 200 kilograms or less to an empty mixer. Then, just before mixing is complete, auger out about 50 kilograms and put it back in the mixer. These two practices will reduce the chances of a feeder being filled with straight premix, base mix, soybean meal, etc.

Portable mixers and stationary mixers in some conditions pose other problems. It is tempting to weigh all ingredients except the grain, put them in the mixer, and then fill the mixer with grain. It is impossible to measure weight by measuring volume in grain. Another problem is running the mixer until the grain is ground and then shutting the mixer off. The feed must mix at least 5 minutes after the last of the grain is in the mixer. For most mixes, the time should be 7 to 10 minutes, depending on the model of the mixer and the amount of feed being mixed. Over-mixing can lead to feed separation in some farm conditions. More importantly, it increases the amount of fuel or electricity used, therefore increasing the cost of mixing.

Do not deviate from proper mixing times. If possible, have mixing time controlled by a timer. Mixing time increases with the level of liquid feed added to the mix. This is because the mix becomes more viscous, slowing down the flow of ingredients through the mix. This problem accentuates when the level of molasses added to the mix exceeds the absorptive capacity of the mix. Thus, the level of molasses employed in a diet formulation should be considered not only with respect to relative cost of the molasses, but also with respect to practical mixing time and the acceptable distribution of the limiting micro ingredient throughout in the mix.

Still another problem is scales. Many portable mixers do not have scales. Scales are expensive and require frequent maintenance. However, the cost of scales is more than offset by the improved quality of feed when scales are used. Balance manual and electronic scales frequently. Scales for portable mills are designed for rough conditions, but they are still delicate instruments.

Check the accuracy by adding a known weight of ingredients. If scales are not weighing accurately, have them repaired.

	**Individual Activity 4:**

THE PRINCIPLES OF FEED PRESERVATION

Introduction

South Africa is known for seasons where abundant feed production takes place, and seasons where high-quality feed is scarce. It stands to reason then that feed should be collected and preserved during the seasons of plenty so that ample feed is available during times of scarcity.

In general, South African livestock farming, especially ruminant production, takes place under extensive conditions. It is in these farming systems that feed preservation is most often practised. In South Africa the most common forms of feed preservation are the making of hay or silage.

In contrast, the production systems of pigs and poultry are intensive. In these systems the feeds provided to mono-gastric animals are manufactured either by the farmer or commercial feed manufacturers. This has allowed the formulation of feeds for mono-gastric animals to the level of precision where particular amino acids are perfectly balanced to meet the requirements of mono-gastric animals at a particular level of production.

Factors influencing feed preservation or spoilage

The success of haymaking depends on the rapid and almost complete removal of moisture from plant material. It is thus highly dependent on hot, dry weather. Several factors influence the final quality of hay.

These include:

- The type of material from which the hay is produced. Hay made from legumes is obviously higher in protein than hay made from grass or grain materials.
- The growth stage at which the material is harvested. As a plant matures its dry matter content increases, its fibre content increases and its digestibility decreases.
- The method used to make the hay. Methods include, sun-drying, drying in a shed with warm air, drying in a shed with cool air or artificial drying.
- The form in which the hay is fed to the animal. More wastage and poorer intake occurs with hay in the long form, versus hay which has been chopped, ground and pelleted. Hay fed in the long form is also often prone to selection by the animal (in other words the animal selects the tastier bits and leaves the bits that are less palatable). Chopped and pelleted hay also takes up much less storage space.

When feeding hay, the farmer should always be on the look-out for moulds (perhaps if the bale was accidentally wet during storage). Moulds are particularly dangerous to pregnant animals and horses.

The success of silage making depends on the ability to preserve plant material in a wet form. It does not depend on the weather for its success. Several factors influence the final quality of silage.

These include:

- The type of material from which the silage is produced.
- The dry matter content of the material that is ensiled.
- The rate at which the required pH is reached.
- Whether anaerobic conditions in the silage is maintained.
- Whether the silage is protected from rain and sun.
- The size of the particles that are ensiled since this influences the degree to which the material can be compacted and thus has a direct influence on the anaerobic circumstances in the silo.

Feed quality

Feed quality is dependent on both the original plant material and also how the material has been processed to arrive at the final feed.

Problems that might arise in rations include:

- Mould growths that can grow on feed crops before or after harvest and on feeds during storage. These may result in the production of mycotoxins (the most important being aflatoxin). Sometimes moulds form in feeds such as maize, peanuts, cottonseed and ryegrass. Some animals such as cattle can tolerate a little mould in their rations, but moulds are particularly toxic to horses and pregnant animals.

- The presence of anti-nutritional factors. These may include:
  - Factors affecting protein utilisation and digestion e.g. tannins
  - Factors affecting metal ion utilisation
  - Anti-vitamins
  - Others such as saponins (Lucerne), cyanogens, alkaloids, photosensitizing agents, isoflavone

- Contamination with poisons or poisonous plants such as oleander can cause problems in mixed or complete feeds

- When plant material is harvested mechanically small animals such as frogs, mice and even snakes may get killed in the process. They end up in the bulk feed bins and are processed along with the feed.

- If the quality of the original plant material is poor then the preserved feed, or the mixed feed ration manufactured there from will also be of poor quality. In this sense poor quality feed may include a raw material like Lucerne that is harvested at a mature stage, when it is very dry and has already lost most of its leaves.

Feed preservation techniques

Silage

The normal process of making silage depends on the transformation of soluble carbohydrates in the plant (or which are added to the silage) into lactic acid so that the pH of the silage drops to approximately 3.8 to 4.2. Well-made silage has a lactic acid content of approximately 8 to 12% of dry matter. Silage at a pH of 4 is stable and can be preserved indefinitely as long as the anaerobic conditions in the silo are maintained. If rain enters the silage or if the lactic acid

concentration is too low, then a secondary clostridium-type fermentation ensues where lactic acid is converted into butyric acid.

Silage in which this spoilage has occurred has a pH higher than 5 and has a bad taste and smell. Because this secondary type of fermentation can only take place in the presence of moisture, it is often recommended to wilt the plant material before ensiling and in this way reducing the moisture content of the plant material to between 65 and 70%. If the plant material, which is to be ensiled, does not contain enough carbohydrates (for example, if Lucerne is to be ensiled versus the more common maize silage), then external carbohydrates can be added. This can be done by adding 2 to 3 percent molasses to the mixture and mixing well (20 to 30 kg of molasses per ton of silage) or by adding 45 to 55kg of maize meal to the mixture and mixing well. A well-made silage smells of fresh apples.

Any moisture rich material can be ensiled if adequate carbohydrates are available. Also, the material must be chopped fine enough to allow effective compaction to ensure that anaerobic circumstances are maintained in the silo. Materials as diverse as the leaves and trunks of banana trees, a mixture of oranges and cabbage, cosmos flowers, sugar cane tops, citrus pruning, and mango pruning have been successfully ensiled during research aimed at small scale farming at the Animal Nutrition and Products Institute of the Agricultural Research Council at Irene.

Drying

Plant material should be cut several times during the growing season. The quality of the hay is directly dependant on the stage of maturity of the plant when harvested: the younger the plant the higher the final hay quality will be. However, it must be remembered that younger plants are higher in moisture and thus that the drying process will take longer. Drying takes place on hot, sunny days, and ideally with a light breeze. The hay rows should be turned on the land several times to allow the hay to dry on all sides. When the hay is completely dry it can be raked and baled. Hay should be stored out of direct sunlight and away from moisture and pests such as birds and rodents.

	**Individual Activity 5:**

QUALITY CONTROL MEASURES THAT AFFECT FEEDS

Introduction

Quality control in feed production is of utmost importance in the overall success and profitability of animal enterprises. There is no other factor, directly or indirectly related to the proper nutrition and high performance of animals that is more critical than feed quality control and ration consistency. The degree of quality is the consistency in which feed is formulated, processed, mixed and delivered as compared to what is expected. Animals thrive on a routine and respond better if the feed is low in nutrient variation as offered to them; and is similar in moisture content, texture and rate of energy availability.

Quality has been defined as "any of the features that make something what it is" and "the degree of excellence which a thing possesses". Either definition may be acceptable if one recognizes that quality control means knowing the quantitative amounts of all components, good and bad, in a feed. Usually, quality is verified by comparison with a known standard. However, relative values of quality over time is extremely valuable and useful in many situations.

The relationship between feed quality and animal performance is important and encompasses not only the quantitative amounts of all feed components, but also the digestibility and metabolism of those components. Thus, the challenge for nutritionists and others involved in animal feed production is to consistently monitor all aspects of the feed production system being used and measure those variables that are good indicators of quality control. For the feed industry, a quality control system is the responsibility of management and involves personnel being properly trained to ensure a high level of organization, documentation, and the policing of various procedures and processes necessary to guarantee the basic quality of feedstuffs and feeds.

How to sample and evaluate animal feeds

Quality control of incoming ingredients is crucial to predicting the quality of a complete feed, supplement, premix, etc. An important first step is accurate sampling and complete examination of the ingredient prior to unloading. Sampling and inspection procedures need to be in writing and kept in a Quality Control Procedures Manual. The goal in sampling any lot of ingredients or finished feed is to obtain samples that are representative of the lot in question. A wrong answer

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-- which may arise from incorrect sampling, incorrect handling of samples, analytical error, etc -- is worse than no answer. Thus, it is our responsibility to know proper procedures and techniques for sampling to be sure that correct formulations can be made.

Sampling

Below are some suggested sampling procedures for bulk ingredients and mixed feeds, bagged ingredients and mixed feeds, hays, and syrups and fats.

- Bulk Ingredients and Mixed Feeds

Take a minimum of three, 2 kg samples.
Each 2kg sample should be the composite of several cores taken randomly from the delivery truck, bull storage bin or feed bunk, as applicable.
Duplicate determinations are recommended for all variables measured.

- Bagged Ingredients and Mixed Feeds

Use slotted feed tier for sampling and take one kg samples.
For lots of one to ten bags, sample all bags.
For lots of eleven or more, sample ten bags.
Analyse a minimum of three samples and average the results.

- Hays

For chopped hay, take ten samples per lot.
For cubes, take forty cubes from a given population.
For bales, take one 30cm to 50cm core from the end of forty bales in a given population.

- Syrups and Fats

Use a continuous flowing sampling procedure at the point of delivery, or a core liquid sampler.

- Evaluation

Establishment of a retention schedule is recommended for all ingredients and mixed feed samples. Separate analytical analyses should be routinely performed on samples of the following for quality.

  - Water
  - Grains
  - Roughages

- Silages
- Protein supplements
- Mineral mixtures
- Vitamin premixes
- Molasses and fat
- Specific feed additives

As a starting point for insuring quality in feedlot rations, all incoming feed ingredients should be quality checked for the following:

- Moisture
- Colour
- Off odour
- Presence of foreign material
- Texture and uniformity
- Evidence of heating
- Deterioration due to biotoxins

More detailed analyses are performed on individual feed ingredients for the purpose of feed formulation, and sometimes before the purchasing of commodities if the seller does not provide this information. Analyses that usually are considered to be routine for the different feed ingredients include:

- Grains - grade, moisture, protein, ash.
- Grain by-products - moisture, protein, ash.
- Dry roughages - moisture, protein, ash, and acid detergent fibre.
- Silages - moisture, ph, temperature, protein, ash.
- Protein supplements - moisture, protein, ash, non-protein nitrogen.
- Mineral mixtures - moisture, specific nutrients.
- Molasses - moisture, ash.
- Fats - moisture, free fatty acids, impurities, unspecifiable.

Determining the variation in the four major areas that affect feed consistency can derive an overall evaluation of feed quality delivered. They are:

- Variation of incoming ingredients.
- Variation in feed mixing efficiency.

- Variation in efficiency of delivery of mixed feed from mixing point to the animals.
- Variation in analytical procedures.

Maintaining feed quality through the application of good manufacturing practices

The management of a feed mill has an obligation to uphold Current Good Manufacturing Practices. The use and endorsement of appropriate and proper procedures and practices in the production of feeds do not cost the feed industry, they pay dividends. The feed mill manager is a key individual involved in the daily activities associated with the management of people, facilities and resources, that ensure the procedures appropriate for the production of feed in his/her feed mill are enforced. The feed mill manager, as his/her supervisors and the people working under their direction, have an obligation to the animal food industry to maintain high quality standards in the production of feeds for animals -- to produce meat, milk, eggs, etc. for the consumer.

Good Manufacturing Practices deal specifically with the manufacturing of any feed containing one or more feed additives. If any feed obtains a feed additive, it is a medicated feed. The feed mill management should have written instructions that cover GMP's and quality assurance programs. Good Manufacturing Practices cover all areas involved in the production of feeds including personnel, facilities, feedstuffs, quality assurance checks, inventory control checks, processing methods, mixing procedures, finished feeds, and feed delivery. Although commercial feed mills that produce and sell a complete line of feeds to the general public have a somewhat greater task in assuring quality and prevention of cross contamination of feed additives, the obligation and importance in all feed mills are still great. Outlines, checklists and procedures relevant to feed mill operations are presented below.

Personnel training are essential and should be conducted periodically to assure compliance with procedures and ensure quality of feed produced. These meetings usually are helpful in establishing and maintaining good morale and teamwork among employees.

The feed mill and adjacent buildings must be of suitable construction to minimize access to rodents, birds, insects and other pests, and located in an area that will allow proper drainage. The building and grounds should be maintained as needed to assure a clean workplace for employees and for the production of feeds. Litter, refuse, improperly stored equipment, and

supplies are hazards and should be removed. The building must also provide sufficient space for facilities and personnel to perform their job properly. Examples for the production of medicated feeds include:

- Appropriate area for receiving and storing of ingredients and feed additives
- Adequate space for grain processing, etc.
- Appropriate space for feed mixing
- Reserved area for equipment maintenance

Equipment must meet safety standards and be properly installed. All scales and metering devices must be tested for accuracy upon installation and at least once per year thereafter. Equipment must be constructed and maintained to prevent lubricants and coolants from contaminating ingredients or feeds. Excessive spills, leaks and dust problems must be prevented.

Ingredients should be systematically monitored for quality factors throughout the entire process of purchasing, receiving, sampling and handling. All ingredients should be inspected for any abnormality that may result in a quality risk when added to the feed, and representative samples taken for assays. During this handling of ingredients, care must be taken to prevent contamination.

Feed additives and premixes require special handling and record keeping. Records on feed additives received must show the following information:

- Name of feed additives, including potency.
- Date received.
- Amount in kilograms.
- Supplier's name.
- Supplier's code for feed additives (if applicable).
- Supplier's lot or code number.
- Return of any damaged or unacceptable feed additives.

Other procedures that must be followed in the storage, handling and use of feed additives include:

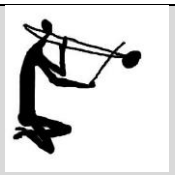
- Check each feed additive for identification. Do not accept unless properly identified.
- Keep all feed additives and premixes stored in a neat and orderly manner for easy identification. It is preferable to store feed additives in a separate room.

- Each bag or feed additive container must be coded with the supplier or company code for that feed additive.
- Packaged feed additives in the storage area must be stored in their original closed containers.
- Check bags for tears and any other abnormalities. Do not accept any feed additives that are not in good condition.
- Feed additives in the mixing area must be properly identified, stored, handled and controlled to maintain their integrity and identity.
- Clean up any spilled feed additives immediately, dispose of properly and record in the Feed Additives Inventory Record.
- Use a separate scoop for handling each feed additive.
- Feed additives and premixes must be used on a first received basis.

A daily inventory of feed additives and premixes is required. The Feed Additives Inventory Record should be completed at the end of each 24-hour period. One should check usage of each feed additive against medicated feeds produced. The feed additives container should be weighed before it is opened, and every kilogram of feed additive must be accounted for in usage or adjustment. (If a 20kg bag was purchased but the feed additives amount to 19kg, then list 1.0 adjustment). Other adjustments could be due to improper weighing and spillage.

Cleaning processing and mixing of feed ingredients requires that personnel involved by thoroughly trained and properly supervised. Considerations for proper GMP's include the following.

- Screening of grains and use of magnets
- The grind should be as uniform as possible
- Flaking of grain should be accomplished with proper amount of steam, temperature and roll tolerance
- Mixing directions should be standard for a feed mill. (Certain mixed feeds may require specific directions)
- Prevention of contamination
- Checking for accuracy of all scales used for weighing ingredients (including feed additives) at least once per year.

	**Individual Activity 6:**

FEED STANDARDS

Introduction

The quality and standards of Feed in South Africa is controlled by the Fertilizers, Farm feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act no. 36 of 1947). This act is available on the Agricultural Feed Manufacturers Association website at www.afma.co.za. Obtain a copy of this act for this Session.

Compare the quality of feed ingredients and complete feeds with the standards described in the Farm Feed Act (Act 36 of 1947)

The Farm Feed Act gives specific requirements regarding:

- The registration of farm feeds (application, duration of registration, and renewals of registration.
- Conditions for the registration of farm feeds:
  - Requirements for custom mixes.
  - Marking and labelling of Animal Feeds.
  - Invoicing.
  - Registration requirements for feed ingredients.
  - Registration requirements for enzymes, micro-organisms and their preparation.
  - Publication or distribution of false or misleading advertisements.
  - Harbours and ports through which imports may occur.
  - Practices to be followed at establishments.
  - General requirements for establishments.
  - Keeping of records
  - Substances whose use is prohibited in mixed animal feeds.

- Ingredients allowed in mixed animal feeds.
- Undesirable substances with limited use in animal feeds.
- Maximum and minimum levels of additives in animal feeds.
- Additives in supplementary and concentrated animal feeds.
- Maximum and minimum levels of stock remedies in animal feeds.
- Stock remedies in supplementary and concentrated animal feeds.
- Sampling of animal feeds.
- Analysis methods.
- Tolerances.
- Offences and penalties.
- Payment of fees.

Developing on-farm nutrient variability standards

As a farmer or farm manager it is your task to ensure that any feeds that you mix yourself or which you acquire from a feed manufacturing company complies with the legislation. This is to ensure the health of animals, but more importantly the health of the public that consumes the products from the livestock. Also, international sanitary regulations are becoming very strict especially regarding the use of feed additives. It would be irresponsible to use a feed ingredient which is prohibited by law and in doing so jeopardising the good standing of South African livestock products internationally.

Remember, legislation does not only serve a prohibitor purpose; laws also provide Good Practice principles which are useful guidelines to apply to your own farming operation.

	**Individual Activity 7:**

FEED EVALUATION AND FEEDING MANAGEMENT

Introduction

Although Nutrient Requirement tables and Feed Composition tables (as supplied in Appendix A) provide volumes of information that is useful in feed formulation, it should be understood that the farm manager has a more comprehensive set of feed management "tools" at his/her disposal. These "tools" can assist the farmer on a daily basis to improve the feed management on the farm.

Remembering that feed is the most expensive input in a livestock production operation, it makes sense that different methods should be employed to obtain the most benefit out of feeds at the lowest cost.

Data required for nutrition management decisions Several data types can be utilised by the farmer to make feed management decisions. These include:

- Feed conversion ratios. Feed conversion ratios indicate the amount of product produced per weight of feed consumed. To calculate feed conversion ratios the daily weight gain of the animal should be measured, and the weight of feed consumed by an animal on a daily basis should be measured.
- Feed intake values. If an animal can be stimulated to consume a large amount of feed, growth will obviously be enhanced. However, there are health and physical (anatomical) limitations to the amount of feed that an animal can consume.
- Growth rate values. No production system can claim to be a production facility if production is not measured (monitored) on a regular basis. Growth rates can be measured weekly or monthly depending on the labour requirements, the facilities available and the type of operation. Feedlot steers are often weighed when they arrive at the feedlot, and they are measured again at sale. Their daily gain is estimated from previous experience and their market readiness is also measured subjectively by experienced feedlot operators. However, where this "experienced eye" is lacking, animals should be weighed at regular intervals to check progress.
- Nutrient composition of feeds and feed ingredients: It is good practice to send feed ingredients for analysis on a regular basis. The nutrient composition of purchased feeds can be determined from their labels, but feeds grown on the farm need to be analysed.

Interpreting the data

Feed conversion ratios

A feedlot steer may consume 15 kg of complete feed per day, whilst gaining 2.5 kg per day. The feed conversion ratio in this instance is thus 6.8. In other words, the steer consumes 6.8 kg of feed for every 1 kg of live weight gain. If this live weight gain is translated into carcass weight gain (one can assume a dressing percentage of 65%), then 1 kg of live weight gain translates into 650 g of carcass weight. Thus, for every 15 kg of feed consumed 1.625 kg of carcass is produced. Let us see whether this is a profitable situation.

Let us assume that the feed costs R1200 per ton. Thus, the feed costs for the feedlot steer is R18 per day (we are not including the other costs of the feedlot such as labour, electricity, water, etc). If the feedlot operator obtains R13.00 per kilogram live weight for his steer, the Rand per kilogram carcass weight translates into R20. The feedlot operator can expect to make R2 per kilogram of carcass weight gained by the steer. It is thus important that the feedlot operator tries and obtains an optimal weight gain for the least amount of feed. He cannot starve his animals (this would result in little weight gain) so he must ensure that the feed conversion ratio is as low as possible. For example, a chicken has a feed conversion ratio of approximately 2! This means that the chicken consumes 2 kg of feed for every 1 kg of weight gained. Imagine the fantastic future feeds necessary if a feed conversion ratio of 2 could be obtained for feedlot steers

Feed intake

Even when animals are fed in groups, estimates of feed intake per animal can still be made. This is done by measuring the amount of feed provided to the group, measuring the amount of feed left over by the group, and dividing the amount consumed by the number of animals in the group. If animals are grouped according to similar sizes and types, then an assumption can be made that feed consumption of individuals within the group are roughly the same.

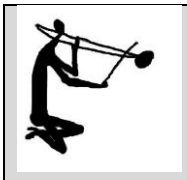
Several methods can be used to stimulate intake of feed. Such methods include pelleting of the ration (which reduces selection), adding palatable substances such as molasses, reducing the stressors in the environment of the animal (for example removing animals that bully, allowing enough crib space, ensuring the health of the animal) and reducing the dustiness of the feed.

Growth rates

If regular weighing is done and all animal weights recorded it is possible to determine whether there is a problem in the herd. For example, if your animals are grazing on pasture with a feed supplement provided, and excellent weight gains are obtained in the month of November, but poorer weight gains are obtained in the month of December, this may be an indication that the grazing quality is reducing, and an adjustment must be made to the feed supplement. Or, it may be an indication that the animals are experiencing an increased parasite load (e.g. tape worm), and that they should be treated with anthelminthic.

Nutrient composition of feeds and feed ingredients

If feed ingredients grown on the farm are analysed on a regular basis (monthly), then it is possible to adjust the feed supplementation required (if any is required) to match the nutrients already provided by the grazing. This manner of feed management will provide the farmer with the best growth rates since he/she is not overfeeding or underfeeding the herd. This is also a good method to manage the costs of feed supplementation since supplementation will only be done when absolutely necessary.

	**Individual Activity 8:**

FEED FLOW PLANNING

Introduction

It is all very well to know how much feed an animal or a herd of animals need. It is also useful to know how to formulate rations for these requirements and to know how to mix such rations. However, if feed is the most expensive input in a livestock production system then the management of the feed throughout the production cycle, where the correct nutrients are provided to the herd on an on-going basis, becomes crucial. This is known as "feed flow". How does the farmer plan this annual feed flow?

Seasonal production of feed ingredients

In South Africa there is no area where feed from the natural veld is available in the right quantities and quality all year round. However, with correct pasture management, this feed resource is the most inexpensive feed resource and should be used optimally. Where deficiencies in this resource occur, the farmer needs to supplement those nutrients that are lacking. It should also be remembered that the natural veld resource should be managed sustainably. That is why the word "optimal" is used and not "maximum". You cannot expect to extract the maximum from the veld pasture without ruining it for the future. Thus, the correct stocking rates, camp rotation and resting should be used to manage the natural pasture resource for the future.

Feed flow for animal requirements for maintenance and production

Determining the nutrient requirements of the production herd

When planning the feed flow for an operation it is first necessary to determine the production cycle of the animal. In this way it becomes possible to ascertain the general requirements of the herd over time. This can then be matched to the provision of nutrients from the natural pasture at that same period and shortfalls can be determined.

There are six important periods that need special attention during the production cycle of a female small stock animal (sheep and goats):

1. Dry: this is the period between weaning the offspring and being bred. During this period, the female is regaining the weight lost while nursing the offspring. She must reach a satisfactory condition score before being bred again. However, the nutrient demand here is the lowest.
2. Mating: flushing can be used to increase ovulation rate. Flushing involves providing supplementary feeding 3 weeks before the male is introduced, and 3 weeks after they were introduced. If the herd is on the veld, flushing can be accomplished by putting the females onto lush pasture, or by feeding pellets or grain.
3. Early gestation (1st 100 days): foetus growth is slow during this period. A maintenance diet is enough, and no ill effects will be found if the females are grazing veld.
4. Late gestation (last trimester): foetal growth is very rapid, and the foetuses gain 70% of their birth weight in this 50-day period. Protein and energy requirements increase dramatically. In adverse weather conditions the farmer should provide adequate feed for the pregnant females, to avoid losing offspring, or to have offspring born in poor

condition. During the 5th month of the gestation period, daily gains of the female should range from 0.1 to 1.2 kg.

5. Lactation: this is the most critical period. It is vital that the female's requirements are met, as the production of sufficient milk of good quality ensures that the offspring are healthy, grow fast, and at the end of the day they produce more meat, which means more money in the farmer's pocket.
6. Active growth stage of the young animal - A high quality feed should be fed to young animals because the requirements for growth are high and the rumen capacity at this stage is still a limiting factor. Poor nutrition during this stage can lead to permanent stunting of the animal. Differences of nearly 20 percent in mature body mass were obtained as a result of differences in nutritional treatment prior to four months of age. Also, the influence of pre- and postnatal treatments was added. This means that if the mother is fed well in the last few weeks of pregnancy, and the young that are born are strong, then, if the young are also fed well up to weaning, the final result will be even stronger and healthier offspring.

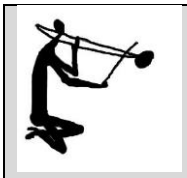
Determining the nutrient provision of the pasture It is now necessary to match these to the nutritive value of the natural pasture and see if any gaps occur. If we assume that the small stock herd mentioned above is being produced in a summer rainfall area such as the Northern parts of South Africa, the following pattern emerges:

January	Pastures of high quality	High protein and energy	High parasite load
February	Pastures of high quality	High protein and energy	High parasite load
March	Pastures starting to deteriorate	Decrease in protein	Parasite load reduced
April	Pastures deteriorating	Potential for frost damage	Decrease in protein
May	Pastures of poorer quality	Energy content still good	
June	Pastures of poor quality	Energy content dropping	Higher cellulose and hemicellulose
July	Pastures of poor quality	Energy content dropping	Higher cellulose and hemicellulose
August	Pastures of poor quality	Energy content dropping	Higher cellulose and hemicellulose
September	Very poor pastures		
October	First rains – new growth - rich in protein	Energy may be limiting	
November	High quality pastures rich in protein	Energy may be limiting	Increase in parasite load
December	High quality pastures		High parasite load

Filling the gaps

The nutrient requirements of the herd and the nutrient provision of the natural pasture is now super-imposed on each other. Where a shortfall of nutrients occurs, the pasture can be supplemented with either energy rich licks, or protein-rich licks as required. As a general rule a salt lick containing minerals should be provided all year round.

Keep in mind that with ruminants the farmer is actually feeding the micro-organisms in the rumen and not the ruminant animal itself. Therefore, all feed management decisions should keep the livelihood of the micro-organisms in mind. For example, any changes in feed should be done slowly over at least a seven-day period. Furthermore, inexpensive Non-Protein Nitrogen sources such as urea (or sterilised chicken litter) can be used instead of expensive protein resources such as Lucerne, fish meal etc. This is because the micro-organisms are capable of using these Non-Protein Nitrogen resources in the synthesis of amino acids and proteins.

	**Individual Activity 9:**
SUMMATIVE 2	

Learning Unit 3: Animal Health

Unit Standard	
116308	Implement animal health and bio-security programs
Specific Outcomes	
SO 1: Supervise animal disease prevention and ensure correct practices are in place. SO 2: Ensure that basic clinical examination is done correctly. SO 3: Ensure correct dosage rates and calibrate and use instruments correctly. SO 4: Ensure that vaccination and treatment are done correctly. SO 5: Ensure that pre-planned programmes are carried out.	
Learning Outcomes	
Identifying	Science
Organising	Communicating
Demonstrating	Contributing
Collecting	Working

DISEASE PREVENTION

Introduction

Pathogenic organisms, which are those organisms that are harmful to the animal and that cause infection, may enter the body directly or indirectly by an intermediate host.

Bacteria and viruses gain entry to the body through several routes e.g., the intestinal tract, air passages, sex organs, and wounds in the skin. The organisms then enter the bloodstream, which transport them through the body and to target organs. The changes that these organisms cause, produce the condition known as disease. If any changes in the physiology of the organ take place the whole body is affected. The animal starts to display abnormal behaviour e.g., it stops eating, start coughing, lie down or develop diarrhoea that may all be linked with fever. Ticks, mosquitoes, midges, etc. act as intermediate hosts for some bacteria.

Prevention is better than cure. Prevention seldom causes interruption in production, while treatment of disease can only start after production has already been affected.

Prevention of diseases

- Prevent contact between the animal and the pathogen through good hygiene and management.
- Dip animals frequently to prevent external parasites.
- Dose/ deworming animals.
- Vaccinate.
- Provide good balanced feeding.
- Use quarantine camps.

Definition:

Pathogen - a specific causative agent (as a bacterium or virus) of disease

You can control external parasites by the application of chemical which are toxic for the ticks etc. but harmless to the animal. There are various methods that you can use to apply these chemicals.

Internal parasites can be control by the regular application of dosing remedies to all animals. It is impossible to prevent exposure to some organisms and in these cases vaccines are used exclusively.

Diseases like contagious abortion can be diagnosed in apparently healthy animals. During clinical examination symptoms can be identified but laboratory test is also necessary to confirm diagnoses. These tests can identify infected animals, which do not show any clinical symptoms.

Good feeding provides natural resistance to all diseases or parasites. Deficiencies of nutrients like minerals can cause diseases, which can be rectified by means of nutritional supplements.

Definition:

Supplements - feed that are given as an addition to complement/complete the dietary balance

It is important that animals undergo a period of quarantine when entering a specific area of production. During this period the animal can be observed for any disease symptoms. Treatment against parasites and the necessary vaccine are administrated.

Equipment for basic veterinary procedures

Introduction

To perform elementary procedures on animals there are a few very important aspects that must be kept in mind. At first, we will discuss a few of the procedures before we attempt to perform it. Make sure you understand how the apparatus work before you use it. Especially instruments like a Burdizzo can cause the animal a lot of discomfort and damage the animal permanently if applied incorrectly.

Thermometer

To take the body temperature of an animal you only need a good clinical thermometer. The temperature is normally taken in the anus of the animal. Normally the animal will feel no discomfort and will not react too much. Large untamed animals can be difficult and needs a little bit of restraint just to insert the thermometer and take it out again.

Dehorning of animals

There is more than one method to dehorn animals such as cattle, sheep and goats. Some of these methods can easily be performed while the others may be done under local anaesthesia and must preferably be done by a veterinary surgeon.

Dehorning of cattle

The dehorning of cattle is recommended for various reasons, namely, polled animals cannot injure each other, especially in kraals, at dipping-tanks, at drinking and feeding troughs and in railway trucks. Losses due to wounds and bruises inflicted by sharp horns are avoided. Bruised meat on carcasses, usually acquired by horn blows during transport, are condemned for human consumption at abattoirs daily, leading to losses amounting to thousands of Rand annually.

Certain objections can also be lodged against it

Horns are useful when catching and securing animals: (Halters and head clamps can, however, be used with success). Horns are indicative of the quality of the animal. (The skin, bone and hooves can also judge Quality).

Methods

Various methods and apparatus can be used for the dehorning of cattle. It is, however, preferable to have cattle dehorned as calves. The most suitable age is from 2 - 4 weeks, or as soon as the horn bud is palpable. When the horn is well developed, the lumen of the horn is connected to the frontal sinus, which makes the process of dehorning a painful operation, and the risk of complications is greatly enhanced. Because of this the dehorning of mature cattle is not recommended, except in exceptional circumstances. A veterinarian should then do it under local anaesthesia.

- Dehorning iron

Cast the calf and cut off the hair around the horn bud and make sure that the iron fits over the horn bud. (The tip of the iron is concave). If necessary, the tip of the horn bud may be cut off with a sharp knife to ensure that the growth area around the horn bud is burnt. Heat the iron until it is red-hot. Now press it down on each bud for about 6 seconds. No after treatment is necessary. Care must however be taken to ensure that the skin around the bud is well burnt thus preventing the growth of a malformed horn.

- Dehorning paste (caustic potash)

Cut off the hair around the horn bud and smear petroleum jelly around the base of the bud. The dehorning paste is then rubbed in well on the horn bud for 15 - 20 seconds. Ensure that the calf does not get wet or that the paste does not run down its face as the skin may be burnt and the eyes or ears damaged.

- De-budding forceps

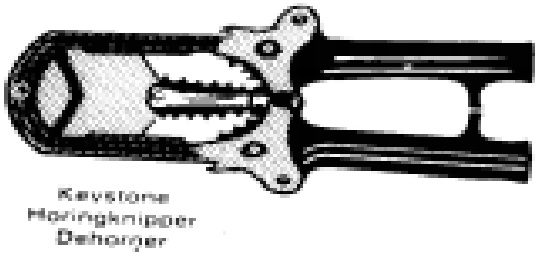
This can be used for calves up to 4 months of age. Cut off the hair and paint the horn bud and the surrounding area with a germicidal agent e.g., tincture of iodine. Place the jaws of the forceps around the horn bud and close the forceps. It must be deeply recessed. Do not feel sorry for the calf, as the operation may then be unsuccessful. Paint the wound with tincture of iodine, healing oil, etc.

- Hacksaw

This is used when horns are fully grown and should be done under local anaesthesia. Mature cattle should be well-controlled, and the head must be securely held. It is often necessary to cast the animal for this operation. The horn can then be neatly sawn off jointly with a ±1 cm ring of surrounding skin. It can be done in a short time by an experienced person. If the frontal sinus is exposed, the hole should be plugged with cotton wool and painted over with Stockholm tar.

- Keystone Dehorner

Large, heavy forceps with compound hinges. This is a quick method, but two people or at least one strong person is necessary to handle it. Cracking of the skull and serious haemorrhage are often complications with this method. This should be done under local anaesthesia and the head of the animal firmly secured. If bleeding is profuse, a thin rope should be tied around the base of the horns in a figure 8 to stop the bleeding. After-treatment with cotton wool and Stockholm tar as described above.



- Embryotomy wire

This cable-like wire is drawn to and fro around the base of the horns, thus sawing off the horn and generating heat. This should also be done under local anaesthesia. Bleeding is limited when using this method. After-treatment is the same as above.

Complications

- Haemorrhage: Can be controlled by means of a rope tied around the base of the horns in a figure 8 or by cauterisation with a branding iron.
- Infection: Local antibiotic treatment after disinfection of the wound.
- Sinusitis: Infection of the sinus cavities. "Boil" out the pus with proteolytic enzymes or hydrogen peroxide and treat with antibiotics afterwards. The pus can quite often be "poured" out by tilting the head of the animal.
- Abscesses: Disinfection and antibiotic treatment.

- Cracking of the skull: Rest and prevent infection.
- Blowfly: Clean the wound and treat for blowfly.

Sheep- and goat rams may sometimes also be dehorned. If done as lambs, the same methods as for calves can be used. If a mature ram is to be dehorned, it is advisable to have it done by a veterinarian who would most probably use the embryotomy wire method.

Techniques employed in the treatment of animals

The choice of drug and route of administration are determined by a number of factors namely, the disease afflicting the patient, the species, breed, size, temperament, manageability, etc. Different routes can be used for administering drugs, depending largely upon the disease condition, acuteness of the disease and general condition of the animal.

Routes of administration

1. External application

- Injuries to and diseases of the skin, eye, ear and nose.

Medicaments are applied to the skin, eye, ear and nose in the form of powders, lotions, sprays and water or oil solutions. The use of water solutions requires repeated applications (every 2 hours) while ointments act over longer periods, requiring application of smaller amounts after longer intervals. Medicaments for the eye and ear should preferably be in the form of an ointment or a water base. This method of application can be used for the local treatment of wounds, rheumatism and diseases of the skin, eye and ear. Local treatment of dogs and cats with skin wounds may often be frustrating as these animals constantly lick the wounds and can thus be poisoned by the medicaments. The local application of medicaments to dogs and cats often require constant securing, large collars around the neck or the administration of sedatives.

The medicament must be applied thinly and rubbed in well into the wound. Sprays are convenient in the sense that they dry fast and thus diminish the chances of the drug being rubbed off or washed away.

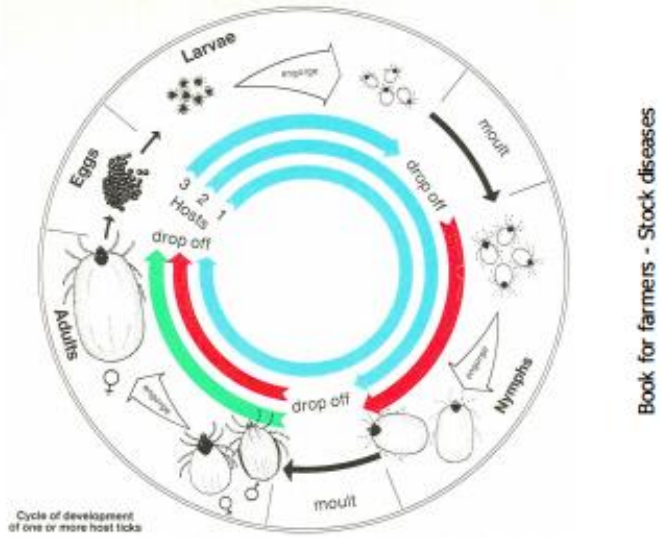
- Treatment of animals for external parasites

For the treatment and control of external parasites, local application of certain substances (e.g. dipping compounds) to the skin by means of various methods, are discussed forthwith.

	Individual Activity 1:

External parasites (dipping)

Engorging tick; some tick species are stated to ingest up to 4 ml of blood



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2. Injections (parental administration) and vaccination of animals

This implies injecting a substance into the body of the animal. The administration thereof also requires, with a few exceptions, the cleaning of the skin (with a disinfectant) as well as the disinfection of the lid of the bottle containing the drug which is to be used. Care must be taken when working with live vaccines (e.g., vaccines against virus diseases) so as not to destroy the vaccine in the process of cleaning. Sterile needles and syringes should be used (sterilisation should preferably be done by boiling the instruments in soft water for 20-30 minutes.) The person giving the injection should possess a sound knowledge of the anatomy of the animal regarding the muscles, veins and nerves. The animal must be effectively restrained for the correct technique of administration. After the needle has been pushed into the injection-site, it is advisable to connect the syringe and draw back the plunger to ensure that the needle is correctly placed. (Withdrawal of blood into the syringe is an indication that a blood vessel has been penetrated). Where possible, a clean needle should be used for every animal to prevent transmission of diseases and germs.

3. Routes used for injections

Subcutaneous	Here the drug or vaccine is injected under the skin. The drug is taken up slower and over a longer period, as is the case with the other routes. Irritant drugs should not be injected subcutaneously. A site is chosen where the skin is loose and thus easily pulled away from the muscle or carcass. Most of the vaccines are administered just under the skin by lifting up the skin between the thumb and forefinger and injecting the prescribed amount (usually 1 - 5 cm) in the space between the skin and muscle or rest of the body
Horses, cattle, sheep and goats	The loose skin in the region of the dewlap or breast, the side of the neck or over the shoulder is used.
Pigs	Just behind the ear.

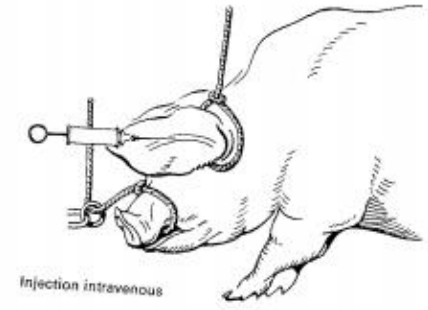
Intra-muscular	Here the drug is injected into the muscles. A sufficiently long needle should therefore be used to penetrate into the muscle. Small volumes should be injected in any one site (not more than 20 ml per site in the case of large animals). Pain and lameness may occur when large quantities are injected at one site. Absorption of the drug is rapid due to a good blood supply to the muscle. Normally hormones and antibiotics are injected into a muscle. You must make sure that the correct muscle is used and that the needle does not enter or damage the nerves and

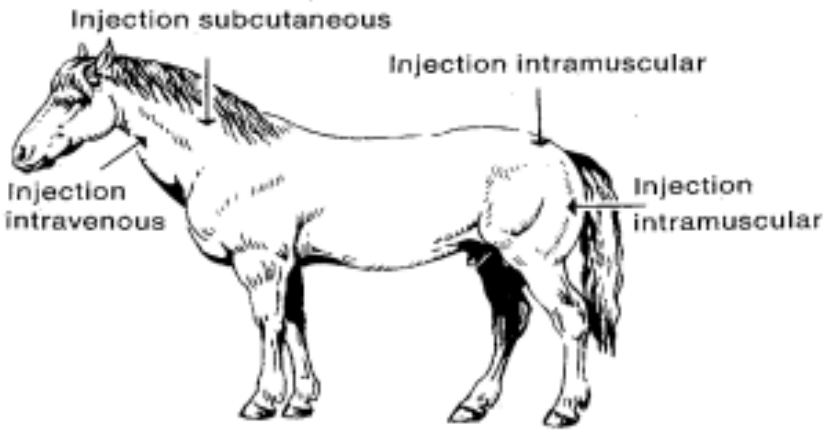
	arteries. The choice of the injection site depends upon the thickness of the muscles at that site.
Horses	Preferably in the breast muscles at the bottom of the neck, although, the neck muscles may also be used (see illustration).
Cattle, sheep, goats and pigs	The muscles of the neck, rump or buttocks are the most suitable. Piglets are injected in the neck muscles behind the ear.
Poultry	Inject into the breast muscle.

Intravenous	In this case the drug is introduced into a vein, in other words, directly into the blood. Various advantages derive from this as the drug is immediately available to the body and larger volumes and more irritant substances may be administered at one time. Drugs are usually introduced slowly, while the animal is kept under control. The technique of administration is as follows: If the jugular vein is used, place a rope around the neck just in front of the shoulder and tighten the rope. This causes the blood to accumulate in the vein, rendering it clearly visible. The needle (not connected to the syringe) is pushed through the skin with a stab-movement into the vein. If the needle entered the vein (and not into the wall of the blood vessel or the subcutaneous tissues) blood will flow freely through the needle. Fit the syringe, release the cord and inject the drug slowly.
Horses, cattle	Jugular vein.
Sheep and Goats	Vein in the ear. The technique is the same as for large animals except that the cord is placed at the base of the ear.
Pigs	Inject into the breast muscle.
Dogs	Front leg.
Poultry	Into the vein of the wing.

4. Intra-mammary

This method is used for the treatment of mastitis. Clean the teat thoroughly. The nozzle of the tube or plastic syringe (specially designed for this type of injection) is inserted into the teat canal. The contents are then squeezed into the udder, which is massaged upwards a few times. Special teat cannulas can also be used.





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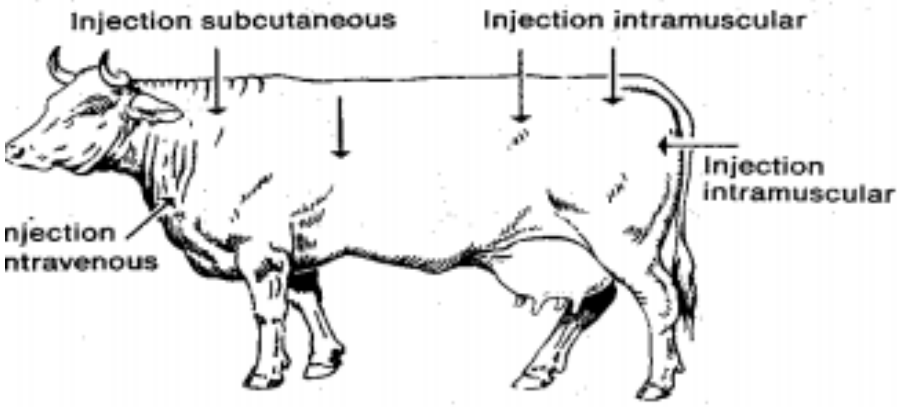

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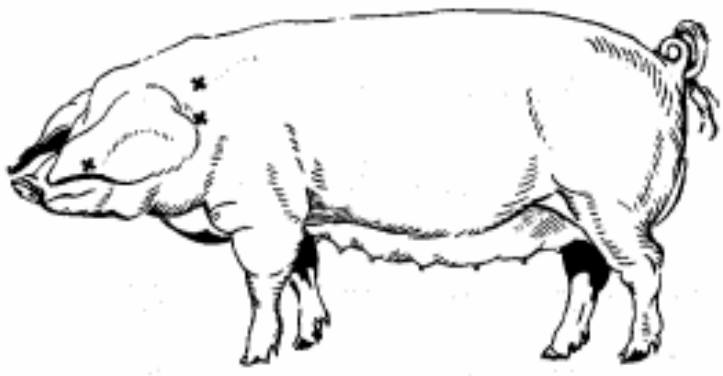

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Injection sites in pigs

5. Intra-vaginal and intra-uterine

In this case the drug is introduced into the vagina or the uterus by hand. Absolute hygiene is necessary, and the hand being used in the operation, must be washed and disinfected, or a sterile glove should be worn. If it is impossible to insert the drug by hand (e.g., fluids) it should be deposited by means of a sterile tube or catheter that is used in the same manner/technique as for artificial insemination.

6. Rectal

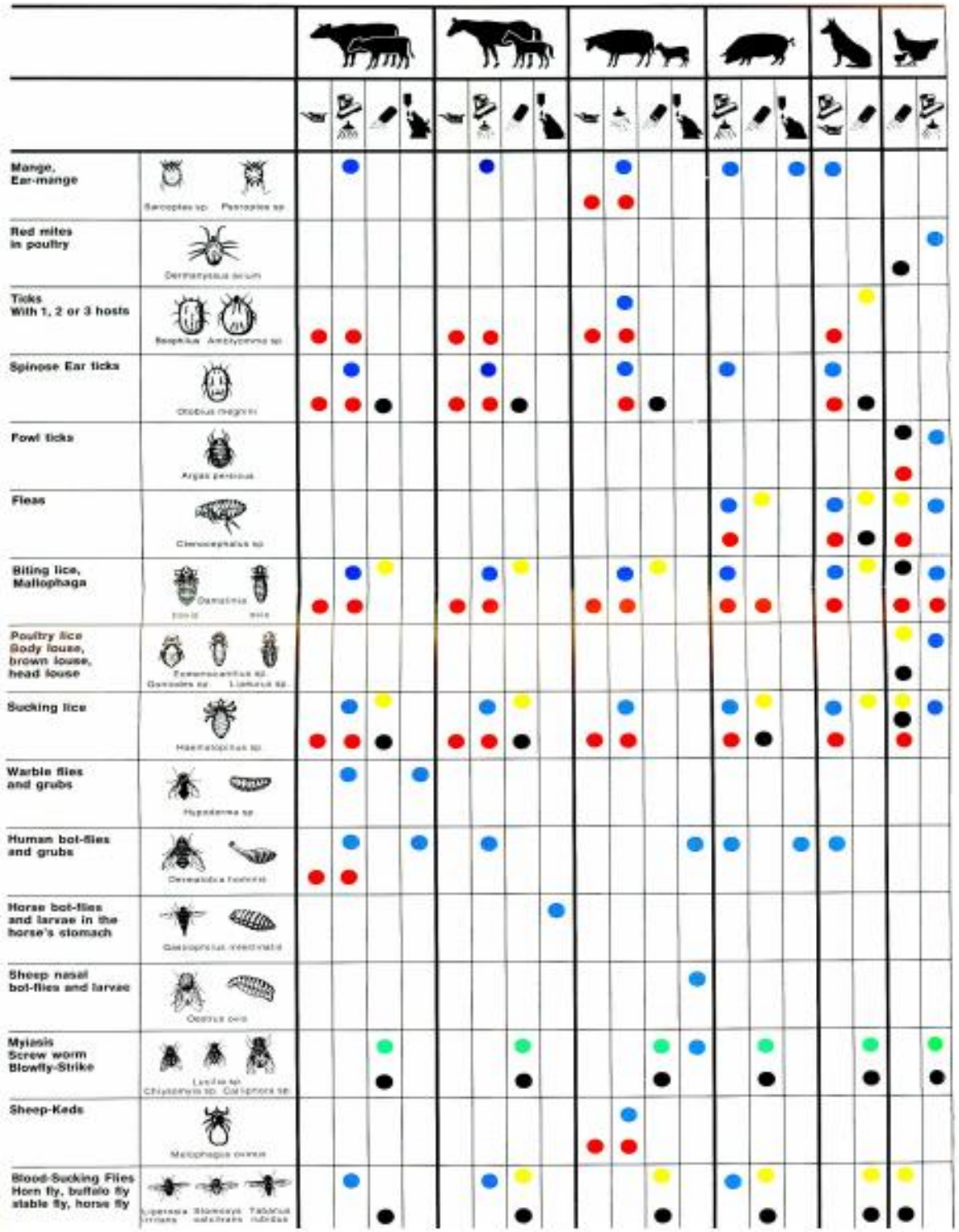
This means the introduction of suppositories, tablets or liquid medicaments into the rectum, mainly for the treatment of constipation.

Complications following injections are as follows:

- Abscesses may develop at the injection-site, especially when proper hygiene has not been maintained.
- Anaphylactic shock or allergic reactions may follow the administration of certain antibiotics or biological substances e.g., antisera.
- When irritating drugs were injected into a vein but leaks into the subcutis, large areas of the skin may peel off leaving unsightly wounds.
- The use of certain vaccine (pyrogenous) substances may cause a fever.

Administration of incompatible substances may result in severe systemic reactions.

Route of application to treat the parasites.



Dipping

Cattle

1. Plunge-dip

Previously, when arsenic was the most important dipping-substance, large dipping tanks were generally used as it forced the animal to swim through, thus ensuring it to be in contact with the dipping-fluid for a longer period. Nowadays only proper wetting of the animal with the modem organic dipping-compounds is necessary.

Smaller dipping-tanks are now recommended (± 15 000 litre) as this helps in keeping costs down when making use of the more expensive dipping compounds. For efficient control of parasites, it is essential to wet the whole animal with a properly constituted dip-wash at the correct strength. (To obtain this the label on the container should always be read carefully). The dipping-tank must be constructed in such a way that there are 5 to 6 steps at the entrance leading down to the water-level. This provides the animal with something to kick against when jumping into the tank, positioning the animal's body in such a way that the head is forced below the water surface when it plunges, ensuring complete wetting with the dip wash.

To maintain the dip-wash of modern dips at the correct strength, (tank tests are time consuming or not available) it is easy and fairly accurate if done in the following way:

- Calibrate the tank and mark each 500 litres on the wall of the tank as well as on the dipstick.
- After preparing the contents of the dipping-tank correctly at the fresh filling rate, record the tank level when the day's dipping is completed.
- Before commencing the next dipping, measure the tank-capacity and compare this with that at the end of the previous dipping to establish whether rain has diluted the dip-wash.
- If the latter is the case replenish with dipping fluid necessary for the volume of extra water which has entered the tank.

This easy, on the spot check, when done regularly at each dipping, will ensure a fairly accurate dip-strength. To protect the dip-wash in the tank as much as possible, avoid dirt and exposure to the sun.

A footbath, 3 - 5 metres long, through which the animals have to walk before plunging, is of great help to clean the hooves and avoid soiling of the dip-wash. A well-constructed roof over the tank, to avoid evaporation and to prevent dilution by rain, is just as essential as a foot-bath.

2. Spray-races

The spraying of cattle was adopted with the introduction of modem organic chemicals which were costlier and more difficult to test than arsenic; and so the development of the spray-race. Spraying of cattle has the advantage that the dip is freshly made up at full strength before it is used, thereby giving maximum control and at the same time any uncertainty regarding the dip strength is eliminated.

The spray-race has an advantage to plunge-dips, provided the following points are observed:

- Only use a manufactured spray-race approved by a pharmaceutical company.
- These are synchronised with regard to the size of the nozzle, type of nozzle, speed of the pump, size of the pump, the pressure and position of the pipes and nozzles in order to ensure proper wetting of all parts of the animal.
- Mix enough dip required for the day's spraying so that no dirty dip remains in the sump or pump until the next dipping.
- Flush all pipes and the sump with clean water after use to prevent blocking.
- Ensure that the pump pulley runs at ± 2 000 rpm. When all nozzles deliver freely, this ensures a delivery rate of 700 litres per minute at a pressure of l, 4bar.
- Ensure that all the nozzles and the strainer are clean before spraying is started. Use clean water only.
- Never build a spray-race near to or under trees, as seeds and leaves may block the strainer and nozzles.
- Build the spray-race with the entrance facing north, if possible. In doing this, the animals, when entering, will walk away from the sun and not facing it. Also keep in mind the prevailing winds when erecting a spray-race.
- Wetting of the ears and under the tail is not always as efficient as in a plunge dip, necessitating special attention to these parts (e.g., hand dressing.)

Hand-spraying This should only be used when less than 25 animals are involved. It has been proved over and over again. When herds (larger than 25 head) were hand-sprayed weekly, the affectivity is greatly diminished. It must be remembered that for hand spraying at least 10 litres of dip-wash is required per animal in order to wet it properly. It is also very difficult to wet all

parts of a beast standing still. Moreover, a high-pressure spray pump is needed to ensure thorough wetting of the skin.

3. Hand-dressing

This method is sometimes used where animals cannot be brought to the dipping tank or where a severe infestation of ticks are present, clustering the ears and underneath the tail.

Only apply hand-dressing materials (patch-treatment) to parts where ticks are clustering. Never treat large areas of the animal, as the animal may become poisoned.

Products such as "Tick dressing S" (chlorphenvinphos) can be used for cattle.

- Pour-on solutions - Products that can be poured on or painted on the infected parts of cattle and sheep/goats include: "Drastic Deadline", "Clout" and "Swift Pour-on".
- Aerosol - An aerosol product such as "Bacdip aerosol" can be applied to heavily infected body parts.

4. Calibration of dip- or spray-tanks

The most accurate way to fill a dipping-tank is by using an open oil drum as a measure. When filled to the top the drum contains 200 litres.

The dipping-tank is filled with this container. Every time a container is emptied into the dipping-tank's sump, the dipstick is marked (calibrated) clearly at the same time. The dipstick is then used to measure the remains after a day's dipping session.

The following formula can be employed:

Dipping tanks:

Measure:

a. = Length at water-level

b. = Length at bottom

c. = Breadth at water-level

d. = Breadth at bottom

e. = Depth of water

Now calculate as follows:

$\frac{a + b}{2} \times \frac{d + c}{2} \times e$ = cubic capacity of dip-tank

NB: 1 cubic metre = 1 000 litres

Spray-races:

Measure:

a. = Length of sump

b. = Width of sump

c. = Depth of sump

Now calculate as follows:

a x b x c = cubic capacity of the spray-race sump

Add the capacity of the sump foot valve

Sheep

1. Plunge-dipping

Two types of dipping-tanks are recommended: the oblong dipping-tank and the circular dipping-tank. Both types work extremely well, provided the following requirements are full filled:

- The draining-pen must be well constructed to facilitate draining and should be large enough to allow complete draining without delaying the dipping process.
- The sheep handling-facilities (i.e., kraals etc.) must be adequate in order that it do not slow down the dipping process.
- The exact capacity of the dipping-tank should be known to ease the preparation (correct concentration) of dip-wash for the dipping process.
- The dipping-tank must be calibrated to facilitate accurate replenishing.
- The presence of a replenishing tank next to the dip will speed up the dipping process and ensure that the dip-concentration is maintained.
- Ensure that each sheep is plunged underneath the fluid level at least twice for proper wetting.

NB. There is a distinct advantage in dipping sheep when the wool is short, i.e., 10 - 14 days after shearing - both as far as thorough wetting and economy are concerned.

2. Foot- and belly-dipping

Foot-dipping is recommended for the control of the paralysis ticks. The depth of water through which the animals walk, should be 15 to 30 cm. Belly-dipping is recommended for the control of the paralysis ticks. The depth of the dip-wash should be 50 - 60 cm.

3. Maintenance of dip-strength

This point cannot be overstressed when dipping sheep. Whether it is plunge, foot or belly dip, the following points must be kept in mind:

- The exact capacity of the dipping-tank must be known to establish the dip wash's correct strength initially.
- Replenishing must be done regularly and continuously to maintain the correct strength.
- This will ensure that the first as well as the last animal dipped will come into contact with the correct concentration of dip-wash to ensure good results. Larger dipping-tanks (4 000 to 5000 litres capacity) are replenished less often than smaller tanks (2000 to 3 000 litres). Nevertheless, it is essential to replenish with fresh water and dipping-compound at the prescribed replenishing rate, before one third of the dip wash has been removed by the animals.
- There is a lot of merit in constant replenishing from a replenishing tank standing next to the dipping-tank. In the case of belly-dipping or foot-dipping where the dip-wash depth is of the utmost importance. The constant replenishment method is also recommended. This ensures both correct strength and depth of dip-wash throughout the dipping process.

Horses

Methods which can be followed are:

- Dipping or spraying, as for cattle.
- (Hand-spraying with dipping compounds.
- (Dusting with dip-powders.

Pigs

Dipping of pigs or spraying may be applied to small numbers. It is necessary to wet the pig thoroughly to obtain good results. Pigs with advanced mange should be scrubbed to ensure thorough wetting. It may also be necessary to add a wetting agent to the dip-wash.

Poultry

Dusting of poultry under each wing and tail may be done mechanically or by means of a sandpit with dip-treated sand.

Internal parasites

Normally there are two methods to control internal parasites: **dosing** or **drenching**. There are a lot of drenching remedies on the market; some of them can be administered orally while the other can be injected e.g., Dectomax.

The following are examples of different internal parasites that may occur in your area:

CLINICAL EXAMINATION

Introduction

You must have knowledge of the normal functions and anatomy of an animal before you can differentiate between the normal and abnormal. When clinical examinations are done you should do it systematically and all systems or organs should be examined. It is important to identify the animal and to get the history of that animal before you start with the clinical examination.

Clinical examination

When you observe an animal from a distance, you should be able to notice abnormalities. You should look at:

- Condition of the animal
- Body conformation
- Movement of the animal

For systematic examination you should look at:

- Skin and the hair coat
- Skeleton and movement systems
- Respiration systems
- Circulatory systems
- Digestive systems
- Nervous systems
- Uri-genital systems
- Sensory organs

When observing these systems, you should be able to identify abnormalities. You cannot always make an accurate diagnosis, but the information will help you.

When you look at the hair coating and skin you could conclude that if there are no hair it means the animal is affected with ringworm. If the skin, when pulled away from the body (pinched), remains pinched, the animal is dehydrated. When you examine circulatory systems, you should look for anaemia (mucous membranes are white), signs of bleeding, etc.

Observe the animal while eating; Can the animal swallow, is eructation normal. Take a look at the teeth, tongue and jaw. When you look at the condition of the faeces, the animal will appear lacking energy.

You can also make use of diagnostic aids like:

- Blood samples (test for the presence of antibodies)
- Blood smears (examine for bacteria, anaemia, etc.)
- Faecal egg count (examine for parasites, consistency, content)
- Urine (examine for diseases, like pulpy kidney)

- Milk (examine for mastitis) This information can also be of great assistance when you are consulting a veterinarian by telephone.

Some ailments that need treatment on the farm without consulting a veterinarian

- Wounds
- Bleeding
- Abscesses
- Diarrhoea
- Bloat

After this section you will know how to treat these ailments.

Wounds

Wounds can be caused by various objects and infected with bacteria. If wounds are older than eight hours, it should be regarded and treated as infected.

Treatment: Bleeding should be stopped. Remove all foreign material such as sand, grass, faeces, etc. Wash the wound with disinfectants such as salt water. Clip the hair around the wound, dry the surface and keep the wound dry.

Abscesses

It is an accumulation of pus in a cavity. It is hard and painful.

Treatment: Allow the abscess to ripen before it is opened by an incision. Treat the animal with antibiotic injections afterwards.

Bleeding

Slight bleeding is beneficial because it tends to clean the wound. Severe bleeding must be stopped.

Methods: Apply a pressure bandage.

Difficult births

When an animal is on the point of giving birth, it must be left undisturbed. If there is a delay in normal birth the cause should be examine. If you cannot find the cause within five minute a veterinarian should be contacted. If the veterinarian cannot be found you should attempt to do it yourself to safe the cow and the calf. It however takes experience to identify if a cow is experiencing difficult birth. Do not assist too soon or too late.

Long rubber gloves that cover your arm must be worn to protect the cow from injury and you from infections. The vaginal and anal area must be washed and disinfected before an internal examination is attempted. The arm must be lubricated. You must work carefully. If traction is use it must be applied in the same direction as normal birth.

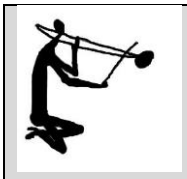
After assistance has been given, afterbirth suppositories must be inserted deep into the uterus to neutralise any infections.

Keeping records

It is advised that records must be kept for animals on the farm. These records are essential for traceability of diseases; animals with poor performance, animals that has chronic disease disorders and to have a database as reference, should a certain animal be examined in the future. Most dairy farmers keep a file for each cow, recording all necessary information regarding. This record enables the farmer to make a practical assessment concerning the productivity of each animal in the heard. Such a file would include:
the pedigree of each cow,
a record of all medical treatments and diseases and dates when it occurred and was administered,
a record of the number of calves produced as well as the lactation periods.

Very important, the milk production performance of each animal is recorded daily!

	**Individual Activity 2:**

 **Individual Activity**	**Individual Activity 3:**

Dosage and calibration

Introduction

The choice of drug and route of administration are determined by: the disease, the species, breed, size, etc. Different routes can be used for administering a drug.

Routes of administration

External application

- Injuries to, and disease of the skin, eye, ear and nose
- External parasites

Cattle

- Plunge dip
- Spray-races
- Hand spraying
- Hand dressing
- Pour-on solution

Sheep

- Plunge dipping
- Foot-and belly dipping

Horses

- Dip or spray
- Hand spraying
- Dusting with dip powders

Oral administration

- By means of food or water
- By means of a tablet pistol Dosing of fluids by means of a dosing syringe
- Drenching by means of a stomach tube

Injections

- Subcutaneous
- Intramuscularly
- Intravenous
- Intra-mammary
- Intra-vaginal and intra- uterine
- Rectal

Now you are familiar with the routes of administration. In the following section the treatment of dairy cattle will be discuss. Livestock medicines are an important tool in the treatment and prevention of diseases. Correct treatment methods assure the safety of food products and insure an effective response to treatment.

Consider the following points before treating dairy cattle.

Drug selection

Select the correct therapy. Consult your veterinarian for advice on the correct medication, the route of treatment, the treatment dosage, the time between treatments and the number of treatments. Veterinarians should leave clear written instructions with the herd owner identifying the treated animal and giving information on the treatment protocol. The veterinarian also plays an important role in monitoring the response to treatment.

Treatment method

Treatment must be given correctly to be effective and to prevent complications. Use the following guidelines to develop good treatment habits.

- Wash your hands before and after handling livestock medicines.
- Use proper equipment: Choose the correct syringe and needle size for the dosage and the type of injection to be given.

- For intramuscular injection use a 1 1/2", 16 or 18-gauge needles to insure the drug reaches into the muscle and not just under the skin. Before injecting, pull back on the plunger to ensure the needle tip is not in a blood vessel. Select appropriate injection sites with the help of your veterinarian. Read the label for the maximum amount to be injected in one site.
- For subcutaneous injection use a 1/2" to 1", 16 or 18-gauge needles. Check that the needle tip is moveable. Inject a small amount of drug to see if a bulge is formed in the area of the needle tip. This will verify that the needle is under the skin and not in the muscle. Inject only in sites recommended by your veterinarian.
- Inject only in clean body sites.
- Use clean equipment. Singly used, sterile, disposable needles and syringes are preferred.
- Give repeated injections in different body sites.
- Before infusing antibiotics into the udder, wash the teat and your hands and dry with singly used paper towels. Disinfect the teat with an alcohol swab provided in the medication package. Avoid touching the infusion canula at the end of the treatment tube. Only use single dose infusion products in disposable syringes. Dip the teat after infusion of medication.

Dosage calculation

To calculate the correct dosage, you must know the weight of the animal and the dosage rate. For example, treat a 600kg cow with procaine penicillin. Prescription on the label: dosage = 2.5 ml per 100 kg of body weight once a day. Calculation: 600 kg bodyweight divided by100 x 2.5 ml = 15 ml.

One millilitre (ml) and one cubic centimetre (cc) represent the same volume and are interchangeable in calculating drug dosages.

Treatment records

Many antibiotic residue violations result from failure to:

- identify treated cows, maintain treatment records and use proper milk withholding times.
- identify treated cows in a manner that she is clearly visible when entering the milking parlour.

Some of the commonly used methods are:

- Leg bands,
- Coloured tape or fluorescent hockey tape around the legs or tail, or
- Paint markings on the cow's flank, rump or legs

In larger herds identification may be colour coded to show the last day to withhold milk. In tie-stall barns where cows always occupy the same stall, coloured tape or tags attached to the milk inlet of the pipeline can identify a treated animal.

Walls constructed of "white board" on with special markers are an excellent way to create a very large bulletin board. The identity of all treated cows and the date and time of the last withholding of milk should be clearly visible.

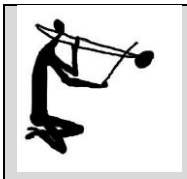
Keep a permanent, detailed treatment record for reference and management purposes. Write this in the herd's health book or in the individual cow record files. This record should identify the animal, the product and dosage administered the date of treatment and the milk-withholding period. Before shipping any animal for slaughter, check this record to insure pre-slaughter treatment withholding requirements are met.

Here is an example of a record card:

Treatment Record
Cow Identity: _____

Date	Diagnosis	Treatment	Dosage	Duration of Treatment	Label Withdrawal (No. of milking)	Date Tested	Milking Returned to Tank

Correct usage of livestock medicines, recording of treatments, and clearly identifying treated cows are essential practices.

	**Individual Activity 4:**

VACCINATION & TREATMENT

Introduction

Immunity only develops after an animal has been exposed to a specific organism causing a disease. Due to this, pharmaceutical factories (Onderstepoort) are preparing and have the available vaccines.

If an animal is infected with a disease-causing organism, the animal will become ill or can die. There are two types of vaccines; the live and the dead vaccines. The differences between live and dead vaccines:

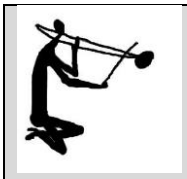
1. Dead vaccines are distributed as suspensions, and need only to be shaken before used. Live vaccines are freeze-dried into a powder form. You can only add sterile water.
2. Dead vaccines can be stored at 20°C. while live vaccines must be kept at 4°C inside a refrigerator.
3. Immunity against dead vaccines is of a short period. Repeated vaccination is therefore recommended.
4. Dead vaccines normally do not cause a fever reaction and are safe to administrate to pregnant and working animals.

Handling of vaccines

Vaccines are a highly perishable product, and they should be handled with great caution.

- Store vaccine in the correct way.
- Keep in a cooler bag when transporting it.
- Avoid unnecessary exposure to direct sunlight.
- Only use sterilised syringes and needles when vaccinating
- Change needles as soon as possible if practical
- Correct dose must be given, using the correct route of vaccination

- Take precaution not to inject oneself by mistake
- Make sure that all equipment used are sterilised and stored correctly after vaccination.

	**Individual Activity 5:**

Pre-planned programmes

Introduction

Vaccines should be given at strategic times of the year or season. These times vary depending on the vaccine and particularly on the disease, which you are trying to control.

When do you need to vaccinate or dose?

The response to this question depends on the individual farm, age of an animal, previous disease problems, whether the herd/flock is open or closed, geographic region of the country, soil type, diet, and the flock economics.

Example: Vaccination and Dosing programmes for Agricultural College Grootfontein, Middleburg

	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
Pulpy Kidney	All weaned-lambs	goats	whole flock			whole flock & Angoras					whole flock	
Pasteurellosis	All weaned lambs	goats	whole flock			whole flock & Angoras				order	whole flock	
Black Quarter	whole flock pre-shearing				goats pre-shearing		Hamel shear group & Demo-ewes			order		
Rift Valley Fever								order		whole flock		
Blue tongue A											whole flock 1st week	
Blue tongue B											whole flock 3rd week	
Bluetongue C												whole flock 2de week
Lumpy skin disease Supavax (Blackleg, Milt & Botulism)		cattle								order		
CVD (Respiration disease)		cattle								order		
Enzootic Abortion	Order		breeding ewes				Last week pregnant ewes					
Blue udder & Multivax P	Order		breeding ewes Multivax P				pregnant ewes					
Rev 1	Ram- and ewes lambs at weaning										order	
Dose	Tapeworm Lintex - weaning Lambs & calves	whole flock goat and sheep Liver fluke & Tapeworm	Breeding rams Nose worm	wide-spectrum whole flock				wide-spectrum whole flock			Tapeworm lambs	wide spectrum whole flock

Multimin	at weaning	breeding ewes						ewes & lambs				
Vit ADE		whole flock			whole flock			pregnant ewes			order	
Deadline			Cattle sheep & Goats			cattle, goats and sheep						

Individual Activity 6:

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SUMMATIVE 3

Learning Unit 4: Reproduction

Unit Standard	
116318	Plan and maintain breeding systems
Specific Outcomes	
SO 1: Explain and understand the basic genetic principles pertaining to farm animals. SO 2: Plan and maintain breeding systems for farm animals. SO 3: Compare and understand the different breeding methods that can be applied to farm animals. SO 4: Explain and maintain a breeding management programme for farm animals. SO 5: Describe the basic biological and behavioural concepts that will illuminate the geographical, traditional and historical distribution and use of the animal.	
Learning Outcomes	
Identifying	Science
Organising	Communicating
Demonstrating	Contributing
Collecting	Working

THE BASIC GENERIC PRINCIPLES – FARM ANIMALS

Introduction

"The whole subject of inheritance is wonderful", wrote Charles Darwin in 1868. Darwin admitted, however, that the biology of his day provided no solution for what continued for many years to be called the "riddle of heredity".

At the same time that Darwin was writing this work, a monk and biologist Gregor Mendel was doing experiments with peas, and he was beginning to unravel the riddle of heredity. His work became known around 1900 and the concept of the gene was developed. Today we still use the gene terminology and the genome (where the genes of a species are situated on which chromosomes or on the specific loci) of a lot of species are fully understand and described.

Mendel worked on what we call today the single gene inheritance. In other words, where the gene is inherited in a predictable statistical ratio and the expression of the characteristic controlled by the gene can be easily recognized.

Definition:

Locus: Where a specific gene is situated on a chromatid of a chromosome.

Loci: Plural of Locus.

Genome: The genetic makeup of specie. That will give you the full picture where genes are situated on which chromosome and its location on the chromosome.

However, most of the genes responsible for production characteristics in farm animals are controlled by a lot of genes. The selection for such production traits is much more complicated. Scientists have developed many methods during the past years with which they can eliminate the concealing environmental aspects with complicated statistical calculations and are now able to come up with breeding values that can predict quite accurately how a breeding animal will breed. They also developed analytical skills with which they can determine the genetic profile of any individual animal. In the future it seems that this DNA profiles will be used to predict an animal's breeding abilities.

Nature and function of the gene

Knowledge of the gene and some of its functions is necessary to obtain a good foundation in the principles of animal breeding. The gene is the smallest biological unit of inheritance and is carried, as was mentioned already, on the chromosome. Hundreds and possibly thousands of genes are carried on each chromosome.

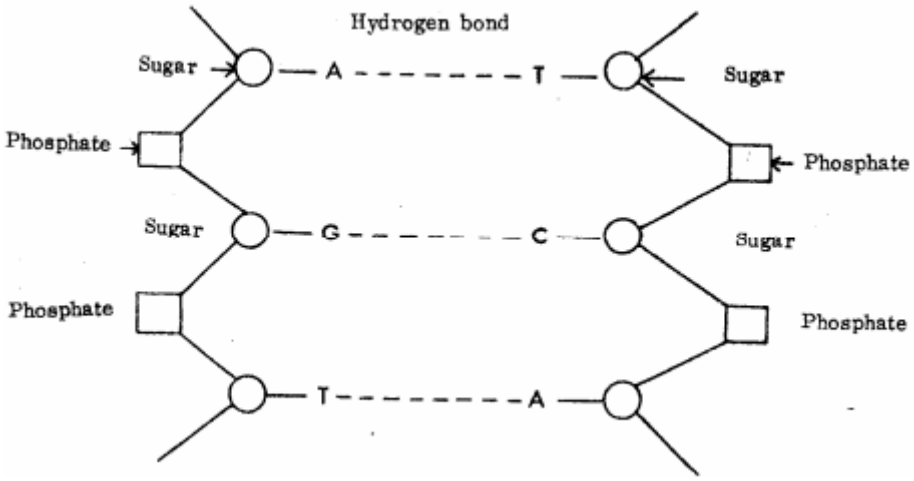
The chemical composition of the gene has been studied indirectly by the chemical analysis of the chromosomes. It was found that chromosomes contain proteins and nucleic acids. Two kinds of important nucleic acids occur in cells, namely DNA and RNA. DNA (de-oxyribonucleic acid) is the primary genetic material and the gene is a segment of a DNA molecule.

Electron microscope pictures show that the DNA molecule is longish and rather stiff, like a piece of cord. X-ray analysis shows that it is actually a double molecule or chain with one chain wrapped around the other in a helical structure. The two chains are connected at various points.

Our knowledge on the structure of the DNA molecule is mainly due to the work of two brilliant scientists, namely an American, Watson and an Englishman, Crick. While working at the University of Cambridge in 1953 they put forward a new idea for the structure of the DNA molecule. It is known as the Watson - Crick Model and up to now it is still the model that fit the facts most closely.

This model shows the DNA molecule as a double spiral consisting of smaller molecules held together in a special way. One can think of it as a twisted ladder in which the two uprights consist of alternating phosphate and sugar groups, held together by strong chemical bonds. The rungs, which hold the uprights together, are attached to the sugar groups. These rungs may consist of any pair of a wide range of different combinations of nitrogen bases, which is called purines and pyrimidines. Weak chemical forces, hydrogen bonds, between matching bases of the two chains hold the molecule together. In the figure the structure of DNA is presented according to the Watson - Crick Model.

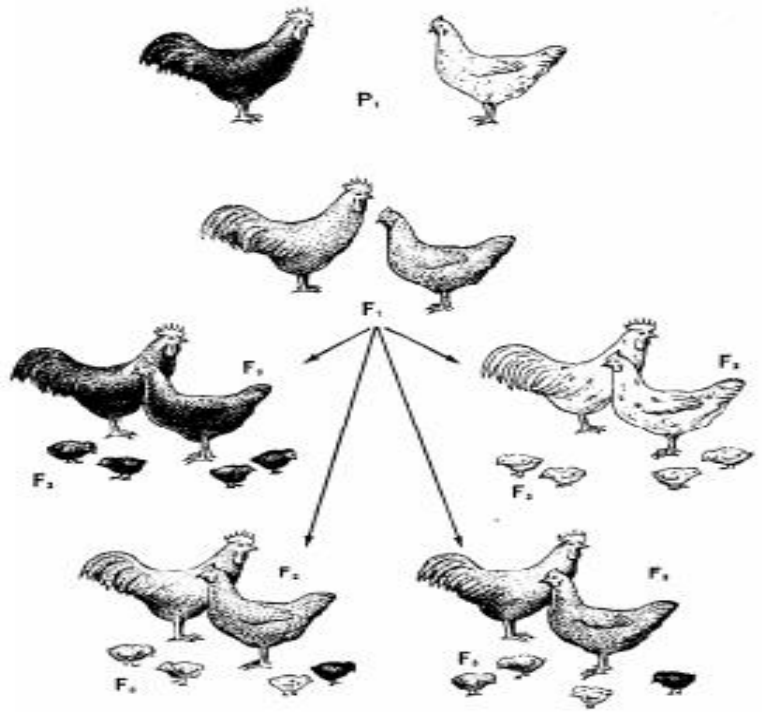
If we imagine the strands of the spiral unwound and the whole structure flattened out, it will look somewhat like this.



Where A, T, G and C etc. are the nitrogen bases (purines and pyrimidines)

Figure - Representation of the double helix set upon a flat surface. The next figure illustrates the inheritance of a single gene responsible for the plumage colour of Andalusian fowls.

Crosses between black and white fowls produce only blue-grey offspring in the F1 generation. When the F1 offspring are mated with each other, the F2 generation they produce will have: 25% black, (which breed true); 50% blue grey, (which breed like the F1 offspring), and 25% white (which breed true) coloured plumage.



The principals of genetics

All living creatures consist of millions and millions of cells. Every cell has a cell nucleus. In this cell nucleus very small strings, known as chromosomes, are found. On this small chromosome strings the genes are found. In body cells the chromosomes are found in pairs and therefore the genes are also found on both chromosomes.

Formation of gametes

The ovum or **gamete** of the female animal has only one of the pair of chromosomes that is found in a body cell. We said the cell is haploid (has only half the chromosomes and genes of a body cell). The body cell is diploid full set of chromosomes. The mature sperm (male gamete) cells of the male have also only half the chromosomes and genes of the male's body cells. Therefore, the sperm cell is also haploid.

When the two gametes (sperm and ovum) combine during fertilization the result is a cell with a new combination of two sets of genes. Diploid and very unique in combination of its genes and is called the zygote.

The gamete is formed through a division called reduction division (Meiosis) because the chromosomes and genes are reduced to half (haploid) that of the body cells. When body cells divide we call it mitoses. After mitosis the resulting cells have the same amount (diploid) of genes than that of the dividing cell.

Mitosis

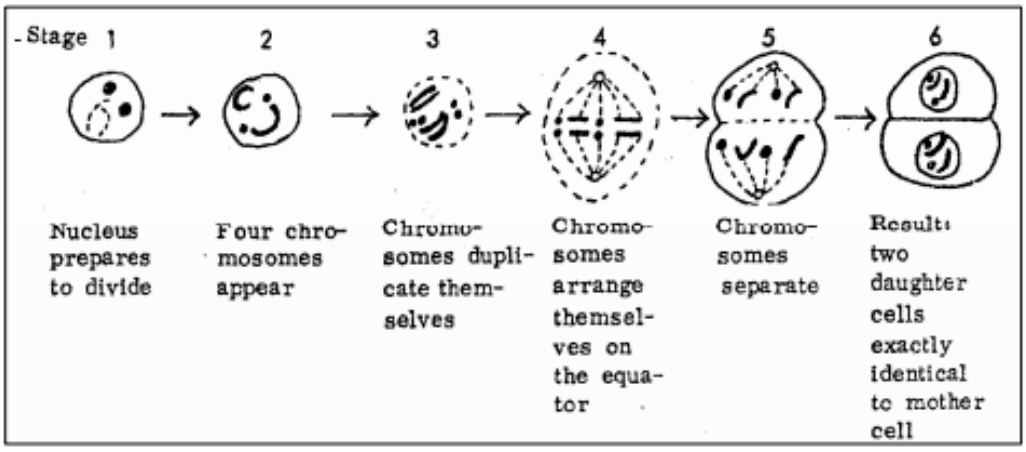
We are now coming back to the fertilized egg cell. The cell divisions, which affected the growth of an animal, are called mitosis. It is visible under a strong microscope, shown schematically in the figure.

The most important feature of mitosis is that the chromosome number remains constant throughout successive cell divisions.

The result is an exact distribution of chromosomes to the new cells as they are formed. The new sell, formed by the chromosomes, is the same as that of the cell from which it has been derived. The ability for a single cell to give rise to all the different kinds of specialized body cells can be explained by the mechanism of differentiation.

Mitosis, then, is the normal duplication of body cells to form new daughter cells with the same chromosome number as the mother cell.

Stage 1 - 6 of the mitoses division - division of body cells

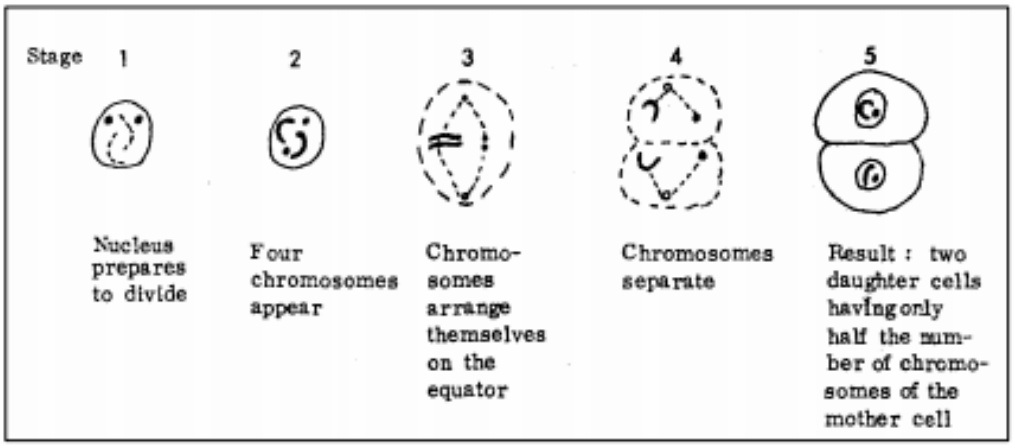


Meiosis

Fertilization occurs when the sperm and the egg unite to form a new individual. For species to maintain a constant chromosome number, it is therefore necessary that each egg and each sperm should contain only half the chromosome number. The process of cell division that results in the formation of sex cells (gametes) and the halving of the chromosome number are known as meiosis.

During meiosis the members of each pair of chromosomes line upside-by-side and separate in such a way that each daughter cell has one member of each chromosome pair. Each gamete will therefore contain exactly a half of the normal chromosome number. With fertilization the normal chromosome number is restored. The process of meiosis is illustrated in the figure.

Stage 1 to 5: Meiosis forming of male and female gametes



Body cells

There are thousands of genes situated on the chromosomes in an individual's cell nucleus. The composition of the genes in each individual is unique. That is because nature mixes the genes in the individual parents before a half from each parent is transferred to its offspring via the ovum in the female parent and the sperm cell of the male parent.

During the process of fertilization, the two sets of chromosomes of the mother and father are joined, and a new individual with his own unique gene composition is conceived. Note that each sperm / ovum produced by an animal does not carry exactly the same gene component, because a different chromosome combination is possible in both the sperm and the ovum. This contributes to the variation in genotypes produced. Since new gene combinations occur continuously, new variations are also produced continuously.

Qualitative inheritance

Interpretations of Mendel's single gene inheritance (The experiments were done with peas. Therefore, the male gametes are pollen and female gametes are egg cells)

Interpretation

Assume that for a given pair of alternative characters, F1 individuals have received an appropriate genetic element from each parent. That will be the contribution of each gamete. Let X be the element representing the character that is expressed in the F1, and x be the element that is the basis for the character that is not expressed in the F1. The F1 individuals may then be designated Xx. Suppose that the pollen and egg cells, produced by these individuals, contain only one of the elements, X or x, and that these two kinds of elements are represented equally among gametes.

Definition:

F1 - The first gross offspring of parents.

F2 - Offspring of the possible crosses between F1 individuals.

As a result of fertilization when the male gamete (pollen) joins the female gamete (egg cell) the resultant combinations may be predicted as shown below:

	Pollen (male) X	x
Egg cells (female) X	XX	Xx
x	Xx	xx

Summarizing, we expect to find F2 combinations of genetic elements in the proportion. 1 XX: 2 Xx: 1 xx

If in the F2 the relationship of element X to x is as it was in the F1, Xx individuals can be expected to express the characteristic expressed in F1 individuals. This means that in the F2 one expects XX and Xx individuals to show the same characteristic and xx individuals to show the alternative. F2 individuals are then expected to occur in a proportion of three (1XX + 2Xx) to one (1xx) and that is what Mendel found in his experiments.

Terminology

The following basic concepts are important:

A **unit of heredity**, for example the element that controls the stem length in peas, is called a gene.

The members of a pair of such units, like L and l controlling the long - short-stemmed alternative, are called alleles.
One (or very few) pair of genes with a large effect controls the Mendel inheritance of traits. We called these traits or characteristics qualitative or single gene traits. They have **a characteristic, easily recognizable**, that can be identified as either a dominant or a recessive characteristic, or each gene expresses a part of the characteristic's expression.

Dominance is where a gene's influence will show (it does not matter if one or both of the dominant genes are present) its will to be expressed in its offspring. Recessive genes can be obscured by the presence of the dominant gene.

The gene theory of heredity

Single gene heredity was the first clear experiments in the early years of the development of the theory of inheritance. That was because the environment does not have an effect on this kind of inheritance. Morgan, a well-known investigator of Mendel's theories, and his team put the facts together into a theory. This is known as the gene theory of heredity and can be summarized as follow:

- Hereditary traits are determined by tiny particles called genes.
- These particles are transmitted from one generation to the next during the process of reproduction.
- The genes are strung in single files along the length of nuclear structures called chromosomes.
- Each gene has a definite position, or locus, on the chromosome in which it resides.
- The gene, at a given locus on a chromosome, may take one of several different (allelic) forms.
- Each gamete has a complete set of genes carried in a single set of chromosomes (monoploid / haploid).

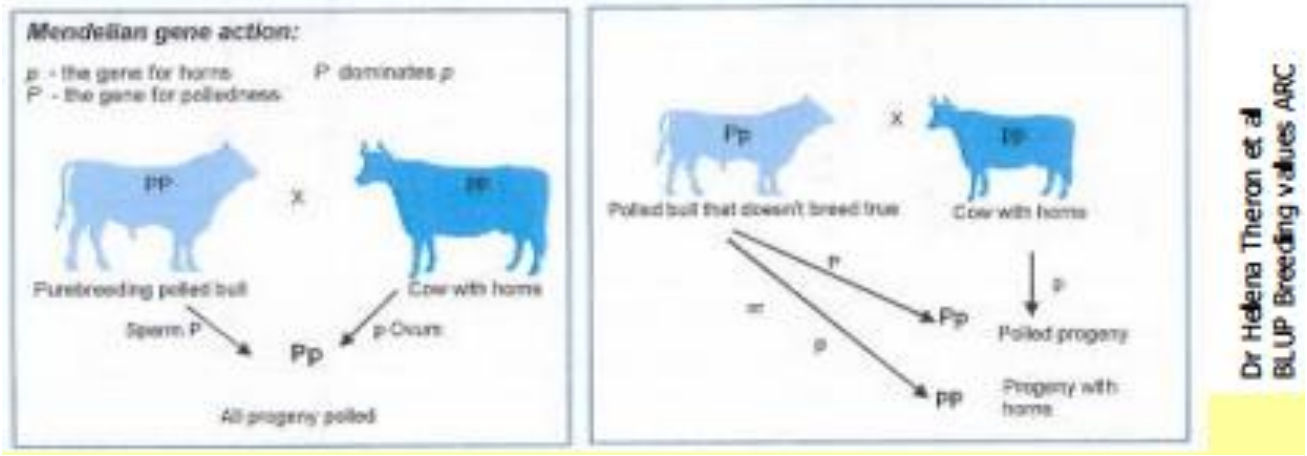
- When two gametes unite, the resulting zygote receives two complete sets of chromosomes carrying two complete sets of genes (diploid).
- When the zygote develops into an organism, each cell receives two complete sets of chromosomes carrying two complete sets of genes.
- The interaction of the two sets of genes contained in each cell determines the characters which show in the organism.
- When this new organism produces gametes, reduction division (meiosis) causes the paired chromosomes to separate, so that only one member of each pair goes to any one gamete.
- This separation of chromosomes provides the mechanism by which allelic genes are separated from one another.
- Since each gene retains its own identity at all times, allelic genes separate in pure form.
- Chance determines how gametes unite to produce the next generation. Therefore, it is chance that determines the recombination of the segregated genes.
- The recombination of genes by chance results in various ratios (Mendel), such as the 3: 1 ratio
- The gene theory explains the way in which genes are carried over from one generation to the next; that is the mechanism of this process. What the gene really is that its bio-chemical composition and bio-chemical action first became clear by virtue of research done after 1950 and with which people are still busy.

Example:

P = Gene for cattle without horns.

p = Gene for horns

P is dominant over p.



Definition:

Monozygotic - Both the gametes have the same genes.

Heterozygote - Half of the gametes have the dominant gene while the other half has the recessive gene.

Quantitative inheritance

Quantitative inheritance is very common in nature; it is common among plants and animals. Most production traits of farm animals such as growth rate, milk production, and hair and wool production is inherited in this way. Many genes control quantitative traits, each with a small effect, while the environment plays a more important role in the expression of the trait. To fully understand what is meant by certain expressions let us explain a few terms.

Genotype

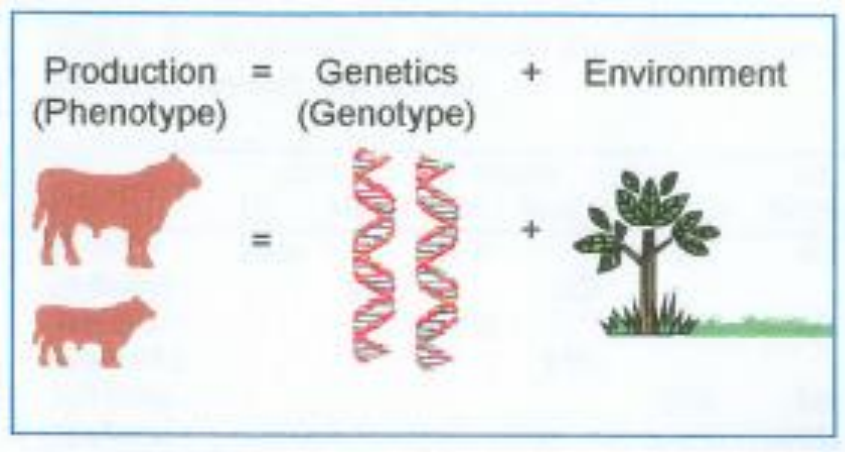
The genotype of a cow, ram or chicken can be described as that specific individual's genetic makeup, in other words, the unique genetic composition of that particular individual. No two individuals, except for clones and identical twins, have the same genotype. At present the genotype cannot be identified because it is inside the very small cell nucleus. Part of its expression in the individual is also obscured by the environmental influence on the development of the individual.

The phenotype

The phenotype, on the other hand, is how the individual expresses itself. In other words, how the individual will look like or what it's mass, colour or built will be. The phenotype is a measurable expression of all environmental and genetic contributions put together in the individual, plus the interaction that the environment changes has on the gene combination of the genotype.

In short:

Phenotype = Genotype + Environment + Interaction of the environment and the genotype.



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The phenotype (P) of an animal refers to the measurement of the animal, e.g. weaning weight (or any other performance record). The genotype (G) is the total genetic composition of the animal for a specific trait and the environment (E) refers to all environmental effects that have an influence on the measurement.

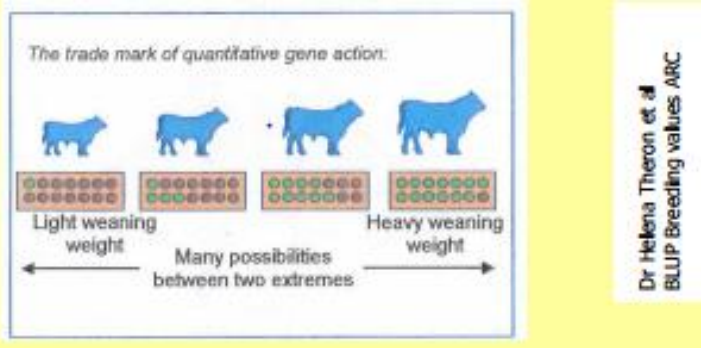
Because most of the production traits inherit in a quantitative way, it is very important that the breeder of farm animals has a basic understanding of how quantitative traits can be selected.

Heritability

Heritability is an indication of the number of genes, that determine a certain production trait, is transferred to the progeny. In genetics the term positive genes is used for the genes that supports and contributes to the development of the trait while the term neutral genes is used for the genes that does not support or contribute.

Example:

Body size of sheep or cattle



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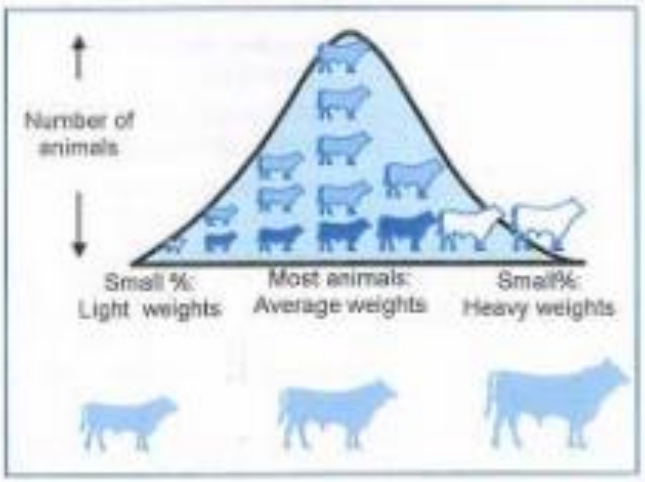
A small sheep and a large sheep will have the same number of genes that are responsible for the size of the sheep. If the two sheep are kept in exactly the same environment, the large sheep will have more positive genes for body size and the small sheep more neutral genes.



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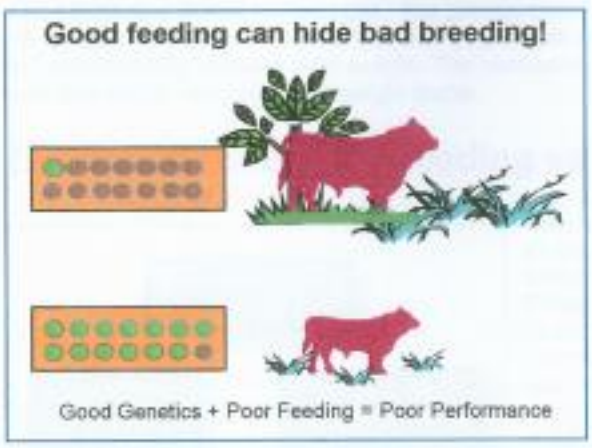
The environment also plays a very important role and may be responsible for 70% of the size of the sheep and the genes only for 30%. Then we say the heritability of body size is 30%. That means that 30% of the body size was inherited form the parent's genes. One important aspect to remember is that although the heritability of a trait is 30%, it means that 30% of the factors determining the body size were inherited from the parents. Each parent contributes only a half of the genes responsible for body size.

If both parents contribute, say 10 positive genes for body size, the body size of the offspring will be bigger than when one parent contributes 5 positive genes and the other parent 10 positive genes, and the environment is kept the same.



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If an animal with a high genetic potential is not fed, it will be impossible for him to reach his genetic potential. A genetically inferior animal, on the other hand, which is well fed, will perform much better than his genetic potential. IN THE SAME ENVIRONMENT, however, the animal with the superior genetics will perform better. Genetic improvement is permanent and is transmitted to the progeny, which is not the case with environmentally induced good performance.

How does a farmer use quantitative inheritance to improve his flock?

Repeatability. As seen in qualitative traits, some bulls will breed purely for certain characteristics. In other words, he is homozygous for that particular aspect. He will repeatedly transfer a trait to his progeny.

However, in quantitative traits, such as body size and milk production, that will not be so clear-cut.

After careful selection and by means of line and inbreeding for a specific trait, the "positive" genes that enhance that trait, will accumulate in the progeny. We will say the progeny become more Homozygotic for a particular production trait. That animal will transfer his super gene combination to his entire offspring. We call that the animal's high repeatability for a specific trait.

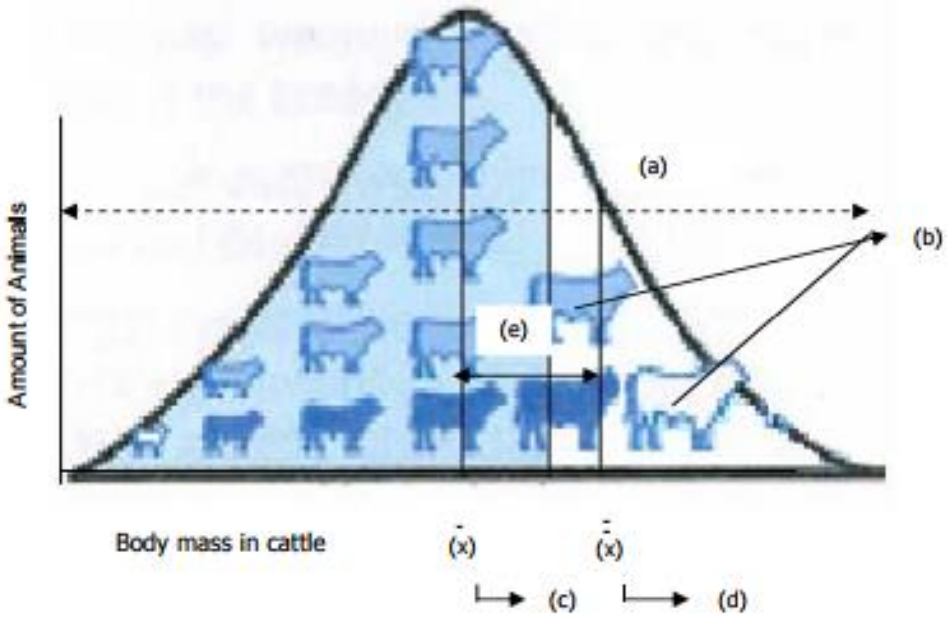
Selection of animals to improve performance

The normal curve

The so-called normal curve and selection: The normal curve is a graph that gives the variation for a certain trait among farm animals. Let us use fleece mass of merino sheep to explain.

In a flock of merino sheep there will be sheep that produces only one kilogram of wool per year and there will be sheep that produces 6 kg of wool per year. Then there will be a lot of sheep producing wool between 1 and 6 kg wool per year. The variation of wool production will therefore be between 1 and 6 kg of wool per year.

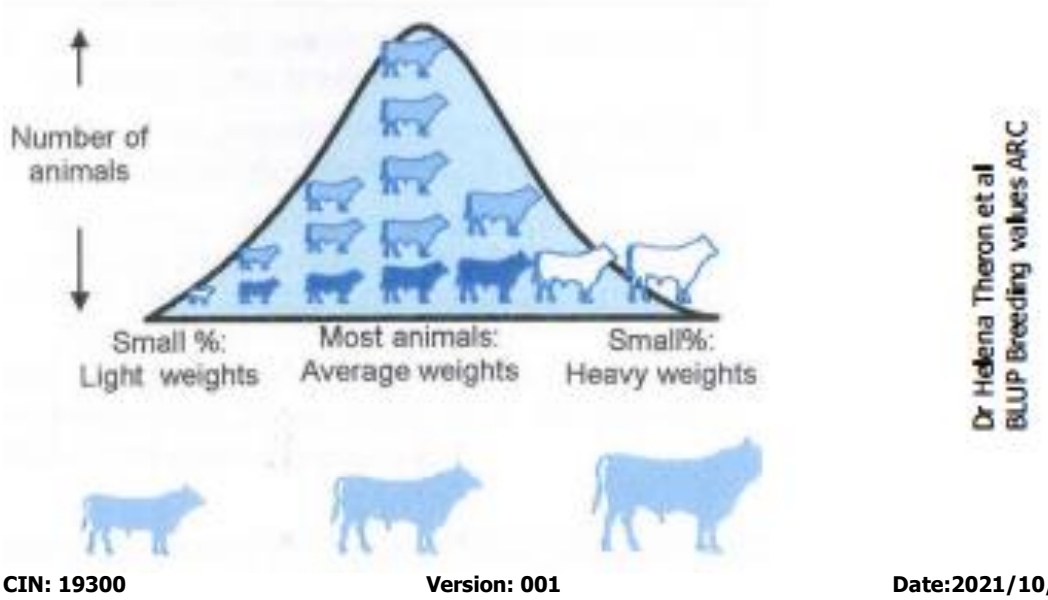
If you plot all the sheep's production on a graph, then you will find that most of the sheep will produce round about 3.5 kg (the average wool production of the flock) of wool per year. The curve will look like a clock and is called the normal curve.

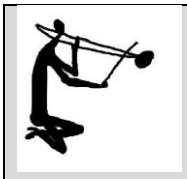


a) Represents the variation in body size of the cattle
b) Represents the selected group of animals
c) Represents the average of the population
d) Represents the average of the selected group
e) Give you the selection differential

You can use this curve to select the animals that are superior, and you can work out the selection differential. That is the amount (difference) the average of the wool production or body mass will be higher in the selected group, than the average production of the sheep or cattle in the unselected population. Another example: Body size in cattle.

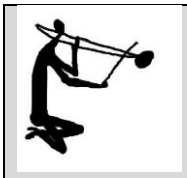
Cattle example



	**Individual Activity 1a:**

The importance of a good reproduction rate in farm animals

To improve your flock, it is important to cull a few female and male animals every year. The average reproductive lifetime of female animals is between five and seven years. If keeping in mind that an animal rarely reproduces in its first year, you will replace breeding stock at a rate of about 20% per year.

	**Individual 1b:**

You will see that he needs nearly a 100% lambing percentage to achieve his goal. The most important aspect to remember where single and twin offspring are concerned is that it is better to rather concentrate on the improvement of the male animals than to give too much attention to female animals.

You can select very strict and will still be able to improve your stock. A ram or bull, if they are correctly selected and tested before you use them intensively; will contribute much more to the improvement of the flock. If you use 1 ram to mate with 30 ewes, half of his gene- influence will be contributed to the offspring (lambs) of all 30 ewes. Now you can see now how important it is to ensure that your breeding animals are fertile and that the male animals are superior for the traits you want to improve.

BREEDING SYSTEMS FOR FARM ANIMALS

Introduction

We have looked at the importance of a high fertility rate to be able to select successfully. To be able to breed successfully, also needs a plan. To understand the plan better, let us have a look at the different breeding systems.

The success or failure of any system depends on:

- The frequency of the desirable genes that can be accumulated in the breeding flock.
- The breeder's ability to select effectively.
- The breeder's ability or good fortune in mating the correct animals. Any system of animal breeding may be classified under one of two headings, namely inbreeding and out breeding. Inbreeding includes line breeding and family breeding; out breeding includes specie crosses, upgrading, crossbreeding, and out crossing. Inbreeding is the mating of related animals; out breeding is the mating of unrelated animals.

Inbreeding

Inbreeding involves the mating of animals related to each other. More specifically, the mating of animals that is more closely related to each other than the average relationship in the flock, and even closer than any two animals drawn from the flock at random. The most intensive form of inbreeding is the repeatedly mating of a full brother with a full sister, sire with daughter or son with dam.

The genetic effect of inbreeding is that it makes more pairs of genes in the population homozygous.

In general, the effect of any system of inbreeding is an increasing of homozygosity and decreasing of heterozygosis. If harmful recessive genes are present in the stock, inbreeding will convert them (homozygous), thus enabling us to eliminate them at a faster rate. It is usually impossible, even by the most rigid selection, to rid an inbred line of all detrimental recessive genes.

Inbreeding depression

Past experience has shown that inbreeding is usually associated with an overall decline in vigour and performance. Some examples of inbreeding depression are given in Table A.

Table A Inbreeding depression per 10% increase in inbreeding coefficient

Character	Inbreeding depression per 10% increase of F	
	Units	% Of non-inbred mean
Cattle Milk yield	 136 liter	 3.2
Pigs Litter size Mass at 154 days	 0.38 young 1.64 kg	 4.6 2.7
Sheep Fleece mass Length of wool Body mass at 1 year	 0.30 kg 0.12 cm 1.33 kg	 5.5 1.3 3.7
Poultry Egg production Hatchability Body mass	 9.26 eggs 4.36% 0.02kg	 6.2 6.4 0.8

From the results of these and many other studies we can generalize that inbreeding tends to reduce fitness. Thus, characters that forms an important component of fitness, such as the number of young born, or lactation in mammals show a reduction after inbreeding. In saying that a certain character shows inbreeding depression, we refer to the average change of mean value in a number of inbred lines. These separate lines are commonly found to differ to a greater or lesser extent in the change they show.

Inbreeding is the most powerful instrument at the disposal of the breeder to build up uniform or similar families or bloodlines. Inbreeding is therefore the only way in which pure-breeding groups can be obtained. However, breeders must realize that purity resulting from inbreeding is attributable to the system of mating related animals, while selection merely gives direction to this process.

In practice "pure breeding" usually means inbreeding within a specific breed and crossbreeding with other breeds thus being excluded.

The most important reasons for the application of inbreeding in a flock are the following:

- It is necessary when the relationship with a specific good ancestor must be maintained at a high level.
- It helps to reveal undesirable recessive characters and eliminate it from the flock.
- It results in uniform and separate families, so that the selection between family groups can be applied effectively.
- It increases pre-potency.
- Sometimes it is necessary because of financial considerations, particularly when another good sire must succeed a specific ram in use, which is of excellent quality and has been purchased at great expense.

The danger of intensive inbreeding is that the accumulation of undesirable homozygous genes takes place at such a rate that it is impossible to remove all the animals showing weaknesses as a result, from the flock. Some of these undesirable genes will therefore be fixed in the whole flock.

Definition:

Pre-potency - Power superior to that of the other parent in transmitting inheritable characters to the offspring.

The phenomenon of degeneration resulting from inbreeding may easily make its appearance in a flock without being identified as such. This problem probably arises when farmers breed their own rams by using a few purchased stud rams on a nucleus flock. A nucleus flock is usually small, which means that the successive sets of rams bred from it will therefore practically be regarded as half-brothers. Lambs of successive years will therefore be cousins, and this causes an increase in inbreeding of approximately six per cent in the flock. Dams can also be regarded as of poor quality.

The danger of artificial insemination can also bring about severe inbreeding. The degeneration caused by inbreeding is often greater than the estimate inbreeding improvement resulting from the higher selection intensity. An unqualified recommendation can therefore not be made for the application of artificial insemination with a small stock, particularly not in cases where the flock consists of less than 2 000-breeding ewes.

Line breeding

Line breeding is a form of inbreeding and a system in which the relationship of an individual, or individuals, is kept as close as possible to some outstanding ancestor. The ancestor is usually a male rather than a female because a male produces many more offspring than a female, and this allows a greater opportunity to prove his merit by means of a progeny test. The genetic effect of line breeding is the same as that of inbreeding. Thus, homozygosis is increased, but in addition, line breeding increases the probability that the line-bred offspring will possess the same genes as the ancestor to which line breeding are directed. Line breeding is also possible when the outstanding individual is already dead or not available for breeding purposes. In such a case one or more of the ancestor's sons or descendants may be used to keep the relationship high.

Out breeding

This is the breeding of animals not related to each other. The forms of out breeding to be discussed here are:

Species crossing

This is the widest form of out breeding and involves the crossing of different animal species, for instance, the donkey with the horse. This type of cross is of little practical use in the small stock industry.

Upgrading

Upgrading is the continual use - generation after generation - of male animals of a specific breed in a flock of another breed, e.g., the successive use of Merino rams on a hybrid flock, for the purpose of gradually building-up a Merino flock. Upgrading is the most economical way to build up an ordinary stock to the level of stud animals, or purebred animals. The rate at which purebred male animals will change the genetic constitution of a flock is represented in the Table B:

Table B Rate of blood change with upgrading

Generations	Percentage replaced	Percentage original blood
1	50	50
2	75	25
3	87.5	12.5
4	93.75	6.25
5	96.87	3.12
6	98.44	1.56
7	99.22	0.78

It is clear that a relatively larger improvement takes place in the first few generations. In South Africa many karakul flocks were built up by the continual use of karakul rams in a flock of the Blackhead Persian breed.

Cross breeding

This term is used for the crossing of purebred animals of different breeds. (Merino crossed with Dorset Horn, etc.). Such a cross usually results in a larger animal, greater vigour and a better breeding capacity. The amount of improvement in these characters however differs for different crosses. On the other hand, crossbreeding destroys the character of pure-breeding or homozygosis and crossbred animals (the products of crossbreeding) will, although they may be excellent individuals, not breed pure.

The advantages and use of cross breeding is as follow:

- The application of hybrid vigour or Heterosis. It is applied in the production of meat, milk and sometimes wool. It is generally known that the best utilization of the Heterosis effect can be obtained in a system where the mother herself is a hybrid animal.
- The development of a new breed or breeds.
- With the development of a new breed, the two breeds chosen as parents are crossed. Sometimes another breed is also introduced in the crossing. The new breed is then developed by strict selection according to the aims of the new breed.

Out crossing

This is the crossing of animals within a pure breed of animals, but which do not have a common ancestor or ancestors for many generations. Breeders often make use of this method to introduce new blood into a stud or flock and thus to minimize inbreeding. The principal here is to find an animal better than the animals in the farmer's own flock or stud.

Heterosis or hybrid vigour

The phenomenon of heterosis vigour is generally known. A classic example is that of a mule, which is hardier than any of it parents. The chief character of hybrids, in which they differ from pure bred animals, is that they are more heterozygous in their genetic constitution and for this reason hybrid vigour is ascribed to increased heterozygosis.

Definition:

Mule - Cross between a donkey and a horse.

Breeding season

Some farm animals have very specific breeding seasons. In the previous level we have discussed that very well. To refresh your memory:

The British sheep-breeds have a very well-defined breeding season and so have the Angora goat in South Africa.

The angora goats' breeding season starts in the fall, late February, March and reaches its peak around April, May and decline towards the end of July.

Other breeds like the Dorper and the Indian Bikaneri have a very long breeding season and show no real anoestrus period.

All the Merino and Merino crosses exhibit a long breeding season. There are however farm animals that have a very specific breeding season as day-light length, or the lack thereof play a big role.

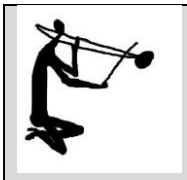
By controlling the daylight, one also has control on such animal's production cycle.

Laying hens of most poultry can be controlled in that way.

Breeding systems and modern technology

There are a lot of breeding systems that can be used in farm animals. The best breeding system to improve production is not always achieved without modern technology.

Beef cattle farmers have a very extensive breeding system going. They test the progeny of the bulls (they want to use in their breeding plan) in a well-structured way. They use production traits such as daily growth rate, weaning mass and a lot of meaningful production aspects in a national progeny-testing scheme.

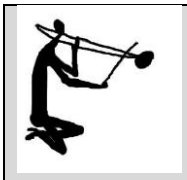
	**Individual Activity 2:**

Different breeding methods for farm animals

Introduction

A management programme on a farm must include a lot of aspects. One of the most important aspects that must form part of your management plans is your breeding program.

You have studied from level I all the different aspects that play a role in managing your breeding. Now you can use your knowledge to compile a management program for a farming enterprise.

	**Individual Activity 3a:**

DIFFERENT BREEDING METHODS THAT CAN BE IMPLEMENTED IN YOUR BREEDING PLAN

Every breeding method can be implemented and have its own advantages and disadvantages. We have discussed the different breeding methods in the previous level. It is such an important

aspect that we will briefly look at it again. The main aim is to get as much offspring from your animals as possible.

Intensive farming with dairy cows enables the farmer to detect cows in heat (oestrus) easily and therefore it is easy to implement an AI breeding program. The farmer normally uses a bull on his heifers and use AI on his cows. The AI industry is very well developed in the dairy industry.

Other animal breeds and the breeding programs used

Mass mating

Mass mating is where three to four percent males are put among a flock of ewes or a herd of cattle.

Especially on extensive sheep farms this is the most common breeding method. The farmer must be sure that the rams in use are fertile. Several methods can be used to ensure that the ewes are served. In beef cattle the numbers are usually smaller and therefore the farmer can give more attention to the heifers than to the old cows. Sheep however can be run in very large camps and definite methods must be exploiting to make sure that all the ewes make contact with a viral ram.

Methods to make sure mass mating is a success

- Make sure that the rams are fertile by testing them before they are put among the ewes.
- If mating occurs for a period of six weeks, make sure that the rams get enough rest.
- Use between 3 – 4 % fertile rams among the ewes (three percent when all the rams are experienced and 4% when some of the rams in the group are still young males).

How to rest the rams

- The best way to rest your rams is to divide the rams in two groups.
- Make sure the condition of the rams is good.
- Give them enough exercise. Exercise and good nutrition is most important to keep your male animals healthy and fertile.
- Use one half of the rams and replace them with the other half after two weeks. Keep on rotating them every two weeks to ensure that they gain condition and get enough rest. Put all the rams among the ewes for the last two weeks.

- It is also a good thing to make sure that the breeding animals (males and females) mingle every day. One water trough in the breeding camp will help in this respect. In group mating, hand mating and artificial insemination, the farmer has better control over the mating process and therefore less rams are necessary.
- A very important point to remember is that the rams must be carefully observed and rams with poor libido and dexterity must be replace with more vigorous rams.

Group mating (group breeding)

In this case the farmer selects a few ewes and mates them with a certain ram. The selected ewes accompanied by a selected ram, are run in a small paddock or camp for about a month.

Hand mating (hand breeding)

Hand mating is a little bit more complicated. The female sheep (let us say 300) graze in a camp, but every morning they are gathered in a big kraal where teaser rams are put in with them. Then, when a teaser ram (he has black paint under his belly for this reason) marked an oestrus ewe by mounting her, the ewe is caught and transferred to a fertile ram in a small kraal. All the ewes that are selected to be mated with a particular ram, is put in the kraal with him. When an ewe is fertilized, she is marked, recorded and joins up with the fertilized flock. After all the ewes in oestrus are identified, the flock is allowed to graze for the rest of the day, until the afternoon. In the early evening the flock is gathered again, and the morning's procedure is repeated. The ewes that were mated the morning are mated again together with the newly identified ewes in oestrus. The new ones are also marked and put among the mated ewes to be mated again the next morning.

Group of ewes identified for hand mating and mated one by one by a specific ram.

AI (Artificial Insemination)

Artificial Insemination is a more technical method of mating. A few methods can be followed:

- The ewes are synchronized.
- The ewes are synchronized by injecting them with hormones to make them come in heat and ovulate at the same time and then a person inseminates them in the morning and in the afternoon.
- You need special equipment to inseminate a ewe that will be discussed under a unit standard for artificial insemination.
- The second method is to identify ewes in oestrus [the same as for hand mating]. The marked ewes are then inseminated artificially by a human. The procedure is repeated in the afternoon.

Management of the pregnant animal

Farm animals need special attention one or other time during their pregnancy.

The pregnancy period (gestation period) can be divided into three stages. The first stage can be seen as a continuation of the period just before mating and requires no special treatment. The female animal must be in a good condition and well fed from approximately three weeks prior to mating. That will ensure that the oestrus period is well-defined, and the mating will be successful.

During the early days of pregnancy, the zygote is very small and needs to be nourished till implantation is well established. After implantation of the embryo and early development of the placenta very little extra feed above maintenance is needed in the adult pregnant female till late in the second trimester (2/3 of pregnancy). During the last third of pregnancy the foetus develops and grows fast. At this stage a female will need extra and good quality feed for building up reserves as well as foetal growth. During the last days, just before birth, the foetus grows very fast. The feeding during this important period is very critical because too much energy and high protein feed may result in a too big foetus and birth problems may occur. However, too little energy can be more dangerous because the female will mobilize her fat reserves. That will produce energy but will also produce ketoses and pregnancy toxaemia may result. Pregnancy toxaemia, a sub-acute metabolic disease of ewes in advanced pregnancy, is characterized by hypoglycaemia, ketonemia and ketonuria. It starts with a quick drop in blood glucose levels and these effects the capacity of the rumen in holding enough feed to be able to

feed the foetus and the ewe. This occurs most commonly when the ewe carries a twin or triplets. Good quality energy feed during the days before birth is essential to prevent the condition.

Feeding after birth

The nursing period is also important. The requirements of the female during lactation is also much more than maintenance.

Dairy cows normally use a lot of their reserves during the first three weeks after birth of the calf. Their milk production increases during that period and reach its peak more or less at three weeks after birth. The intake of the cow will also increase. The space in the abdomen is more because the foetus and placenta were expelled during birth that leaves more space. Now the farmer must make sure that the female animal gets enough good quality food to satisfy her maintenance and production needs.

Management of the male animal for the breeding season

Care of the male animal

The male animal plays such an important role that a few points must be remembered. Make sure the male animal is in very good health, gets enough exercise and gets enough good quality feed. It sometimes happens that the male animal can develop food related diseases such as kidney stone when the ration phosphorus concentration becomes too high. Sometimes the ration contains too many concentrates and ailments such as sour stomach (acidosis) may occur. Male animals are expensive and must be treated well.

When male animals are bought from a breeder the following factors must be established:

- **Inoculation**: Enquire from the breeder against which diseases the male has been immunized. If the male has not been immunized against all local diseases, do so immediately.
- **Dosing**: Determine when the male was last dosed to ensure that he is kept free of internal parasites. Tapeworms and roundworm species can infect all male animals.
- **Dipping**: No young male animal that is chased into the veld and never checked for lice and ticks can be expected to thrive. Every time they are dosed, check for lice and ticks.

Dip at the first sign of lice or for heavy tick infestation. Of course, in heart water areas, these dipping are naturally more frequent.

- **Handling**: Since a high-quality diet increases the possibility of "turned intestines", especially for animals such as sheep rams or Angora goat rams, the handling of male animals during shearing, dipping, etc. should be with the necessary caution to prevent this condition. Although the incidence is very low, whenever it occurs it is fatal and causes death within 30 minutes.
- **Nutrition**: This is possibly the most important aspect of male care. Buying a ram that has been well fed, and then suddenly expecting him to mature properly on poor grazing with no nutrition, can be compared to someone buying a prime plant from a nursery and then planting it in barren soil. The results will be the same - disastrous.

One must always keep young male animals with older females so that the males stay in contact with the females during their puberty stages. It ensures that males develop a normal sex relationship towards the female sex.

Test the male animals for fertility before using them in the flock.

Work as opposed to overwork: Many people expect too much from a male animal. Always have at least 3%, preferably 4%, males in the flock during the mating season

Pregnancy diagnosis

There are many ways to diagnose pregnancy in female farm animals. It is relatively easy to diagnose early pregnancy in bigger animals like cattle. Normally a skilled person examines the female for pregnancy by palpation through the rectum. It is possible to diagnose fairly accurate pregnancy from as early as 1 - 2 months pregnancy.

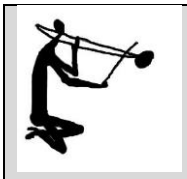
Definition:

Palpation The act of feeling with the hand and/or the application of the fingers with light pressure to the surface of the uterus, for purpose of determining physical diagnosis.

Small stock makes the diagnoses more difficult. There is however very modern apparatus available. Though expensive, the apparatus can be used with high accuracy by a skilled operator. The apparatus is called an ultrasonic scan apparatus and make use of sound to produce a picture

on a screen. It can then be established if the female is pregnant. Although there are a lot of other methods, it is not practical and therefore not discussed.

An experienced farmer can also select ewes in the late pregnancy stage by looking at the development of the udder and the development of the abdomen area. A good stockman can sometimes select pregnant animals as early as a month and a half before birth.

	**Individual Activity 3b:**

Summative 4

Learning Unit 5: Animal Behaviour

Unit Standard	
116300	Apply procedures to manage damage control in animals and victims
Specific Outcomes	
SO 1: Investigate animal defence mechanisms and evaluate related management procedures. SO 2: Communicate evaluations and findings concerning animal damage, to superiors and react with understanding when treating them. SO 3: Suggest alternative practices or control systems that will ensure safe management of animals. SO 4: Maintain systems implemented to ensure safe handling and containment procedures. SO 5: Describe the basic biological and behavioural concepts that will illuminate the geographical, traditional and historical distribution and use of the animal.	
Learning Outcomes	
Identifying	Science
Organising	Communicating
Demonstrating	Contributing
Collecting	Working

ANIMAL DEFENCE MECHANISMS

Introduction

All farm animals including cattle, sheep, goats, horses, pigs and poultry, although domesticated, can still have wild tendencies. As you will know from having studied Defensive Animal Behaviour at NQF Levels 1, 2 and 3, farm animals may behave defensively or aggressively under various circumstances.

Such circumstances will include the breeding season (when the females are in oestrus or the males are in rut), when they are caring for their young (after birth), or when they feel threatened or are in pain. Animals may also act aggressively if they have certain diseases such as rabies.

Even without the exhibition of aggressive or defensive behaviour an animal may pose a safety risk due merely to its size. For example, a cow in a crush could break your arm if you are working through the railings and she moves to one side. It is very important that you are able to distinguish between these different situations and respond accordingly.

Gathering data regarding animal behaviour and factors that could influence animal behaviour

Before undertaking any work on an animal production facility, a quick, albeit thorough, assessment should be made of the potential risks that may be present on the production unit.

- Check accident records to identify tasks most likely to cause injury. Evaluate the records to see if there are new records of accidents.
- Consider situations that cause stress and injury, and monitor the situation closely.
- Consider effects of weather and herding on animal behaviour, and time allowed for settling down. Take also into account sex, weight and temperament of the animals.
- Check potential risk and safety advantages of stock facilities, including mechanical aids and work layout.
- Consider what improvement is required before you can confidently be sure that safety is maintained.

The following questions should be asked and answered:

- At what stage of production is the herd/flock? (For example, are they in their breeding season, have they already given birth to their young, are the young being weaned?)
- Is the herd or flock divided into different groups that may be at different stages of production? (For example, one group of animals may be in their breeding season, while another group have already given birth to their young – this means that as you move from one area of the farm to the next – from one camp to the next – the herds may respond differently to human interaction)
- Are the animals due to undergo any type of processing treatments? For example: do the animals need to be herded into a crush or handling facility and will processing treatments such as branding, castration, vaccinations or dipping take place?
- What type of animals is on the production unit? For example, are the farm animals small stock such as sheep or goats, or large livestock such as cattle or horses?
- What breeds of animals are present? For example, are the breeds the more docile types such as Holstein/Friesland cattle or aggressive breeds such as Brahman?

- Are the handling facilities in good condition? For example, are the floors of sloping areas grooved or rubberised for better grip? Are the railings solidly planted? Are there pieces of wire or metal jutting out of the sides of the crush? Do all the gates open and close well? Has shade been provided for humans and animals? Are the water troughs working and the areas around the water troughs dry and compact?
- Do the handling facilities allow an effective flow of animals through the facility? For example, to sorting gates open in both directions to allow animals to be sorted in different ways. Can animals be moved through the system in both directions? Do the handling facilities allow the handlers to work on the outside of the containment area?
- What time of the day is it? For example, is it still early in the morning or late afternoon when it is still cool, or is it already getting to the hottest part of the day?

Understanding the attributes of defensive behaviour

Animals' senses function much like those of humans; however, animals may detect and perceive their environments very differently as compared to the way humans detect and perceive the same surroundings.
Animals, with their wide-angle vision, have a reduced ability to perceive depth and to judge distances.

Cattle and horses have panoramic vision, which means they can see everything except something that is directly behind them. Sudden movements behind cattle will "spook" them because they can see a quick movement but cannot distinguish how close the perceived "threat" is nor can they determine the seriousness of the movement. In response to sudden movements, fear may develop in the animal's mind that triggers a "flight" or "fight" response. While most animals are colour-blind, their hearing is extremely sensitive relative to humans, especially to higher frequency sounds.

Knowing these characteristics of animal vision and hearing, we can understand why animals are usually balky in unfamiliar surroundings. Experienced animal handlers should recognize that animals perform and or produce best when their environment is as comfortable as reasonably possible.

Avoid extremes in temperature, humidity, lighting, and other environmental conditions such as loud noises, sudden movements, excitement, and harsh treatment. Not only do animals produce

and perform better when extremes in their environment are reduced, they are also more predictable. Animals with histories of traumatic exposure are more likely to overreact to changing surroundings or when confronted with unfamiliar circumstances. Be extra cautious when animals are being medically treated or examined, loaded, moved, or during other handling operations.

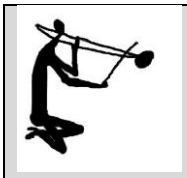
People who work with animals recognize the ability of animals to communicate despite an inability to speak. Most species have and display characteristic signs of fear, aggression, and contentment. These are observed as:

- Raised or pinned ears
- Raised tail
- Erection of the hair along the back (Angry dog)
- Bared teeth
- Pawing the ground (sometimes coupled with vigorous shaking of the head)
- Snorting
- Showing a greater profile (Cat raises its hair to look bigger or a bird will puff out its feathers to look bigger)
- Shaking the head rapidly from side to side (Young cattle or an alerted bull)

Correct animal control systems and handling methodologies – general principals Specific handling methods, like warning signs, vary with species. However, some general handling rules for all animals include the following:

- Most animals respond favourably to routines having calm, deliberate responses.
- Avoid loud noises and quick movements.
- Be patient; never prod an animal when it has no place to go.
- Move slowly and deliberately around livestock.
- Touching animals gently can be more effective than shoving and/or bumping them.
- Respect rather than fear livestock. Breeding stock is highly protective and often irritable. Disposition deteriorates with age and parturition. Old breeding stock can be deceptive, unpredictable, and large enough to be dangerous.
- Special facilities should be provided for breeding stock (especially for large males).
- Most animals are highly protective of their young. Be especially careful around new-born animals.
- Male animals should be considered potentially dangerous at all times.

- Proper equipment and facilities are necessary to assure safety. Extreme caution should be practiced when handling male animals!
- The size, mass, strength, and speed of both individual animals and herds of animals should never be taken lightly.
- Animals will defend their territory and should be worked around keeping in mind that there is always the potential for harm.
- Always provide an escape route (always leave yourself a way out), especially when working in close quarters, with sick or injured animals, and/or under adverse conditions (i.e. severe storms etc.).
- Exercise extra care around unfamiliar animals and enforce extreme care if strangers must be around your animals.
- Maintain equipment and facilities in good repair and exercise "good housekeeping" practices.

	**Individual Activity 1:**

FINDINGS CONCERNING ANIMAL DAMAGE

Introduction

Knowledge of the risks involved in animal handling is an important prerequisite to responding appropriately to that risk. Depending of your level of superiority within the production unit, you may need to respond immediately to potential problems or you may need to report to a manager or supervisor who will assist you to respond appropriately to the risk or to the damage. Always ensure that you have the knowledge to respond appropriately to a problem, if you are unsure, seek assistance immediately.

Evaluate the risk

Once the data regarding the circumstances of the production unit are collected, it is necessary, again quickly but thoroughly, to decide how one will go about the day's activities

- Using accident records, check which tasks and work situations are most frequently linked with injuries.
- Check each identified risk for likelihood and severity of injury.
- Assess proposed safeguards and safe procedures for other risks.

Example:
For each of the factors named in 1.2 above an appropriate response should be developed and any action that follows should be based on the assessment.

Let us use the following scenario to decide on an appropriate response:
Themba has been asked to weigh the one-month-old calves of a Brahman herd of forty cows and is required also to vaccinate the calves and apply pour-on dip. The females and calves will need to be herded to the handling facility which is 500 m from the camp in which they are grazing. Themba has 5 labourers to assist him. The handling facilities are in good condition, with rubberised slopes, shade over the weighing scale area with sturdy railings. Themba checks all the gates into the facility as well as all the sorting gates. He notices that one of the self-locking latches of one of the sorting gates is broken and that the gate is closed using a piece of baling cord (orange nylon cord). He also notices that two of the drinking troughs within the holding area are not working (there are four drinking troughs in total). Themba further sees that there is some garbage (rubbish) within the handling facility (some tin cans, some plastic bags and two empty glass jars). The size of the handling facility is adequate to hold all forty female cattle and their calves (approximately 2m2 per pair).

Themba's assessment of the situation is as follows:

- Brahman's are a large livestock species (cattle)
- They are a notoriously aggressive breed
- The cows are protective of their one-month-old calves
- The calves are unfamiliar with the handling facilities since this will be the first time they will be weighed to check on their growth rate and to dip and vaccinate them
- The handling facilities are relatively far away from the camp; thus, the cow and calf herd must be herded in the correct direction for a distance
- It is still early in the morning, so the task can take place without the animals experiencing heat stress or too much dustiness
- The size of the handling facility is adequate for the herd to be processed

- The self-locking mechanism of the one sorting gate will need to be repaired before the animals are brought to the handling facility
- The two drinking troughs that are broken can be repaired after the animals have been handled, since there are two drinking troughs that are working which will be adequate to water the animals
- The garbage in the handling facility must be removed including the orange baling cord which is holding the sorting gate
- All the labourers are wearing overalls, boots with reinforced toes, peak caps and he notices that each have a pair of thick workman's gloves sticking out of their pockets
- He determines the direction in which the animals should be herded, which gates should be left open before they are brought closer to the handling facility and which sorting gates within the facility should remain closed until the animals are sorted.
- He decides that the calves will need to be separated from their mothers when they are processed since there is the risk that they could be crushed in the chute if they are handled with the larger animals. To do this, the labourers will need to manage the sorting gates in such a way that each calf and dam are separated as they enter the handling facility. Two sorting gates will be used to allow the mothers into the central large area of the handling facility while the calves can be herded into either the left or right side (from where they can be moved to the crush and weighing scale). The handling facility is designed in such a way that the females will be able to see their young, and the labourers will be on the outside of the crush (in other words the labourers will not come between the dams and their calves).
- The railings of the facility are sturdy enough that the labourers can stand on the railings to pour on the dip and vaccinate the calves (intramuscular – in the rump) while they are standing in the crush.
- The weighing scale is a walk-on scale within the crush where a gate is kept open so that it appears as if the chute is clear ahead, but as soon as the animal enters the scale the gate in front and the gate at the back of the animal is closed, so that weighing can take place.
- Themba has two working pens and his record keeping sheets on a clipboard on a working surface specifically built into the side of the weighing scale area of the crush.

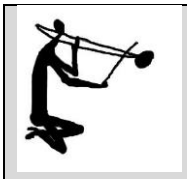
Responding to the assessment or reporting to the manager

Once an assessment has been made of the circumstances of the activities that must take place, matters that are of concern should be reported to the manager, or should be responded to in the appropriate manner.

Using the above scenario as an example, Themba decides to instruct the labourers to do the following:

- One labourer is called on to pick up the garbage in the handling facility after which he should ensure that all the dip, needles, vaccine and syringes are placed on the work table next to the scale.
- One labourer is instructed to fix the gate latch.
- Three labourers are instructed to fetch the cattle. They will be expected to walk to the side of the herd and will use the principles of the "flight zone" to move the herd towards the handling facility. They have been specifically instructed not to shout or prod the animals in any way. The idea is that the herd should remain especially calm while they are walking to the handling facility because the Brahman cows should not feel that their calves are being threatened. Furthermore, a quiet walk will also allow the calves to feel less threatened by this new activity.
- Themba uses this time to sort his record keeping sheets, to read the labels of the vaccination to ensure that he knows what the administration rate should be, ensures that the pour-on dip bottles are working properly, that there is a container in which he can dispose of the used needles, that the correct sorting gates are open or closed, and that the scale is working
- Themba decides that he and his team will be able to handle the processing activity, but he makes a few notes to himself to report the following issues to the manager at the end of the task:
  - That the two drinking troughs within the handling facility need to be fixed.
  - Whether there are any underweight calves or calves with lesions or signs of disease.
  - Whether there are any cows that have lesions or signs of disease.
  - Provide the manager with the weights of the calves as captured on the record sheets.
  - Whether the labourers worked well as individuals and as a team.

- Any circumstances which caused problems during the activity and how they were resolved.

	**Individual Activity 2:**

Here are some suggestions for improving safety in cattle handling.

- Discuss safety concerns in regard to various tasks.
- Always plan ahead. Prepare and communicate safe work practices. Get assistance if necessary.
- Wear appropriate clothing, including protective footwear and a hat for sun protection.
- Make use of facilities and aids - head rails, branding cradles, whips, drafting canes, dogs etc.
- Know the limitations of yourself and others - work within those limitations.
- Lastly, respect cattle - they have the strength and speed to cause injury.

Safe management of animals

Introduction

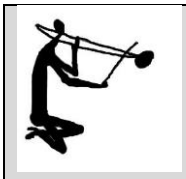
At this level you should be one of the employees in a production system that can make recommendations to your superiors regarding how to improve a system which may be defective. Managers are always looking for better and more efficient methods of doing things. If these new methods mean that there will be less damage to humans, animals and facilities managers will probably be most eager to make the changes. However, most changes carry a cost. When motivating for a change in a production system you should be able to show the cost benefits of the change also.

Problems that may occur in a production unit

In a production system the following problems may occur:

- Animals break out of confinement and stray.

- Animals break the equipment, facilities and infrastructure (and it is not fixed immediately thereafter).
- Animals refuse to enter buildings / facilities / cages / transportation / confined areas etc.
- Animals struggle during handling.
- Animals threaten and / or attacking humans or other animals. x Animals are deliberately hurting /harming themselves.
- Animals are accidentally harming themselves.
- Animals are becoming injured due to competition and pecking-order fights.
- Animals are exhibiting abnormal defensive behaviour (possibly due to some disease such as rabies or mad cow disease).

	**Individual Activity 3:**

Ensure safe handling procedures

Introduction

All production units must be emergency ready. By being well prepared with emergency plans and equipment you will ensure that damage is minimised when accidents happen. To be able to achieve a clear safety record it is necessary to ensure that there are written "Health and Safety Regulations" in place, that the regulations are effective and that all employees are familiar with the regulations. Regular opportunities should be allowed for this information to be refreshed in the minds of the employees and the regulations should be put up on display somewhere in the workplace.

These regulations should include the following:

- Where is the First Aid Kit kept?
- Location of telephones and emergency numbers.
- Who the Health and Safety officers are and how to contact them (At least one person should be trained in first aid)?
- Who to contact in case of a medical emergency (both human and animal)?

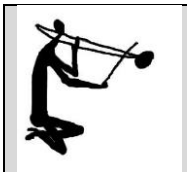
- Who to contact in case a dangerous animal has escaped into a public space?
- Which level of worker is allowed to work with what category of animal under what circumstances?
- What protective wear is expected to be used under what circumstances?
- Who is allowed to administer sedative drugs to animals, where they are kept and how they should be administered?
- If biosecurity (public protection from contamination with animal pathogens) is relevant, procedures to apply Bio-security should be listed.

Because of the potential danger of working with animals and equipment, all employers are obliged by law to pay a levy to the Commissioner of Workman's Compensation. These funds are then available to assist with the medical attention needed by a worker should he or she has an accident or is injured in the workplace. As an employee you are entitled to be re-assured that your employer is paying the levy.

Developing a "Workplace Health and Safety" system

All workplaces should have documented basic procedures that must be followed when workers are dealing with potentially dangerous animals. These procedures should be put up somewhere on display. These procedures are known as the "Workplace Health and Safety Regulations".

The Occupational Health and Safety Act (1993) provides general guidelines regarding the Health and Safety regulations that should be in place in any workplace. It is every farmer's responsibility to make sure that he is aware of and complies with the laws under which he should operate. His activities on farm are subject to such laws and if he does not comply with these laws he may be subjected to prosecution.

	**Individual Activity4:**

Basic information regarding animal handling infrastructure

Having access to good handling infrastructure / facilities goes a long way to create a safe environment in which to handle animals. Points to bear in mind when designing and constructing handling facilities are:

- Use strong and durable materials that can withstand heavy and sudden weight, are easy to clean and do not readily splinter.
- Ensure that floor surfaces are suitably rough to prevent slipping of animals and humans.
- Construct handling facilities under cover or in a shady and wind protected area so that workers do not tire too quickly, and animals do not get agitated in extreme weather conditions.
- Fences and gates need to be in a good state.
- Electric fences need to give a good strong signal to be effective - check the volt reading regularly. Avoid chasing animals towards an electric fence. They will ignore the fence and break it.
- Different species need different sizes and shapes of infrastructure.
- All movable parts of the handling facility need to be free moving (grease or oil joints and hinges from time to time).
- All stables, boxes, crates etc. that are to be used to contain animals, need to be thoroughly checked before they are used. Special attention should be given to sharp objects and loose wires in the handling areas.

For successful beef production, certain facilities are necessary. These facilities must simplify the management of the system and limit labour to the minimum. It must be functional and economical and a safe environment for the animals, as well as a safe working environment for the handlers.

Handling facilities

In the planning of handling facilities, the objective of the facility must be taken into account. The handling facility for commercial cattle will possibly differ from that of a facility for a stud-farm and definitely from that of a feedlot. In a well-designed handling facility, animals can be gathered safely, sorted and controlled. Depending on the size and type of the facility, there are basically five essential components in a well-designed facility:

- Sorting pens
- Crush passage
- Working area

- Crush pens
- Loading platform

Sorting pens Cattle are collected from the field or feeding pens, before being handled. The size of the sorting pens must be as large as the largest group of animals to be handled at a time. Each animal needs approximately 2m² of space in the sorting pen. The shape of a sorting pen depends on the total lay-out of the facility. In feedlots however, provision must be made for a separate recuperation camp. In large feeding pens, a separate infirmary (sickbay) with a crush pen and special facilities will even be necessary.

Crush pens

Crush pens are used to drive cattle from the sorting pens to the loading platform. It is usually provided with moveable gates, used for leading the cattle into the crush, by making the area behind them smaller. Cattle will move into the crush more effectively if handlers wait until the crush is half filled before they drive in more cattle. This will create enough space for the cattle to follow a leader into the crush. As cattle usually walk along a fence and are inclined to stand in corners, a round crushing corral is usually better than a rectangular one, as it helps with the flow of cattle.

Mobile crushes

Mobile crushes are generally used for field work where permanent handling facilities are not close to pens, or where it is not viable. It can also be used to treat sick animals in a camp. Mobile crushes can basically be used anywhere in the field next to a fence. Such a crush will obviously have to be easily assembled and transported.

Working area

The working area is at the end of the crush. This is the area where the animals are handled and can contain the following items:

- Neck clamp
- Body clamp
- Scale

The working area must preferably be provided with a roof and concrete floor. The floor must be made coarse to prevent the animals from slipping. If an earth floor is used, it must be such

that it can drain easily and not be trampled into slush - it should therefore be thoroughly compacted. The work area components must be arranged in such a way that the openings and gates are combined, to make access to the cattle possible. A gate that swings open from the side in the direction of the crush in order to block off the crush for other animals, but give access to the rump of the animal, is convenient. A comfortable work area must be provided in front of the animal.

Neck clamp

A neck clamp is one of the most essential items in the working area and is used to hold the animal in position if work is done on it. Quite a few neck clamps are available on the market, with different opening mechanisms and different neck openings. Guard against delicate neck clamps made from poor materials. The shape of the neck clamp plays a major role in decreasing the vertical movement of the head. The locking mechanism of the neck clap must also have a fine setting. It is advisable to obtain the opinion of other farmers or owners about a certain product on a certain breed before a neck clap is purchased.

Body clamp

A body clamp is used for holding the animal firmly in position when working on it. The sides of the clap swing inwards to clamp the body of the animal. Some body clamps are provided with removable side plates for easier access to the animal.

Scales

The current emphasis on standardization and increasing economic pressure contributes to the situation where a high number of livestock have to be weighed several times during their lives. High demands are placed on scale operators and psychological and physical exhaustion gives rise to inaccurate results, rough handling of the animals and mistakes in information collected. Special attention must therefore be given to the choice and placing of a scale to ensure easy and effective handling of animals.

The four basic categories of scales include:

- Spring balance scale
- Hydraulic scale
- Oil bath scale
- Electronic scale

Basic contents of a First Aid Kit

Annexure (GSR.3) of the Occupational Health and Safety Act (Act 85 or 1993) contains the "Minimum Contents of a First-Aid Box." According to this Annexure and with additions a well-equipped First Aid Kit should include:

- A list of emergency phone numbers, including the police, fire department, ambulance services and poison information.
- Wound cleaner or antiseptic
- Cotton wool for padding
- Sterile Gauze
- Splint wadding
- Sterile gauze swabs
- Forceps
- Scissors
- Safety pins
- 4 Non-woven Triangular Bandages
- 4 roller bandages
- Conform bandage
- Plaster roll
- Anti-allergenic tape
- Plaster strips
- 4 First Aid Dressings
- Lock-on splint
- Disposable Surgical gloves (medium and large)
- 2 CPR mouthpieces
- Eye wash

	**Individual Activity 5:**

An "Incidents register" and "Maintenance register"

To ensure that problems do not re-occur continuously without any changes to the operation being made, it is wise to keep an "Incidents Register". Whenever damage occurs due to defensive animal behaviour or an accident occurs in which a person, an animal or equipment or infrastructure is damaged or hurt, a report should be filled in. This report should include not only all the details of the incident and why it happened and who was involved, but also, how the incident was resolved and what measures were taken to prevent it from happening again. An example of an "Incident Register" is shown below.

INCIDENT REPORT: PETER LANGA'S BEEF CATTLE STATION	
DATE OF INCIDENT:	
DESCRIPTION OF INCIDENT:	
Here the reporter should include the circumstances surrounding the incident, eye-witness accounts, what exactly happened, who was involved, and where the incident occurred.	
DAMAGE OR INJURY SUSTAINED:	
Here the reporter should include the ID of the Animal that was injured or the name of the person who was injured, and a description of the injury that was sustained. Or, the reporter should describe the damage that was incurred on infrastructure or equipment.	
HOW INCIDENT WAS RESOLVED:	
Here the reporter should describe the actions that were taken at the event of the incident (For example: the injured animal was moved to the infirmary, the wound was treated and the animal given a sedative, or the person was moved out of harms way, and his leg wound was treated using the First Aid Kit, or the gate that had been ripped off its hinges was moved out of the way of the animals in the sorting yard).	
ACTIONS TAKEN AFTER THE INCIDENT:	
Here the reporter should explain what steps will be taken to avoid a re-occurrence of the incident and any actions to repair the damage. For example, the reporter may describe that the reason for the incident was the slippery floor of the crush and that a grooved cement slab would assist to reduce the slipperiness within the crush. The report should describe what actions will be taken to install a concrete floor in the crush and by when the work should be complete. Or, the reporter can explain that the items used from the First Aid Kit must be re-ordered and replaced.	

Regular maintenance on the production unit will ensure that equipment and facilities are always in good working order and available for use when required. A "Maintenance Register" should include a list of all the infrastructure and equipment on the production unit, allow a column for a date and an area to mark that the piece of equipment has been checked and maintained. The facility manager should decide how often this maintenance should take place. Maintenance should be a regular task on an animal production unit. An example of a "Maintenance Register" is shown below.

MAINTENANCE REGISTER: PETER LANGA'S CATTLE STATION				
MONTH	JUNE 2006			
WEEK	Wk 1	Wk 2	Wk 3	Wk 4
Item				
Drinking trough No. 1	√	Valve replaced	Leak fixed	Entire drinking trough re-constructed
Drinking trough No. 2	Cleaned of algae	√	√	Cement apron constructed around trough
Drinking trough No. 3	√	√	√	√
Fence in camp No. 1	√	Fixed porcupine hole	Porcupine hole again (Rocks also placed)	√
Fence in camp No. 2	√	√	√	Gate to camp fixed (hinges rusted)
Fence in camp No. 3	√	Two strands replaced for 10m	√	Rocks packed on western side
Sorting gate No. 1	Latch repaired	Latch repaired	Latch replaced	√
Sorting gate No. 2	√	√	√	√
Panels of handling facility	√	Replaced two railings	Painted all railings	√
Roof of sorting facility	√	√	√	Nailed down western corner
Latches of all gates	√	2 repaired	√	2 repaired

Summative 5

Learning Unit 6: Language Skills

Unit Standard	
119471	Use language and communication in occupational learning programmes
Specific Outcomes	
SO 1: Access, use and manage suitable learning resources. SO 2: Formulate and use learning strategies. SO 3: Manage occupational learning materials. SO 4: Conduct basic research, and analyse and present findings. SO 5: Lead and function in a team. SO 6: Reflect on how characteristics of the workplace and occupational context affect learning.	
Learning Outcomes	
Identifying	Science
Organising	Communicating
Demonstrating	Contributing
Collecting	Working

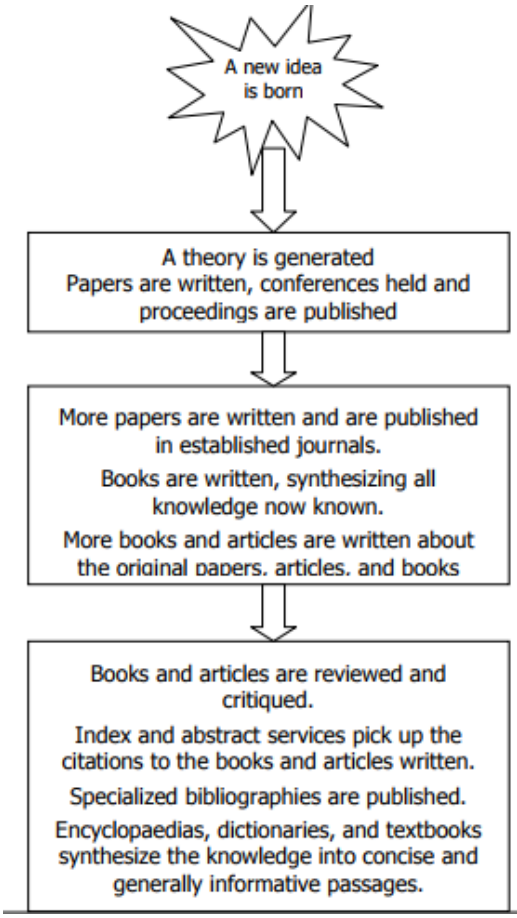
LEARNING RESOURCES AND STRATEGIES

How Literature is structured

Libraries contain information in bibliographies, guides, indexes, abstracts, databases, almanacs, catalogues, newspapers, dictionaries, directories, encyclopaedias, and journals. Although a relationship between these sources may not be apparent to the untrained eye, these different information sources are published systematically to meet the specific information needs of an academic discipline. Researchers using library materials, can benefit from having an understanding of the inherent structure of published literature. Once they see the order in the wealth of materials on the library's shelves, retrieving the information successfully from a discipline's literature becomes a matter of backtracking through its development stages.

The structure of literature

When we talk about the structure of literature, we are describing the physical manifestation of the growth of an academic discipline. As the field matures, the amount and type of literature that become available increase. The literature produced can be divided into three distinct developmental levels.



At the primary level, an idea, sometimes a whole discipline is in its infancy. Great thinkers or pioneering intellectuals discuss new ideas with friends and colleagues, conduct research and postulate new theories.

They disseminate their findings beyond personal contacts by writing and publishing papers and presenting them at conferences.

The secondary level is marked by the increased number of scholars reading, researching, and writing on the original ideas and theories.

The number of articles proliferate and books appear on the topic.

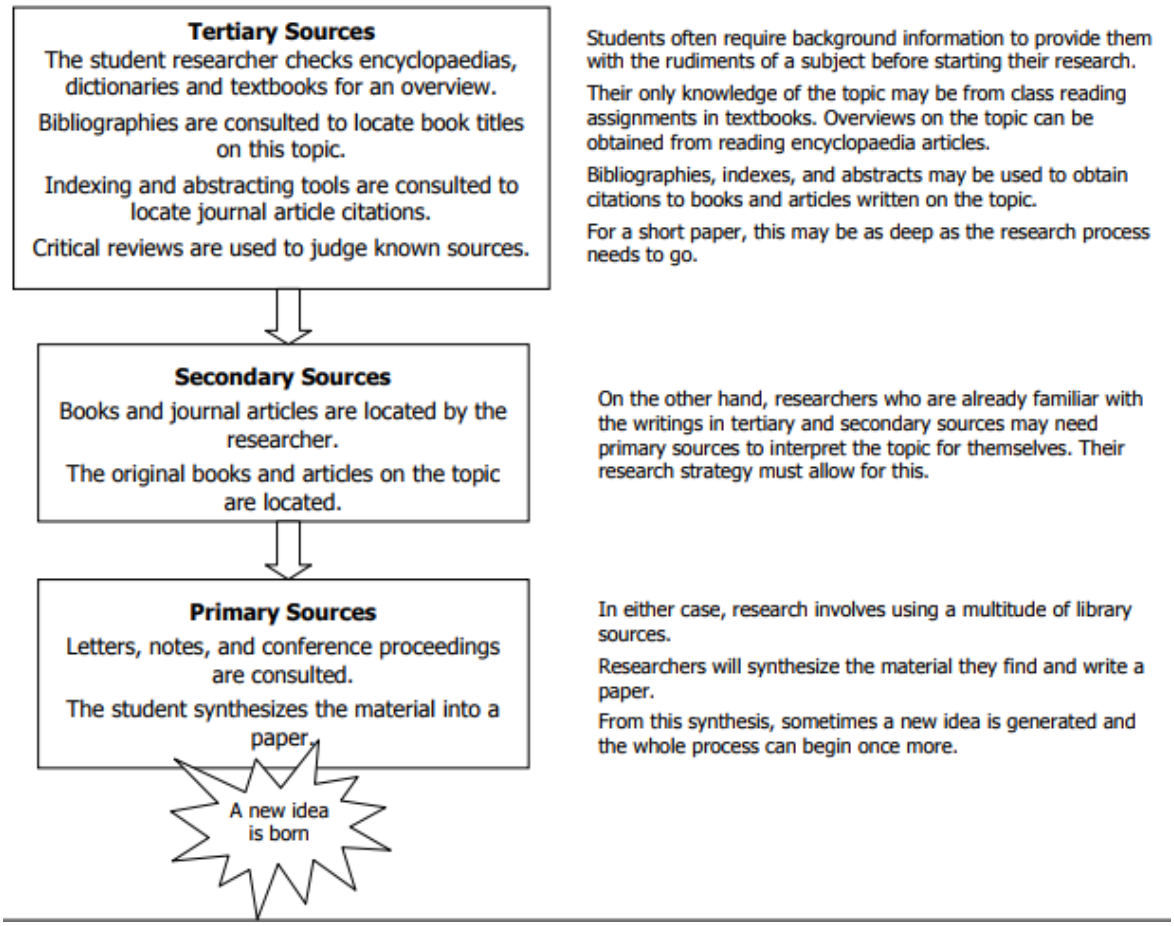
Still other scholars interpret and assess what the first generation of researchers accomplished and publish still more articles and books.

At the tertiary level, the idea becomes widely accepted or a new discipline becomes established.

Curricula are developed, and tertiary sources are published to meet the demand for discipline related reference books and textbooks.

The search strategy

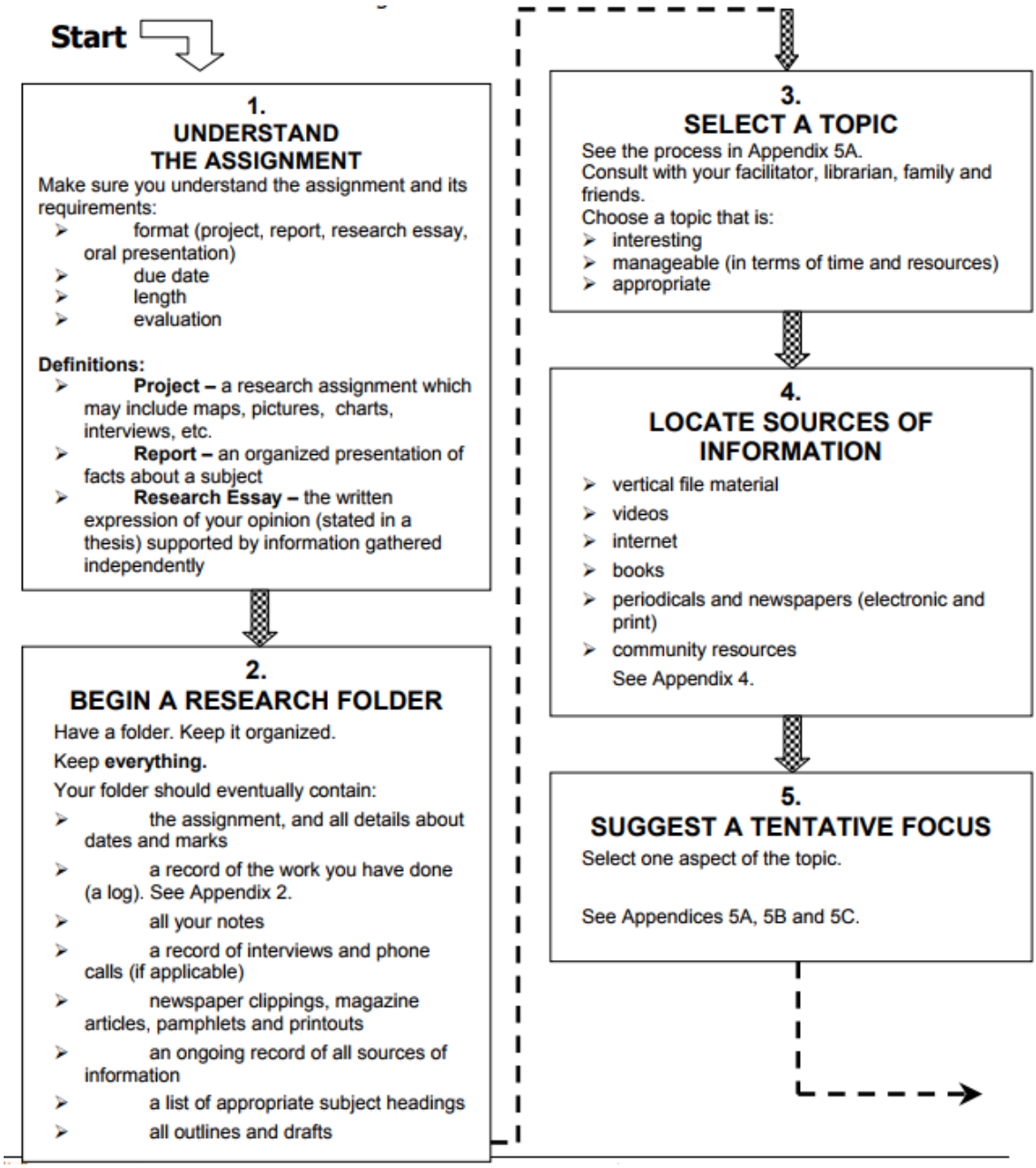
The search strategy is a logical process used by a researcher to locate information that will fill an information need. Where the researcher begins, the literature search will depend on the depth of information required and the researcher's knowledge of the discipline.

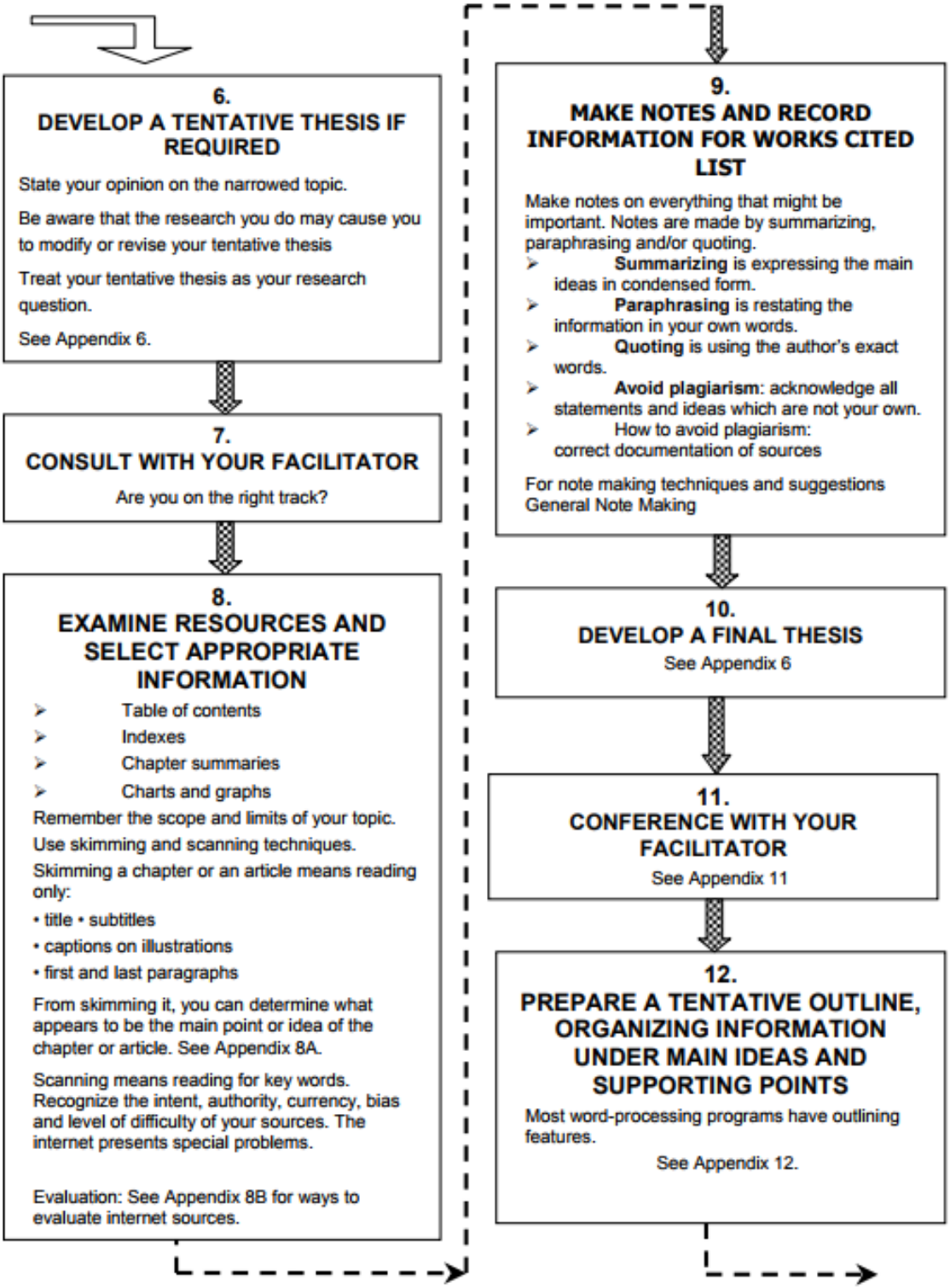


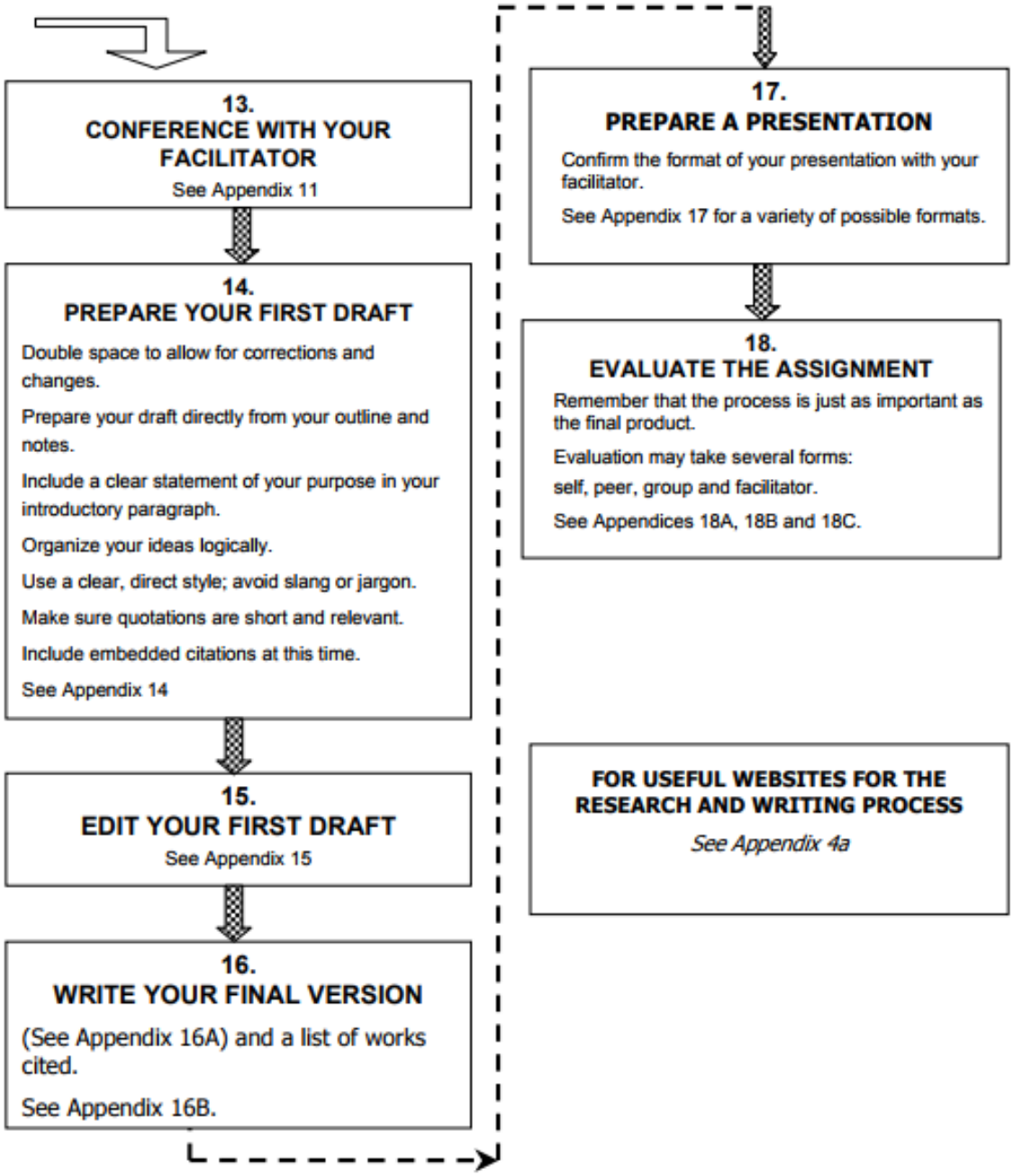
Steps in the Independent Study Research Process

1. Understand the assignment
2. Begin a research folder
3. Select a topic
4. Locate sources of information
5. Suggest a tentative focus
6. Develop tentative thesis if it is required
7. Check/consult with your facilitator
8. Analyse resources and select appropriate information
9. Make notes and record information for works cited list

10. Develop a final thesis
11. Conference with your facilitator
12. Prepare a tentative outline, organize information under main ideas and supporting points
13. Conference with your facilitator
14. Write a first draft
15. Edit the first draft
16. Write the final version
17. Prepare a presentation
18. Evaluate the assignment


Start
1.
UNDERSTAND
THE ASSIGNMENT
Make sure you understand the assignment and its requirements:
format (project, report, research essay, oral presentation)
due date
length
evaluation
Definitions:
Project – a research assignment which may include maps, pictures, charts, interviews, etc.
Report – an organized presentation of facts about a subject
Research Essay – the written expression of your opinion (stated in a thesis) supported by information gathered independently
2.
BEGIN A RESEARCH FOLDER
Have a folder. Keep it organized.
Keep everything.
Your folder should eventually contain:
the assignment, and all details about dates and marks
a record of the work you have done (a log). See Appendix 2.
all your notes
a record of interviews and phone calls (if applicable)
newspaper clippings, magazine articles, pamphlets and printouts
an ongoing record of all sources of information
a list of appropriate subject headings
all outlines and drafts
3.
SELECT A TOPIC
See the process in Appendix 5A.
Consult with your facilitator, librarian, family and friends.
Choose a topic that is:
interesting
manageable (in terms of time and resources)
appropriate
4.
LOCATE SOURCES OF INFORMATION
vertical file material
videos
internet
books
periodicals and newspapers (electronic and print)
community resources
See Appendix 4.
5.
SUGGEST A TENTATIVE FOCUS
Select one aspect of the topic.
See Appendices 5A, 5B and 5C.


6.
DEVELOP A TENTATIVE THESIS IF REQUIRED
State your opinion on the narrowed topic.
Be aware that the research you do may cause you to modify or revise your tentative thesis
Treat your tentative thesis as your research question.
See Appendix 6.
7.
CONSULT WITH YOUR FACILITATOR
Are you on the right track?
8.
EXAMINE RESOURCES AND SELECT APPROPRIATE INFORMATION
Table of contents
Indexes
Chapter summaries
Charts and graphs
Remember the scope and limits of your topic.
Use skimming and scanning techniques.
Skimming a chapter or an article means reading only:
• title • subtitles
• captions on illustrations
• first and last paragraphs
From skimming it, you can determine what appears to be the main point or idea of the chapter or article. See Appendix 8A.
Scanning means reading for key words. Recognize the intent, authority, currency, bias and level of difficulty of your sources. The internet presents special problems.
Evaluation: See Appendix 8B for ways to evaluate internet sources.
9.
MAKE NOTES AND RECORD INFORMATION FOR WORKS CITED LIST
Make notes on everything that might be important. Notes are made by summarizing, paraphrasing and/or quoting.
Summarizing is expressing the main ideas in condensed form.
Paraphrasing is restating the information in your own words.
Quoting is using the author's exact words.
Avoid plagiarism: acknowledge all statements and ideas which are not your own.
How to avoid plagiarism: correct documentation of sources
For note making techniques and suggestions General Note Making
10.
DEVELOP A FINAL THESIS
See Appendix 6
11.
CONFERENCE WITH YOUR FACILITATOR
See Appendix 11
12.
PREPARE A TENTATIVE OUTLINE, ORGANIZING INFORMATION UNDER MAIN IDEAS AND SUPPORTING POINTS
Most word-processing programs have outlining features.
See Appendix 12.


13.
CONFERENCE WITH YOUR FACILITATOR
See Appendix 11
14.
PREPARE YOUR FIRST DRAFT
Double space to allow for corrections and changes.
Prepare your draft directly from your outline and notes.
Include a clear statement of your purpose in your introductory paragraph.
Organize your ideas logically.
Use a clear, direct style; avoid slang or jargon.
Make sure quotations are short and relevant.
Include embedded citations at this time.
See Appendix 14
15.
EDIT YOUR FIRST DRAFT
See Appendix 15
16.
WRITE YOUR FINAL VERSION
(See Appendix 16A) and a list of works cited.
See Appendix 16B.
17.
PREPARE A PRESENTATION
Confirm the format of your presentation with your facilitator.
See Appendix 17 for a variety of possible formats.
18.
EVALUATE THE ASSIGNMENT
Remember that the process is just as important as the final product.
Evaluation may take several forms:
self, peer, group and facilitator.
See Appendices 18A, 18B and 18C.
FOR USEFUL WEBSITES FOR THE RESEARCH AND WRITING PROCESS
See Appendix 4a

Work Log **Appendix 2**

WORK LOG

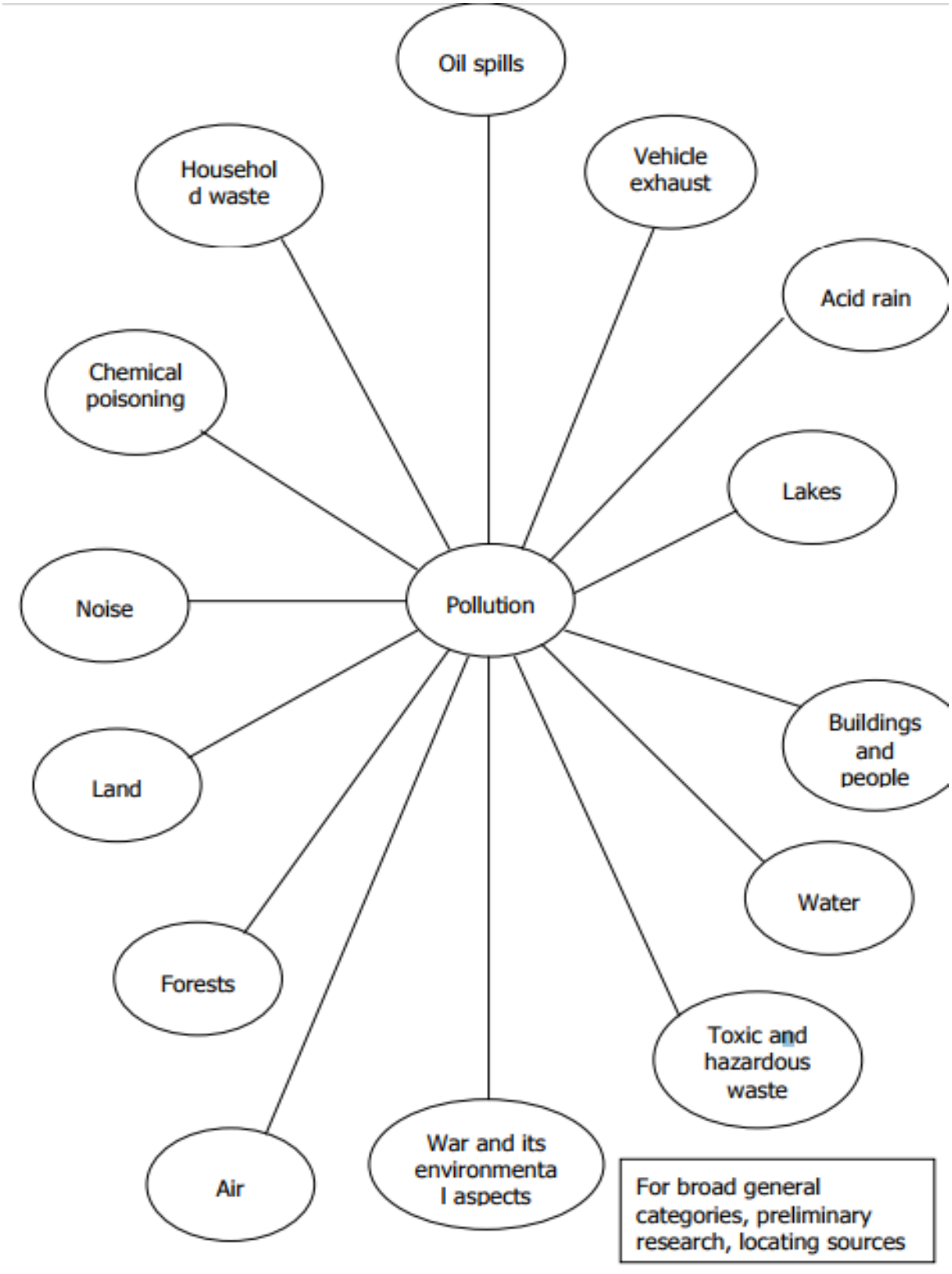
Name: _____ Assignment: _____

Date: _____ **Time Spent:** _____ **hour(s)** _____
Work done: _____
_____
_____
_____
Resources used: _____
_____

Date: _____ **Time Spent:** _____ **hour(s)** _____
Work done: _____
_____
_____
_____
Resources used: _____
_____

Date: _____ **Time Spent:** _____ **hour(s)** _____
Work done: _____
_____
_____
_____
Resources used: _____
_____

Brainstorming the topic – "Pollution"



SOURCES OF INFORMATION:	HOW and WHERE TO LOCATE:
Reference Materials	
• general encyclopedias	• reference section
• subject specific encyclopedias, dictionaries, handbooks and Encyclopedia, indexes (e.g. McGraw-Hill Encyclopedia of Science and Technology)	• Internet • CD-ROM (e.g. Canadian World Book)
• print (e.g. World Book, Britannica) Britannica, World	• on-line via www: Grolier, Book, Galenet
• dictionaries	
• yearbooks, almanacs, directories	
• atlases	
Books:	
• electronic catalogue	
Periodicals and Newspapers:	
• Guide to Periodicals and Newspapers in the Public Libraries	
• on-line access via the Internet (Electric Library, EBSCO, SIRS, CPIQ, NEWSCAN)	
• Internet	
Other resources	
• videos	
• film and video catalogues are available	online
• films	
• television programs	• SABC videos are available
• audio tapes	
• slides	

USEFUL WEBSITES FOR THE RESEARCH AND WRITING PROCESS
Resources for Writers: http://owl.english.purdue.edu/writers/by-topic.html
Writing at the University of Toronto:
http://utl2.library.utoronto.ca/www/writing/index.html
Research and Argument: http://karn.ohiolink.edu/~sg-ysu/
Infozone: http://www.mbnet.mb.ca/~mstimson/
A+ Research & Writing: http://www.ipl.org/teen/aplus/
Researchpaper.com: http://www.researchpaper.com/

Search Strategy Sheet **Appendix 4B**

- Describe Your Topic:

_____

_____

_____

- Identify the Main concepts:

Concept # 1	Concept # 2	Concept # 3

- Find Synonyms:

Use the appropriate thesaurus to identify synonyms. Synonyms, related terms and alternate spellings should be placed in the same CONCEPT column.

Concept # 1	and	Concept # 2	and	Concept # 3
_____		_____		_____
_____		_____		_____
or_____		or_____		or_____
_____		_____		_____
or_____		or_____		or_____
_____		_____		_____
or_____		or_____		or_____
_____		_____		_____
or_____		or_____		or_____
_____		_____		_____
or_____		or_____		or_____
_____		_____		_____
or_____		or_____		or_____
_____		_____		_____
or_____		or_____		or_____
_____		_____		_____

Search Strategy Sheet Example **Appendix 4C**

- Describe Your Topic:

What are the effects on children of violence in the mass media?

_____

_____

- Identify the Main concepts:

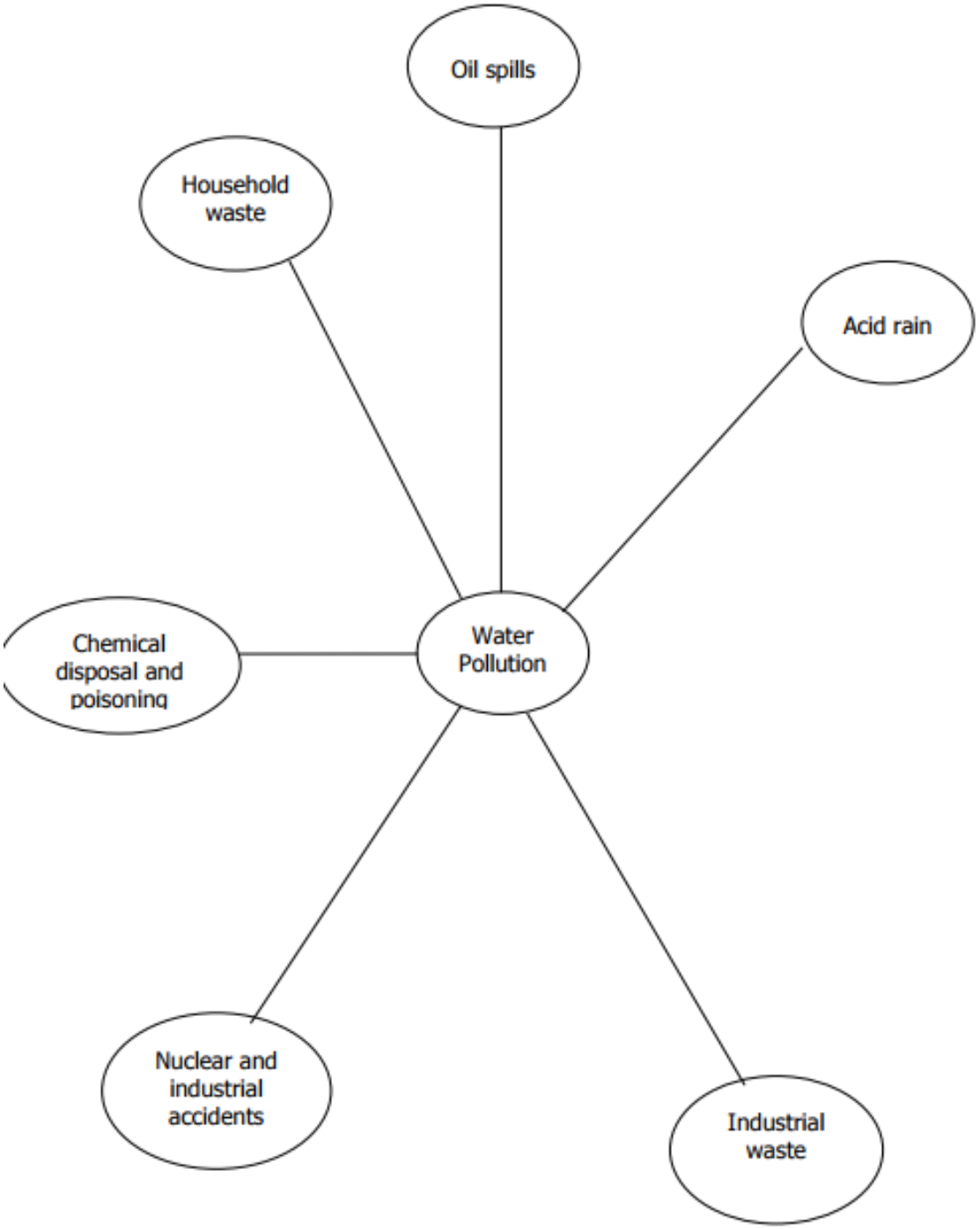
Concept # 1	Concept # 2	Concept # 3
Violence	*Mass media*	*children*

- Find Synonyms:

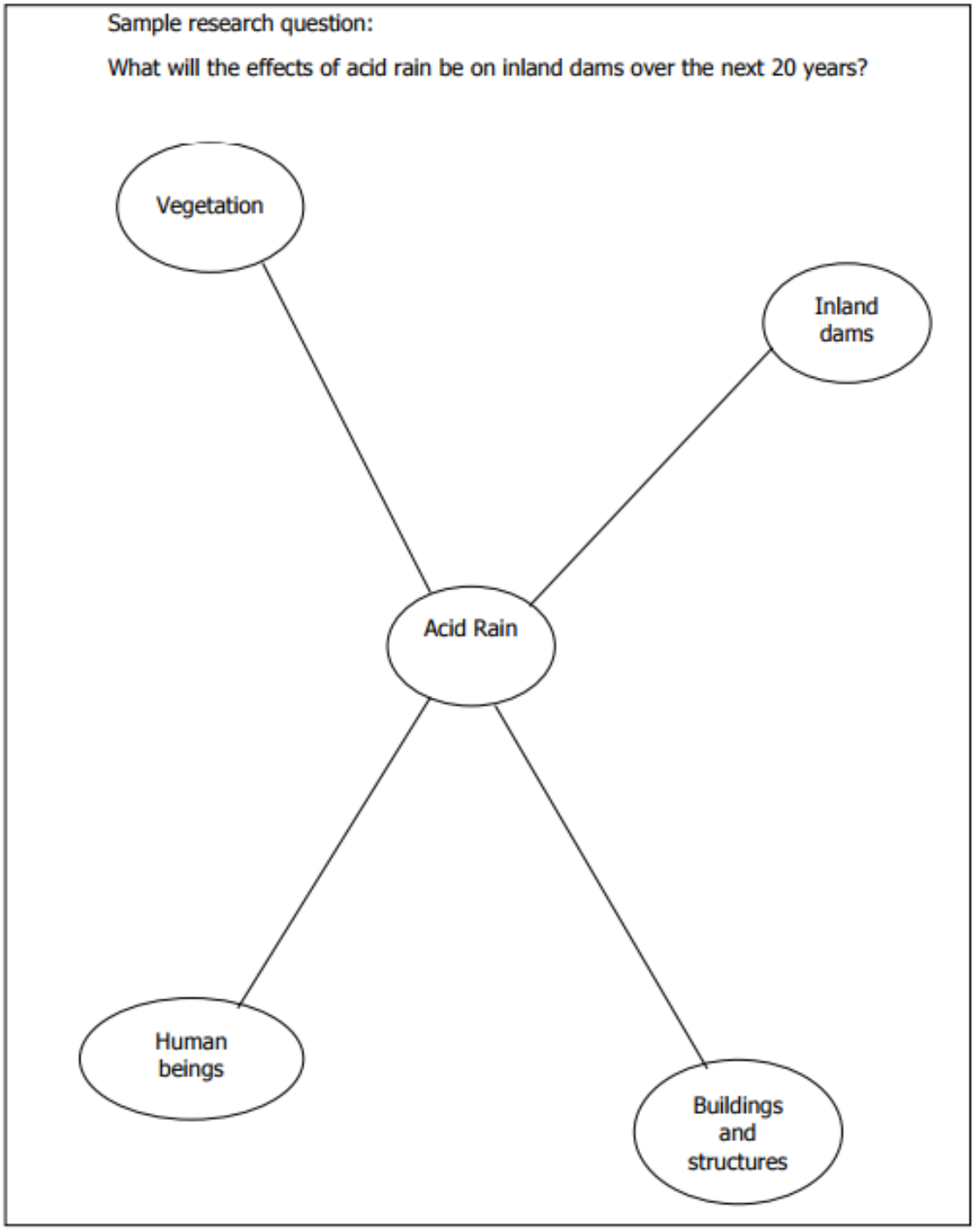
Use the appropriate thesaurus to identify synonyms. Synonyms, related terms and alternate spellings should be placed in the same CONCEPT column.

Concept # 1		Concept # 2		Concept # 3
Violence	**and**	*Mass media*	**and**	*children*
or *aggression*		or *television*		or *childhood*
or *anger*		or *films*		or
or		or *computer games*		or
or		or		or
or		or		or
or		or		or
or		or		or

Selecting One Aspect of the Topic "Pollution" Appendix 5A



Focusing on One Aspect of the Topic "Water Pollution" **Appendix 5B**



Developing a Thesis **Appendix 6**

A thesis is the expression of your opinion on a topic.

- Select a topic:

  My topic: Capital Punishment

- Get an overview from a variety of sources
- Formulate a question from which your thesis statement can develop.

  Question: Does the death penalty prevent crime?

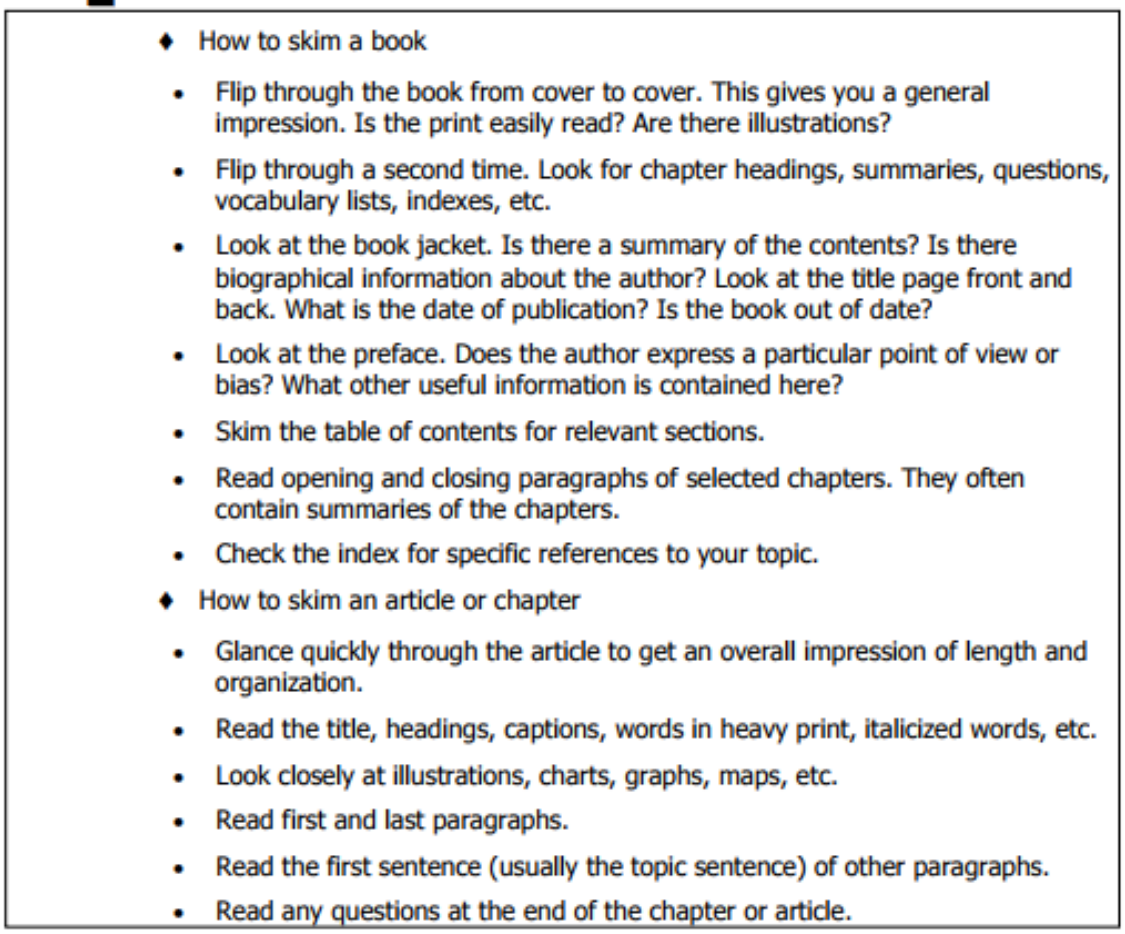
- Formulate a thesis statement that:
  - takes a stand
  - is arguable
  - can be researched
- Tentative Thesis: Capital Punishment does not deter murder
- Check your Thesis Statements against the models

Thesis	Comment	
1) Capital punishment.	This is topic, not a thesis.	
2) Does the death penalty prevent crime?	This is a good question that leads to a thesis, but this is not a thesis.	
3) The murder rate is a concern.	A statement of fact is a weak thesis. Take a stand that is arguable.	
4) Something must be done about the murder rate.	Weak thesis. What must be done? Take a stand that is arguable.	
5) Capital punishment prevents crime.	Good thesis	Both take stands and are arguable.
6) Capital punishment does not deter murder.	Good thesis	

- Can your Thesis be researched?

  Either #5 or #6 above can be researched because there are many resources on capital punishment, both pro and con, in your institution's library and in the community at large.

Skimming **Appendix 8A**



- How to skim a book
  - Flip through the book from cover to cover. This gives you a general impression. Is the print easily read? Are there illustrations?
  - Flip through a second time. Look for chapter headings, summaries, questions, vocabulary lists, indexes, etc.
  - Look at the book jacket. Is there a summary of the contents? Is there biographical information about the author? Look at the title page front and back. What is the date of publication? Is the book out of date?
  - Look at the preface. Does the author express a particular point of view or bias? What other useful information is contained here?
  - Skim the table of contents for relevant sections.
  - Read opening and closing paragraphs of selected chapters. They often contain summaries of the chapters.
  - Check the index for specific references to your topic.
- How to skim an article or chapter
  - Glance quickly through the article to get an overall impression of length and organization.
  - Read the title, headings, captions, words in heavy print, italicized words, etc.
  - Look closely at illustrations, charts, graphs, maps, etc.
  - Read first and last paragraphs.
  - Read the first sentence (usually the topic sentence) of other paragraphs.
  - Read any questions at the end of the chapter or article.

Scanning

Scanning involves running your eyes down the page looking for specific facts or key words and phrases. Think about what FORM the information will take: Is it a number? Is the word in capitals? How does it start?

- VISUALISE what the word or number looks like
- Use numerical order
- Do NOT read every word/number
- Read FAST and when you find the information you want then you slow down and examine it closely

When you locate a new term, try to find its definition. If you are not able to figure out the meaning, then look it up in the glossary or dictionary. Secondly, scanning is useful in locating statements, definitions, formulas, etc. which you must remember completely and precisely.

Evaluating Internet Resources **Appendix 8 B**

Because we live in an information age, the quantity of information on any given topic is huge. However not all of this information is useful or trustworthy. Therefore judging the accuracy of information is an important skill, which is needed all the time.

When researching a topic you will also be evaluating sources as you search for information. You can have some confidence in the information contained in books, newspapers, and magazines since these sources are edited before they are published. You need to judge whether these sources are useful in terms of coverage of the topic, whether the information contained in the source is up to date, and whether the author presents a biased viewpoint.

Evaluating Internet sources can be a problem because anyone can put anything up on the Internet. Many Internet sources are self-published by the author, have not been edited by others and are not monitored. Use the following checklist to judge the Internet sites you find. Articles found in online databases such as encyclopaedias, periodical articles databases, and newspaper databases can be treated as reliable sources because they have been edited in their original publication form. Remember, as well, that you should always use a variety of resources as part of the research process.

Useful Internet Sites for Evaluating Sources

- Kathy Schrock's Guide for Educators: Critical Evaluation Tools

  http://www.discoveryschool.com/schrockguide/eval.html
- Evaluating Sources of Information

  http://owl.english.purdue.edu/Files/131/a-start.html
- Evaluating Internet Sources

  http://members.aol.com/xxmindyxx/evaluate/question.htm
- Evaluating Web Resources

  http://www2.1widener/Wolfgram-Memorial-Library/webeval.htm

Checklist for Evaluating an Internet Site **Appendix 8C**

Title: _____ URL: _____

- Authority
  - Is the author of the page clearly indicated? (If yes, identify) YES/NO
  - What are the author's qualifications and reputation in the subject? If they are not listed, can you find out?

    _____
  - Has the site been rated by a reputable rating group? (If yes, identify) YES/NO

    _____
  - Has it won any awards? (If yes, identify) YES/NO

    _____
- Bias
  - What does the domain address tell you about the site?

    -edu: indicates an educational site (usually a university or college)
    -gov: indicates a government site
    -org: indicates an organization or advocacy group
    -com: indicates a business or commercial organization
    -co: indicates a business or commercial organization
    -za: indicates a South African site
    -uk: indicates a British site
    -~: indicates a personal web page
  - What is the purpose of the site: to inform, to persuade?

    _____
  - Is there an organization sponsoring the page? YES/NO
  - Who are they? What does this tell you about the page's purpose?

    _____
  - Who is the intended audience of the site?

    _____
- Content and Accuracy
  - Is the material covered adequately? YES/NO

    Explain:

    _____

- How does the site compare with others on the same topic?

_____

- How can you tell if it was well researched? YES/NO

  Explain:

  _____

- Is there documentation to indicate the sources of the information presented? YES/NO

  Explain:

  _____

- Does the site have links to other reliable sites on the topic? YES/NO
- Do they work or are they out of date?
- Did you reach this site from a reputable link? YES/NO

♦ Currency

- What is the date of posting of the site?
- Have there been revisions since then? _____ YES/NO
- Is the information current or out of date? _____

♦ Technical Aspects

- Is the site easy to load? YES/NO

  Comment:

  _____

- Is the site easy to navigate? YES/NO

  Comment:

  _____

- Do graphics, pictures and the layout add to the value of the site? YES/NO

  Comment:

  _____

♦ Overall Evaluation

After looking at all the criteria above, circle a general rating for the site:

• Excellent • Good • Average • Borderline Acceptable • Unacceptable

Comments:_____

Appendix 9A

Tips for Note Taking and Avoiding Plagiarism

You must take accurate, informative, point-form notes before writing the rough draft of your essay or report.

As you read and take notes, you analyse and organize the information in your sources. Using a system for taking notes helps simplify the process and later makes writing your essay easier. Generally, you will be making three kinds of notes:

Summarising

When you summarize you condense ideas, details, and supporting arguments in point form using your own words. Summarizing is useful for recording facts, statistics, and background material.

Paraphrasing

When you paraphrase, you take the author's idea, select what is pertinent, and restate it in your own words and sentence structure. Make sure you keep the author's meaning.

Direct quotations

When you use a direct quotation, you copy the material directly from your source because it is important to use the author's words directly. Make sure you copy the material carefully.

Avoiding Plagiarism

Plagiarism, which comes from the Latin word for "kidnapper", is the act of using or passing off someone else's ideas or words as your own. It is a serious and punishable offence. Students who plagiarize may expect a mark of zero and individual schools may also impose other serious consequences. It is important for students to realize that researched information, which is paraphrased or quoted directly, must be acknowledged in the essay.

Factual material such as statistics must also be acknowledged even if you have summarized rather than paraphrased or quoted. Common knowledge such as dates, simple definitions, or commonly known observations do not need to be acknowledged.

Using embedded citations along with a Works Cited List, allowing the reader to easily determine from where material has been taken, does crediting your sources. If you are not sure whether

or not material needs to be acknowledged, always ask for clarification from your facilitator or librarian.

Systems for taking notes

Using a system for taking notes helps simplify the research process, helps avoid plagiarism, and later makes writing the essay easier. There are a number of methods that can be used. Choose the method that works best for you.

Handwritten Notes on Note Making Sheets

- Use the sheets shown in this booklet. The upper portion identifies information that must be recorded for citation information. Make sure you fill in this part!
- Use chapter headings, topic headings and subheadings to separate information.
- Summarize information in point form, using your own words whenever possible.
- Be sure to include page numbers, and to put quotation marks around direct quotations.

Handwritten Notes on Index Cards

- Initially, prepare an index card for each source, identifying the title, author, publisher, date, city of publication and any other pertinent information.
- Assign this card a number, or use the author's name when making up the note cards from that particular resource.
- As you read each book or article, record each point of information on a separate index card, grouping the cards together according to topic. Be sure to include page numbers, and to put quotation marks around direct quotations. Put the author's name or the assigned number in the corner of each card for citation purposes.
- As you work you can assign a brief heading to each note card to help you organize your notes.

Handwritten Notes Using the "5 R Method"

- Use the sheet titled "5R Page for Recording Information". Fill in the upper portion, which is necessary for completing your Works Cited List.
- As you read each book or article, make point form notes of the important ideas and write them in the "Record" column. Use your own words whenever possible, include page numbers, and put quotation marks around direct quotations.
- While recording information, also jot down in the "Relate" column any connected ideas or information that you already know about this topic.

- Think of movies, TV programs, personal experience, books read or people that are related to the topic. This is one way of enriching and personalizing your work.
- At the end of recording your notes, reduce the information to three to five main ideas and write them in the "Reduce" column. These ideas may eventually become the paragraph or section headings of your essay.
- Finally, think about the theme or thesis of the book or article and write it down in your own words in the "Reflect" column. This may become the main thesis of your final product or one of the main arguments to support your thesis.

Notes Word Processed on a Computer

- Type the title, author, publisher, date, city of publication and any other pertinent information for each resource.
- Record information in point form just as you would write it. by hand including page numbers and quotation marks. Leave several lines between facts or points so that you can easily move

USEFUL WEBSITES FOR MAKING NOTES AND AVOIDING PLAGIARISM

How Not to Plagiarize
http://utl2.library.utoronto.ca/www/writing/plagsep.html

Taking Notes from Research Reading
http://utl2t.library.utoronto.ca/www/writingnotes.html

Quoting, Paraphrasing, and Summarizing
http://owl.english.purdue.edu/Files/31..html

Note Making Sheet **Appendix 9B**

Print Reference Material

Name: _____ Course: _____ Date: _____

Topic / Subtopic: _____

_____

Author: _____

Title of the Article: _____

Title of reference material: _____

Format: _____

Place of publication: _____ Publisher: _____

Date of Publication: _____ Volume #: _____ Pages: _____

Type: _____

Page numbers	**Point from notes and quotations**
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Note Making Sheet **Appendix 9C**

Book

Name: _____ Course: _____ Date: _____

Topic / Subtopic: _____

_____

Author(s) / Editor(s): _____

Title: _____

Place of publication: _____ Publisher: _____

Date of Publication: _____ Source library: _____

Page numbers	**Point from notes and quotations**
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Note Making Sheet **Appendix 9D**

Periodical Article:
Accessed via Print, CD or Internet

Name: _____ Course: _____ Date: _____

Topic / Subtopic: _____

Topic / Subtopic: _____

Author(s): _____

Title of article: _____

Title of periodical: _____

How was it accessed: _____

Date of Publication: _____ Pages: _____ Website add: _____

Page numbers	**Point from notes and quotations**
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Note Making Sheet **Appendix 9E**

Other Materials: Audiotape, videos, interviews

Name: _____ Course: _____ Date: _____

Topic / Subtopic: _____

Title: _____

Format: _____

Director: _____

Producer / Distributor: _____

Date: _____ Source: _____

Page numbers	**Point from notes and quotations**

Note Making Sheet Example **Appendix 9F**

Reference Material

Name: _____ Course: _____ Date: _____

Topic / Subtopic: _____

_____

Author: *Lickens, Gene E*

Title of the Article: *Acid Rain*

Title of reference material: *The World Book Encyclopaedia*

Format: _____

Place of publication: *Chicago* Publisher: *World Book*

Date of Publication: *1998* Volume #: *1* Pages: *27*

Source library: *G.S.H.A Library*

Page numbers	Point from notes and quotations
_____	***Summarizing:***
	- article outlines the causes, effects, occurrence and treatment of acid rain
_____	***Paraphrasing:***
_____	***Causes:*** *cars, factories, power plants give off chemical compounds such as sulphur dioxide & nitrogen oxides into the air to form sulphuric acid & nitric acid*
_____	*- these acids pollute rain, snow , sleet etc. to produce acid rain*
	- some acidic gases & particles fall to earth when it is not raining
_____	***Effects:*** *- pollution of lakes, rivers, etc. killing fish and wildlife*
	- damage to buildings, vegetation and soil
_____	*Occurrence: - eastern N. America, northwestern & central Europe, parts of Asia*
_____	*- worse since 1950's (taller smoke stacks)*
	Treatment: *- devices are available to remove sulphur & nitrogen compounds from factory smoke*
_____	*- lime may be added to lakes to neutralize the acids (this treatment does not last and may have harmful side effects)*
_____	***Quoting:*** *"Scientists use the term acid deposition to refer to both wet and dry acid pollution that falls to the earth"*

"5 R" for Recording Information **Appendix 9G**

5R 1 - Read 2 - Record 3 - Relate 4 - Reduce 5 - Reflect

1 – Read Title: _____

Author: _____ Pages: _____

Date of publication: _____ Publisher: _____

4 – Reduce	**2 – Record**	**3 – Relate**
to main points maybe possible headings	Point from notes taken from reference material	make connections to your topic and other notes

5 – Reflect

How can the information gained be used? How do you feel about the information?

Independent Study Conference Notes **Appendix 11**

INDEPENDENT STUDY CONFERENCE NOTES

Section A: To be completed by the learner before conferencing.

Name: _____ Date: _____

Topic _____

Thesis (if it is required): _____

_____

Outline of essay or report:

Resources used:

_____

_____

Questions for your facilitator:

_____

_____

Section B: To be completed by the facilitator.

Comments: _____

_____

Section C:

Plans for the future:

_____

_____

Next conference date: _____

Making an Outline **Appendix 12**

Many word processing programs have outlining features to help you

Report:	**Research Essay:**
INTRODUCTION:	**THESIS:**
I Main point	I Main point
A Sub point	A Sub point
B Sub point	B Sub point
C Sub point	C Sub point
II Main point	II Main point
A Sub point	A Sub point
B Sub point	B Sub point
C Sub point	C Sub point
III Main point	III Main point
A Sub point	A Sub point
B Sub point	B Sub point
C Sub point	C Sub point
CONCLUSION:	**CONCLUSION:**

NOTE:

Research Essays and Reports are not limited to three main points

Editing the First Draft **Appendix 15**

WHY?

1. **CHECK THE CONTENT.**
   Ensure that you have met the requirements of the assignment, your thesis (purpose) and your outline.
2. **CHECK THE MECHANICS (PROOFREADING).**
   Ensure proper spelling, grammar, punctuation and style.

HOW?

1. Read your draft at least twice, once aloud.
2. Read your paper into a tape recorder. Listen. Does it make sense?
3. Have another person edit your work, checking co.

WHAT TO LOOK FOR

The draft flows smoothly.
It makes sense.
The introduction includes at least a thesis or clear statement of purpose.
The parts of the draft are in the most effective order.
The first sentence of each important paragraph refers to the thesis in some way.
Each paragraph begins with a link to the previous paragraph.
Use transitional expressions such as "...However, in addition...", etc.
Each paragraph includes a clear topic sentence.
Each paragraph is long enough to develop its topic.
Sentences vary in length and structure.
The draft has a strong conclusion.
Spelling, capitalization, grammar and punctuation are correct.

ADD A TITLE

It should reflect your thesis.

Sample Title Page **Appendix 16A**

The Global Threat of Acid Rain

by

Violet Ntibane

Unit Std 8979

SBV Midrand

16 October 2004

Documentation **Appendix 16B**

Because you are borrowing the words, facts, or ideas of others when you do research, you must tell readers that you borrowed the material and from where you have borrowed it in order to avoid plagiarism.

To make your use of borrowed material honest rather than plagiarized, you must acknowledge this material in **citations** within your essay and with a list of your sources on a separate page at the end.

You must document everything you use in your essay, not only direct quotations and paraphrases, but also opinions and ideas.

Facilitators require special documentation styles or formats in their learner's essays.

In the past, this has meant using either numbered footnotes at the bottom of each page or numbered endnotes at the end of the essay, followed by a bibliography listing all sources.

Footnotes and endnotes have been replaced with the more modern technique of using **embedded citations** within the text of the essay.

These citations are placed at the end of a quotation or paraphrased sentence and are placed in parentheses. An embedded citation serves two purposes.

The citation tells readers that the material is borrowed, and it refers readers to more detailed information about the source so that they can locate it. The older term "Bibliography" has been replaced by "Works Cited" or "References" because sources now usually include electronic and visual material as well as print sources. The two documentation styles which are used most often are:

- **Modern Language Association (MLA)** which is used for English, history, the arts, and foreign languages.

This style gives authors' names and page numbers for citations which are embedded in the essay, and then a **Works Cited List**, containing full bibliographic information at the end of the essay.

- **American Psychological Association (APA)** which is used for science, and mathematics. This style gives authors' names, publication dates, and page numbers for citations which are embedded in the essay, and then a **References** list , which includes full bibliographic information at the end of the essay.

Caution: The MLA style is quite different from that of the APA style. This booklet will use MLA style for examples of embedded citations and for examples to use in setting up a Works Cited List.

If your facilitator wants you to use APA style, consult the print and web resources listed at the end of this section for examples of APA citations and References Lists.

The author's last name and the page number from which the quotation, paraphrase or idea is taken must appear in the text and a complete reference should appear in your Works Cited list. The author's name may appear either in the sentence itself or in parentheses following the quotation, but the page number should always appear in the parentheses.

Example:

Direct Quotation - One Author

Some argue that "a dream is the fulfilment of a wish" (Freud 154).

Freud states that "a dream is the fulfilment of a wish" (154).

Example: Paraphrase of Author's Idea - One Author

The historian, Crane Brinton, believes that the French and Russian revolutions had similar causes, (Brinton 155)

Format: If you are using several books by the same author, add an abbreviation of the title so that the reader knows which source you have used.

Direct Quotation - More Than One Work by the Same Author

"There is room enough in anyone's backbone for too much duplicity. (Laurence, Jest 182)

Format: Place quotations longer than four lines in a block of lines and omit the quotation marks. Start the quotation on a new line, making sure you indent. Your citation should come after the closing punctuation mark.

Example:Long quotation

Ralph and the other boys finally realize the horror of their actions: The tears began to flow and sobs shook him. He gave himself up to the first time on the island; great shuddering spasms of grief began to wrench his whole body. His voice rose under the black smoke before the burning wreckage of the island; and infected by that emotion, the other boys began to shake and sob too. (Golding 186)

Format: When quoting from plays, cite the act, scene, and line numbers for Shakespeare's plays, and the page number, act and scene (if any) for other plays.

Example: Direct Quotation - Play by Shakespeare

Later in King Lear Shakespeare has the disguised Edgar say, "The prince of darkness is a gentleman" (3.4.147)

Example: Direct Quotation - Play

In Death of a Salesman, Linda defends Willie Loman by stating: He's not the finest character that ever lived. But he's a human being, and a terrible thing is happening to him. So, attention must be paid. He's not allowed to fall into his grave like an old dog. Attention, attention must finally be paid to such a person. (Miller 56; act 1)

Preparing Your Works Cited List

This list, placed at the end of your essay, should include all the sources you quoted, paraphrased, or summarized. It provides the information necessary for a reader to locate any sources you cite. Each source you cite in your essay must appear in your Works Cited List.

General Rules:

- Arrange your sources in alphabetical order by the last name of the author.
- List the author by last name, follow it with a comma, and then first name.
- If a source has more than one author, invert only the first author's name, then continue listing other authors.
- If a source has no author, put it in the list by title, but leave out A, The, or An.
- Indent second and third lines.
- Capitalize each word in the titles of books, articles, etc. not including A, An, The or conjunctions

Basic Forms for Sources in Print

Book

Follow the general format shown below and as further illustrated in the more specific examples, which follow.

Format:

Author (s). Title of Book. Place of Publication: Publisher, Year of Publication.

or

Author (s). Title of Book. Place of Publication: Publisher, Year of Publication.

Note: You may choose to underline the title or to use italics. Be consistent by using one form only in your Works Cited List. Both forms are correct. Ask your facilitators which style they prefer.

Examples, which follow, will consistently use italics.

Note: For well-known encyclopaedias, it is not necessary to list the publisher or place of publication. Usually, it is only necessary to list the edition number (if any) and the publication date. See the examples below.

The following serves as an example:

Example: One author

Goleman, Daniel. Emotional Intelligence. New York: Bantam, 1995.

Example: Two authors

Gilbert, Sandra M. The Norton Anthology of Literature by Women: The Tradition in English. New York: Norton, 1985.

Example: More than two authors

Hudson, Joe and others. Justice and the Young Offender in Canada. Toronto: Wall & Thompson, 1988.

Example: No author given

The Dorling Kindersley World Reference Atlas. London: Dorling Kindersley, 1994.

Example: Editor (s)

David, Jack and Robert Lecker, eds. Canadian Poetry: Volume One. Toronto: General Publishing, 1982.

Example: A part of a book, such as an essay in a collection

Anderson, Doris. "Real Women in Fiction, Where Are You?" The Role of Women in Canadian Literature ed. Elizabeth McCullough. Toronto: MacMillan, 1975.

Example: Print Encyclopaedia article with author given

Likens, Gene E. "Acid Rain." World Book. 1998 ed. Example: Print Encyclopaedia article with no author given "Winnipeg." The Canadian Encyclopaedia. 1987 ed.

Example: Government Publication

Canada. National Council of Welfare. Women and Poverty Revisited. Ottawa: Supply and Services Canada, 1990.

Example: Pamphlet

Aids in the "90s: The New Facts of Life. Pamphlet. Health and Welfare Canada, 1996.

Magazine, Newspaper or Journal

Format:

Author(s). "Title of Article." Name of Magazine Day Month Year: Pages

The following serves as an example:

Example: Magazine article with author given

Morrow, Lance. "The Fog of War." Time 4 Feb. 1991: 61-62. E

Example: Newspaper article with author given

Roseman, Eleanor. "Retirement Planning Pays Off." The Star 10 Dec.1997: B3.

Example: Newspaper article with no author given

"Protesters Greet Chretien in Vancouver." Toronto Sun 12 Jan.1998: A11.

Basic Forms for CD-ROM and Computer Disk Sources

Treat sources on CD-ROM or diskette the same as you would for sources in print, with two main additions: the medium ("CD-ROM," "Diskette") without quotation marks, and the distributor of the electronic work, if one is given, as well as the publisher.

The following serves as an example:

Example: Encyclopaedia article on CD-ROM with no author given

"Aardvark." World Book Multimedia Encyclopaedia. CD-ROM. 1998.

Example: Encyclopaedia article on CD-ROM with author given

Sentman, Eugene. "Aardvark." Multimedia Encyclopaedia. CD-ROM. 1997 ed. New York: Grolier, 1997.

Example: CD-ROM Periodical Database

Begley, Sharon. "Odds on the Greenhouse Effect." Newsweek. 1 Dec.1997: Sirs Researcher. CD-ROM.SIRS. Spring 1998.

Example: CD-ROM Newspaper Article Database

Mitchell, Bob. "Peel Sets up Squad to Deal with Abuse" The Star. 24 Mar. 1994: Canadian News Disc. CD-ROM. Toronto: Micromedia, 1995.

Basic Forms for Internet Sources

World Wide Web Pages

Format:

Author (s). Name of Page. Name of Organization (or the term Home Page if it is a personal home page). Date of Posting/Revision (if available). Date of Access.

Note: It is necessary to list your date of access because web postings are information available at one date may not be available later. Be sure to include the complete address for the site, and enclose the address in the angled brackets so that the address is clear.

The following serves as an example:

Example: a personal home page, no date of posting available

Jones, Ellen. Home Page. 1 Jun. 1998.

Example: a professional website with date of posting available

Abilock, Debbie. Research on a Complex Topic. Nueva Library Help. 9 Sept. 1997. Nueva School. 31 Dec. 1998.

Example: a scholarly project which has an editor

Perseus Project. Ed. Gregory R. Crane. 1997. Tufts U. 31 Dec.1997.

Online Encyclopaedias

The following serves as an example:

Example: an article in an online encyclopaedia with no author "Fresco." Britannica Online. Dec. 1998. 14 Dec.1998.

Online Newspaper and Magazine Articles

Database Subscriptions

Format:

Author. "Article Title." Original Source of Article Date of original source: Page Numbers. Product name. Date of access.

The following serves as an example:

Example: A magazine article found in an online subscription database

Lanken, Dane. "When the Earth Moves." Canadian Geographic March-April 1996: 66- 73. Sirs Researcher on the Web. 10 Nov.1998

Example: A newspaper article found in an online subscription database

Angier, Natalie. "Chemists Learn Why Vegetables are Good for You." The Star 13 Apr. 1993. Newscan. 12 Oct. 1998.

Online Magazines and Journals

Format: Author(s). "Title of Article." Title of Journal. Date: Pages. Date of access.

The following serves as an example:

Example:

Abilock, Debbie. "The Gestalt of Online Searching." MultiMedia Schools. Nov.-Dec. 1997. 10 Oct. 1998.

Discussion Lists and Newsgroups

The following serves as an example:

Example: A Usenet Group

Madige, Ellen. "How to Build a Better Mousetrap." 16 Jan. 1998. Online posting. 21 Jan. 1998.

File Transfer (FTP) and Telnet

The following serves as an example:

Example (FTP):

Harding, William. "Shakespeare and his Muse." 1 Aug. 1998

Example (Telnet):

Jackson, Fred. "Statistical Weather Data for Ontario" Jan. 1996. 7 Oct. 1998

E-mail messages

Format: Author(s) name. "Title of message." E-mail to the author. Date.

The following serves as an example:

Example: personal e-mail message Millon, Michele. "Re: Grief Therapy." E-mail to the author. 10 Oct. 1998.

Online Images, Video and Audio Clips

Format: "Description or title of image, video, or audio clip." Date of document (if Date of download.

The following serves as an example:

Example: "Hubble Space Telescope Release in the Space Shuttle's Payload Bay." 23 Oct. 1998.

Other Types of Sources

Video or Film

Format: Title. Director. Producer. Distributor, Date.

The following serves as an example: **Example:** After the Montreal Massacre. Dir. Gerry Rogers. Prod. Nicole Hubert. Videocassette. National Film Board, 1990.

Television or Radio Program

Format: "Episode Title". Name of Program. Name of network. Local station, City. Date.

The following serves as an example: **Example**: "Bali, Masterpiece of the Gods." Television Program. National Geographic. NBC. WPNT, Buffalo, N.Y. 5 Feb.1998.

Audio Recording, Tape or CD

The following serves as an example: **Example:** Bach, Johann Sebastian. Italian Concerto in F Major. Perf. Angela Hewitt. Cond. Claudio Abbado. Berlin Philharmonic.Compact Disc. Deutsche Grammophon, 1985. DigitalStereo 419 218-2 GH.

Slide

The following serves as an example: **Example:** "Parthenon." Slide. Silver Padachey Collection, 1998.

Stage Play or Musical Performance

The following serves as an example:

Example:

A Stage Play Bouchard, Michel Marc. Lilies. Dir. Suzanne Smith. Theatre Passe Muraille, 27 Feb. 1998.

Example:

A Concert Mehta, Zubin, cond. Israel Philharmonic Orch. Concert. Roy Thomson Hall, Toronto. 1 May 1997.

Cartoon

The following serves as an example:

Example:

Reilly, P. Cartoon. New Yorker 28 Jan. 1997: 32.

Interview

The following serves as an example:

Example:

Wong, Jan. Personal Interview. Toronto. 8 Feb. 1998.

Work of art

The following serves as an example:

Example: As Viewed at a Museum or Art Gallery Van Rijn, Rembrandt.

Aristotle Contemplating the Bust of Homer. Metropolitan Museum of Art, New York

Example: As Viewed in a Book

Rembrandt van Rijn. Aristotle Contemplating the Bust of Homer. Metropolitan Art, New York. Masterpieces of the Met. by Donelson F. Hoopes. New York: Prentice Hall, 1987.

Useful Internet Sites for Help with Documentation

MLA Style

http://www.mal.org/main_stl.htm

APA and MLA Citation Styles

http://www.english.uiuc.edu/cws/wworkshop/bibliostyles.htm

MLA Interactive Forms

http://www.nueva.pvt.k12.ca.us/flibrary.html

Documenting Electronic Sources

http://owl.english.purdue.edu/writers/documenting.html

Standard Documentation Formats

http://www.library.utoronto.ca/www/writing/document.htm

Appendix 16C: An Example of How to Include Citations

Homeless Children and Crime

Homelessness among children is leading to an increase in the number of crimes committed by youth. The number of teens living on the streets of major cities has doubled in the last decade and crime rates among young people appear to be rising proportionately (Canada Year Book 1997, 126). Children, without the security of a stable place to live and secure adult relationships, can easily become disenchanted with society (Stavsky and Thompson 145). It is important however, to look at the reasons why children run away and how their experiences on the street affect their behaviour.

There seems to be disagreement among the experts as to why teens leave their homes and turn to life on the street. "Public and expert opinion offer a hodgepodge of views as to why kids run away from home" (Hynes). It seems that most runaway children are escaping abusive situations at home, and that few leave home just because they have disagreements with parents over little items like curfews and homework. One runaway states,

> *Although my dad had always been a drinker and a gambler, he'd never squandered our rent or savings before. Poverty soon forced us to move to Regent Park (with more than 10,000 residents, the largest public housing complex in Canada). With the heartbreak came more drinking for both of them. Drunk, my dad couldn't work steady any more, so he'd work on and off. He'd sober up for work and tank up after work. The fights between them became more violent; he'd smack her around and she'd smack me around. (Webber 156)*

According to Dr. Jeffrey Palter, Executive Director of "Homes for Youth", a government agency dealing with homeless teens, there are numerous risk factors that affect a child's decision to leave home and become involved in criminal activity. These include poverty, violence, addictions, neglect, racism, and community apathy. He stresses, however, that "through supporting parents, provided that the support is maintained over the long-term, the effects of poverty, community breakdown and racism on young people are greatly mitigated and delinquency thus largely prevented." (Young Offenders, A Child Welfare Perspective)

Works Cited List

Canada. Statistics Canada. Canada Year Book 1997. Ottawa: Minister of Industry. 1996.

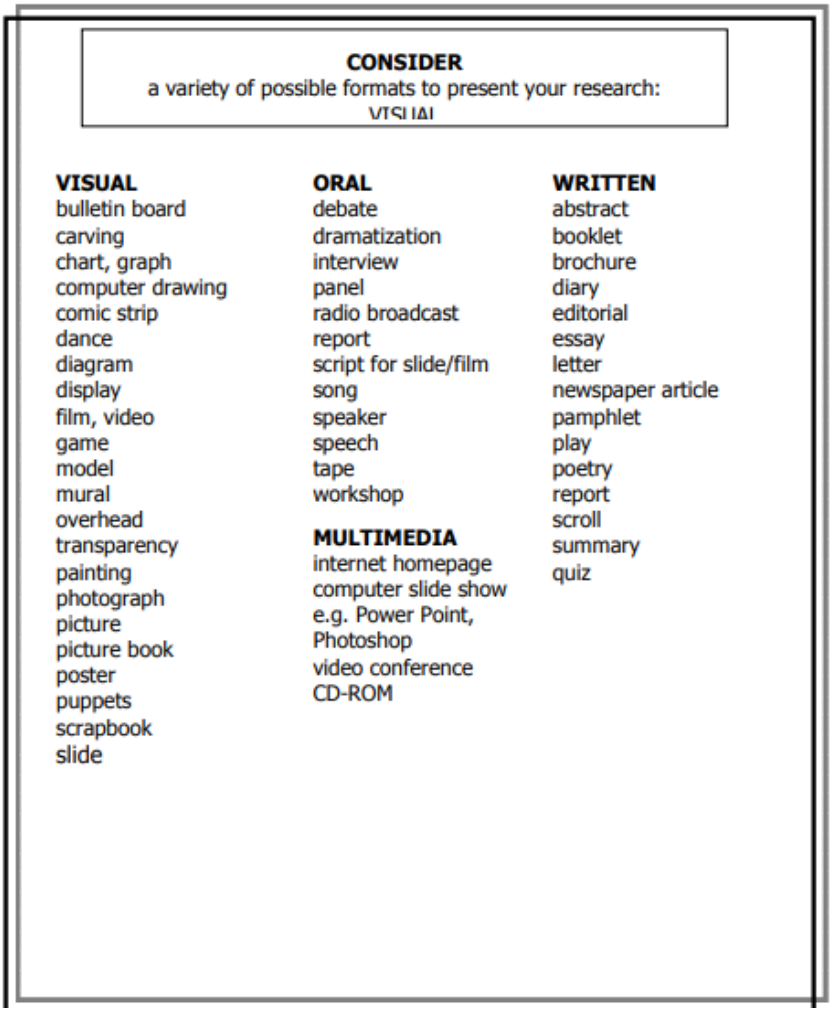
Hynes, Robert. "Street Kids: Behind the Scenes." Ottawa Citizen 12 November 1997. CD-ROM. Canadian News Disk. Toronto: Micromedia, 1998.

Stavsky, Marcia and David Thompson. The Homeless. San Diego: Greenhaven Press. 1994.

Webber, Marlene. Street Kids: The Tragedy of Canada's Runaways. Toronto: University of Toronto Press. 1991.

Child Welfare League of Canada. The Young Offenders Act, Its Implementation and Related Services: A Child Welfare Perspective. 1996. 31 May 1998.

Appendix 17 Preparing a presentation



CONSIDER
a variety of possible formats to present your research:
VISUAL

VISUAL
bulletin board
carving
chart, graph
computer drawing
comic strip
dance
diagram
display
film, video
game
model
mural
overhead transparency
painting
photograph
picture
picture book
poster
puppets
scrapbook
slide

ORAL
debate
dramatization
interview
panel
radio broadcast
report
script for slide/film
song
speaker
speech
tape
workshop

MULTIMEDIA
internet homepage
computer slide show e.g. Power Point, Photoshop
video conference
CD-ROM

WRITTEN
abstract
booklet
brochure
diary
editorial
essay
letter
newspaper article
pamphlet
play
poetry
report
scroll
summary
quiz

Evaluating the Project **Appendix 18A**

INDEPENDENT STUDY: EVALUATING THE PROJECT

Topic: _____ Name: _____

HOW WOULD YOU RATE YOUR WORK?

Rate yourself on a 1 to 5 basis

(1 = poor; 2 = fair; 3 = good; 4 = very good; 5 = excellent).

1. Did I use my research time well? (stay on task, make decisions, and work independently)
   1 2 3 4 5
2. Did I work well with others when appropriate? (sharing ideas, asking for help, getting information - classmates, teachers, other contacts)
   1 2 3 4 5
3. Did I prove my thesis / develop my topic?
   1 2 3 4 5
4. Is my information accurate?
   1 2 3 4 5
5. Did I use a variety of sources, print and non-print?
   1 2 3 4 5
6. Is my material well organized? (main ideas, supporting facts, logical arrangement)
   1 2 3 4 5
7. Did I choose the best way to present my results?
   1 2 3 4 5
8. Have I made good use of special effects to make my presentation interesting? (illustrations, charts, slides, costumes, etc.)
   1 2 3 4 5
9. Is my style clear and effective?
   1 2 3 4 5
10. Have I used correct form for my presentation? (spelling, grammar, essay format, oral skills, etc.)
    1 2 3 4 5

Peer Evaluation: Oral Presentations/Speeches **Appendix 18B**

	Very good 3	Satisfactory 2	Poor 1
1. Gave an interesting introduction			
2. Presented clear explanation of topic			
3. Presented information in acceptable order			
4. Used complete sentences			
5. Offered a concluding summary			
6. Spoke clearly, correctly, distinctly and confidently			
7. Maintained eye contact			
8. Maintained acceptable posture			
9. Maintained the interest of the class.			
10. Used visual/audio aids well			
11. Handled questions and comments from the class very well			
Subtotal			
Total			

Group Effectiveness Appraisal **Appendix 18C**

Group Effectiveness Appraisal

Name:_____ Group: _____

Project Title: _____

Audience:_____

Rate your group on a 1 to 5 basis

(1 = poor; 2 = fair; 3 = good; 4 = very good; 5 = excellent).

1. We worked cooperatively with all group members. 1 2 3 4 5
2. We accomplished what we set out to complete. 1 2 3 4 5
3. We were satisfied with our performance of this group task. 1 2 3 4 5
4. We used our group time efficiently without wasting or misusing time. 1 2 3 4 5
5. We all contributed fairly to the completion of this group task. 1 2 3 4 5

Personal assessment and observations:

1. Did you feel satisfied with your own participation in the project? Discuss your feelings honestly. _____

_____

2. Do you think that the project participation was reasonably equal (that is, do you feel others in your group worked well and contributed fairly?) _____

_____

3. Do you think there are some ways your group could have improved and therefore produced a better-finished project? _____

_____

4. Do you like doing a project like this, or do you honestly prefer to work on your own? (Please answer explaining why or why not.) _____

_____

5. Please add any helpful comments you may think of: _____

_____

BRAINSTORMING AND MIND MAPS

Brainstorming

- The following steps are recommended for a brainstorming session:
- Select the topic or problem to be discussed.
- Each group member makes a list of ideas on a piece of paper. This should take no longer than 10 minutes.
- Each person reads one idea at a time from her list of ideas, sequentially, starting at the top of the list. As ideas are read, they should be recorded and displayed by the group leader. Group members continue in this circular reading fashion until all the ideas on everyone's list are read.
- If a member's next idea is duplication, that member goes on to the subsequent idea on his list. x Members are free to pass on each go-round but should be encouraged to add something.
- The leader then requests each group member, in turn, to think of any new ideas she hadn't thought of before. Hearing others' ideas will probably result in related ideas. This is called piggybacking. The leader continues asking each group member, in turn, for new ideas, until they can't think of anymore.
- If the group reaches an impasse, the leader can ask for everyone's, "wildest idea", an unrealistic idea can stimulate a valid one from someone else.

Rules

Certain rules should be observed by the participants to ensure a successful brainstorming session – otherwise, participation may be inhibited.

- Don't criticize, by word or gesture, anyone's ideas.
- Don't discuss any ideas during the session, except for clarification.
- Don't hesitate to suggest an idea because it sounds silly. Many times, a "dumb" idea can lead to the problem solution.
- Each team member should suggest only one idea at a time
- Don't allow the group to be dominated by one or two people.
- Don't let brainstorming become a gripe session.

Aids to Better Brainstorming

A relaxed atmosphere in which people feel free to suggest any kind of idea enhances the brainstorming session. Here are five techniques that may improve brainstorming by giving people ways to come up with new ideas.

- *Modification* is changing some aspect of an existing product or service. An example is lower-priced movie tickets for senior citizens.
- *Magnification* is enlarging a product or service, such as giant economy-size packages.
- *Minification* is altering a product or service so it becomes smaller or less complex. Examples are portable radios and televisions, electronic calculators, and no-frills airline travel.
- *Substitution* is using a certain material or service in place of what has traditionally been employed. Examples are using polyester instead of cotton, plastic in place of metal, and nurse-midwives instead of physicians.
- *Rearrangement* is altering the configuration of basic elements in a product or service-for example, some housing developments use several floor plans, but all homes have the same basic features.

An Example of Brainstorming

Consider a group of six people, one from each department of an organization, who brainstorm about the problem of excessive employee absenteeism. They've already decided on the topic to be discussed, so they can proceed to making their lists of causes. After completing their lists, they read their ideas, sequentially, one at a time. The designated leader records the ideas on a flip chart.

The first person's list of possible causes of excessive employee absenteeism is

- Low morale.
- No penalties for absence.
- Boredom with job.
- Personal problems. The second person's list is
- Dislike of supervisor.
- Drug problems.
- Performance anxiety.
- Anger over pay.
- Work-related accidents.

Other members have similar lists. After everyone have read their lists and the causes have been recorded, the leader requests any new ideas that have emerged. Piggybacking on one of the first person's causes – "personal problems"- might result in another cause, "family problems." Asking for wild ideas might generate a response such as "addiction to video games" or "rundown bathroom facilities."

After all of the ideas have emerged, each group member gets a copy of the list to study. The group meets again and evaluates the ideas. They rank them in order of importance and decide that low morale, drug problems, and boredom with job are the three most critical causes of absenteeism. They are then in the position to develop an action plan to deal with these causes.

Mind Maps

Mind Maps are very important techniques for improving the way you take notes. By using Mind Maps you show the structure of the subject and linkages between points, as well as the raw facts contained in normal notes. Mind Maps hold information in a format that your mind will find easy to remember and quick to review.

Mind Maps abandon the list format of conventional note taking. They do this in favour of a two-dimensional structure. A good Mind Map shows the 'shape' of the subject, the relative importance of individual points and the way in which one fact relates to other. Mind Maps are more compact than conventional notes, often taking up one side of paper. This helps you to make associations easily. If you find out more information after you have drawn the main Mind Map, then you can easily integrate it with little disruption.

Mind Maps are also useful for:
Summarizing information
Consolidating information from different research sources
Thinking through complex problems, and
Presenting information that shows the overall structure of your subject

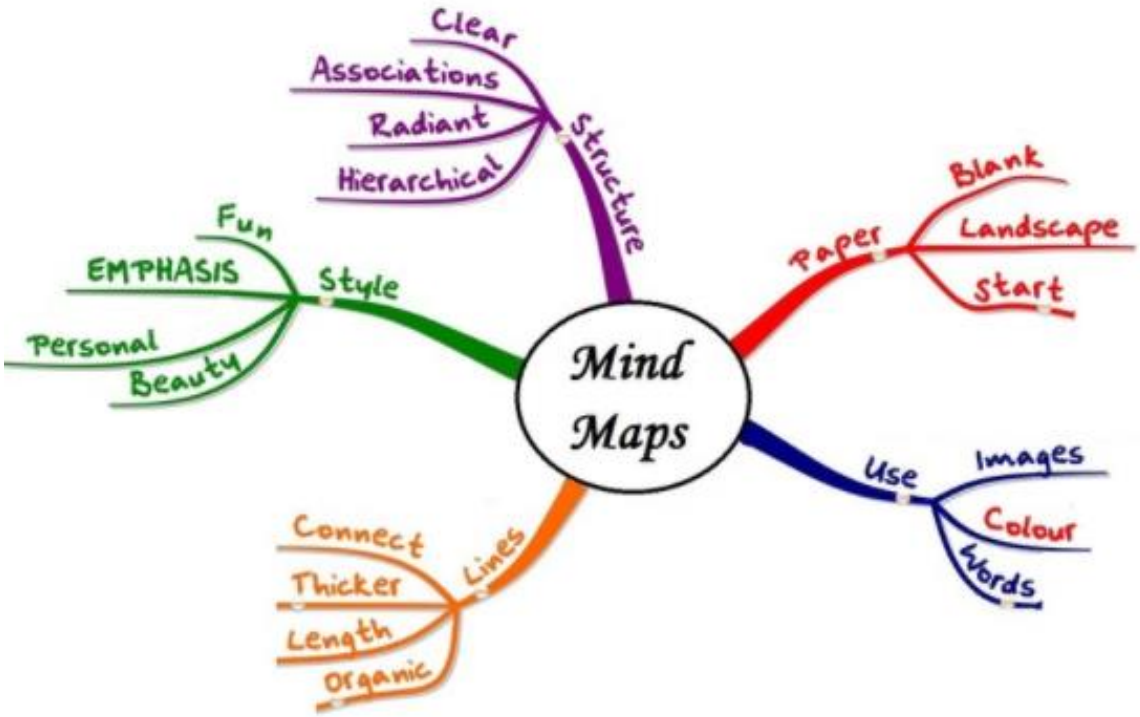
Mind Maps are also very quick to review, as it is easy to refresh information in your mind just by glancing at one.

Mind Maps can also be effective mnemonics. Remembering the shape and structure of a Mind Map can provide the cues necessary to remember the information within it. They engage much more of the brain in the process of assimilating and connecting facts than conventional notes.

Drawing basic Mind Maps

This book was researched and planned using Mind Maps. They are too large to publish here, however part of one is shown below. This shows research into time management skills:

Fig. 1 Example of a mind map



To make notes on a subject using a Mind Map, draw it in the following way:

- Write the title of the subject in the centre of the page, and draw a circle around it. This is shown by the circle marked 1 in the figure 1.
- For the major subject subheadings, draw lines out from this circle. Label these lines with the subheadings. These are shown by the lines marked 2 in figure 1.
- If you have another level of information belonging to the subheadings above, draw these and link them to the subheading lines. These are shown by the lines marked 3 in figure 1.

- Finally, for individual facts or ideas, draw lines out from the appropriate heading line and label them. These are shown by the lines marked 4 in figure 1.

As you come across new information, link it into the Mind Map appropriately.
A complete Mind Map may have main topic lines radiating in all directions from the centre. Sub-topics and facts will branch off these, like branches and twigs from the trunk of a tree. You do not need to worry about the structure produced, as this will evolve of its own accord.

Note that the idea of 'levels' in Figure 1 is only used to help show how the Mind Map was created. All we are showing is that major headings radiate from the centre, with lower-level headings and facts branching off from the higher-level headings.

While drawing Mind Maps by hand is appropriate in many cases, software tools improve the process by helping to you to produce high quality Concept Maps, which can easily be edited and redrafted.

Improving your Mind Maps

Your Mind Maps are your own property: once you understand how to make notes in the Mind Map format, you can develop your own conventions to take them further. The following suggestions may help to increase the effectiveness of your Mind Maps:

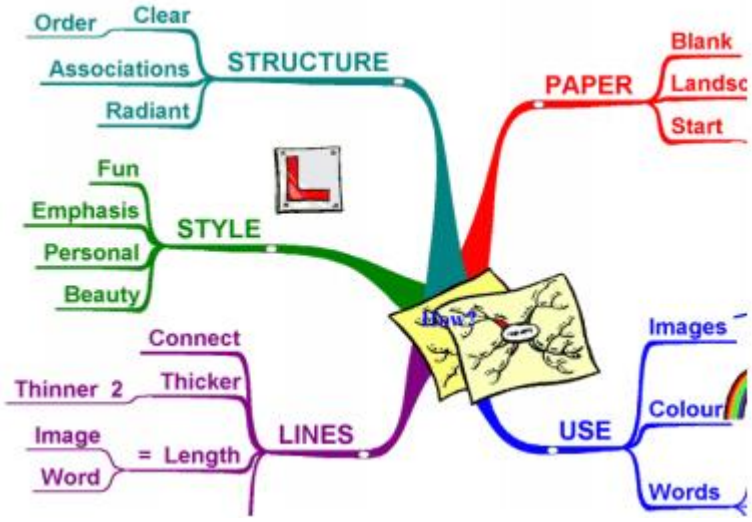
- Use single words or simple phrases for information:
  Most words in normal writing are padding, as they ensure that facts are conveyed in the correct context, and in a format that is pleasant to read. In your own Mind Maps, single strong words and meaningful phrases can convey the same meaning more potently. Excess words just clutter the Mind Map.
- Print words: Joined up or indistinct writing can be more difficult to read.
- Use colour to separate different ideas:
  This will help you to separate ideas where necessary. It also helps you to visualize of the Mind Map for recall. Colour also helps to show the organization of the subject.
- Use symbols and images:
  Where a symbol or picture means something to you, use it. Pictures can help you to remember information more effectively than words.
- Using cross-linkages:

Information in one part of the Mind Map may relate to another part. Here you can draw in lines to show the cross-linkages. This helps you to see how one part of the subject affects another.

Key points:

Mind Maps provide an extremely effective method of taking notes. They show not only facts, but also the overall structure of a subject and the relative importance of individual parts of it. Mind Maps help you to associate ideas and make connections that might not otherwise make.

If you do any form of research or note taking, try experimenting with Mind Maps. You will find them surprisingly effective.



Speed Reading

Speed Reading helps you to read and understand text more quickly. It is an essential skill in any environment where you have to master large volumes of information quickly, as is the norm in fast-moving professional environments.

The Key Insight

The most important trick about speed reading is to know what information you want from a document before you start reading it: if you only want an outline of the issue that the document discusses, then you can skim the document very quickly and extract only the essential facts. If you need to understand the real detail of the document, then you need to read it slowly enough to fully understand it.

You will get the greatest time savings from speed-reading by learning to skim excessively detailed documents.

Technical Issues

Even when you know how to ignore irrelevant detail, there are other technical improvements you can make to your reading style, which will increase your reading speed.

Most people learn to read the way young children read – either letter-by-letter, or word-by-word. For most adults, this is probably not the case – think about how your eye muscles are moving now. You will probably find that you are fixing your eyes on one block of words, then moving your eyes to the next block of words, and so on. You are reading blocks of words at a time, not individual words one-by-one. You may also notice that you do not always go from one block to the next: sometimes you may move back to a previous block if you are unsure about something.

A skilled reader will read many words in each block. He or she will only dwell on each block for an instant, and will then move on. Only rarely will the reader's eyes skip back to a previous block of words. This reduces the amount of work that the reader's eyes have to do. It also increases the volume of information that can be examined in a period of time.

A poor reader will become bogged down, spending a lot of time reading small blocks of words. He or she will skip back often, losing the flow and structure of the text and overall understanding of the subject. This irregular eye movement will make reading tiring. Poor readers tend to dislike reading, and may find it harder to concentrate and understand written information.

Speed-reading aims to improve reading skills by:

- Increasing the number of words read in each block
- Reducing the length of time spent reading each block, and
- Reducing the number of times your eyes skip back to a previous sentence.

These are explained below:

Increasing the number of words in each block:

This needs a conscious effort. Try to expand the number of words that you read at a time. Practice will help you to read faster. You may also find that you can increase the number of

words read by holding the text a little further from your eyes. The more words you can read in each block, the faster you will read!

Reducing Fixation Time: The minimum length of time needed to read each block is probably only a quarter of a second. By pushing yourself to reduce the time you take, you will get better at picking up information quickly. Again, this is a matter of practice and confidence.

Reducing Skip-Back: To reduce the number of times that your eyes skip back to a previous sentence, run a pointer along the line as you read. This could be a finger, or a pen or pencil. Your eyes will follow the tip of your pointer, smoothing the flow of your reading. The speed at which you read using this method will largely depend on the speed at which you move the pointer.

You will be able to increase your reading speed a certain amount on your own by applying speed reading techniques. What you don't get out of self-study is the use of specialist reading machines and the confidence gained from successful speedreading – this is where a good one-day course can revolutionize your reading skills.

Key points:
By speed reading you can read information more quickly. You may also get a better understanding of it as you will hold more of it in short term memory.

To improve the speed of your reading, read more words in each block and reduce the length of time spent reading each block. Use a pointer to smooth the way your eyes move and reduce skip-back.

Speed Reading Self-Spacing Methods

Speed-reading is not magic nor is it a big expensive mystery. Professional speed-reading classes simply teach a handful of easy techniques that help a person focus his or her attention better. The eye is drawn to motion. Speed reading techniques put that motion on the page.

Your starting position is important. You should sit up straight, hold the book down with your left hand, and use your right hand to do the pacing.

You should already be a good reader before you attempt to speed read. Speedreading will not help you if you have problems in comprehension and vocabulary. In fact, it may hurt you to try to rush through stuff that you can't comprehend. You should have the basics down already first. Before you start speed-reading, you should do a survey of the information first to get a general idea of what you will be covering and of the type of writing.

The Hand

The first method is to simply place your right hand on the page and slowly move it straight down the page, drawing your eyes down as you read. Keep an even, slow motion, as if your right hand has its own mind. Your eyes may not be exactly where your hand is, but this simple motion will help you go faster. Don't start, read a little, stop, read a little, start, and read a little. Keep the movement slow and easy. Only do it once per page. If you are "left-handed" use your left hand as the dominant pacing hand.

The Card

The next technique is to use a card or a folded-up piece of paper above the line of print to block the words after you read them. Draw it down the page slowly and evenly and try to read the passage before you cover the words up. This helps break you of the habit of reading and reading a passage over and over again. It makes you pay more attention the first time. Be sure to push the card down faster than you think you can go. Slide the card down once per page.

The Sweep

Another method is to use your hand to help draw your eyes across the page. Slightly cup your right hand. Keep your fingers together. With a very light and smooth motion, sweep your fingers from left to right, underlining the line with the tip of your tallest finger from about an inch in and an inch out on each line. Use your whole arm to move, balancing on your arm muscle. Imagine that you are dusting off salt from the page.

The Hop

Similar to the "sweep" method is the "hop", but in the "hop" you actually lift your fingers and make two even bounces on each line. Each time you bounce, you are making a fixation, which hopefully catches sets of three or four words. Moving to a "hop" method also makes it easier to keep a steady pace as it is a lot like tapping our fingers on a desk. Balance on your arm muscle; don't just wiggle your wrist.

The Zig-Zag or Loop

The last method is a type of modified scanning technique. In this one you take your hand and cut across the text diagonally about three lines and then slide back to the next line. Now the idea here is not necessarily to see each word, but to scan the entire area, letting your mind pick out the main ideas. I wouldn't recommend this for material that requires very careful reading, but it is a way to help you get the general ideas of easy material.

These methods seem simple and easy, but don't let that fool you. These are very useful methods, which can help a good reader, read faster and better in very little time. But these techniques will not do you any good unless you PRACTICE them. It usually takes about three or four sessions before you get accustomed to a particular technique. As you move along and learn the methods, you may find that one is more suitable for you than the others. Find the one that works for you and use it.

Reading Strategies – Reading Efficiently by Reading Intelligently

Good reading strategies help you to read in a very efficient way. Using them, you aim to get the maximum benefit from your reading with the minimum effort. This section will show you how to use 6 different strategies to read intelligently.

Strategy 1: Knowing what you want to know

The first thing to ask yourself is: Why you are reading the text? Are you reading with a purpose or just for pleasure? What do you want to know after reading it?

Once you know this, you can examine the text to see whether it is going to move you towards this goal. An easy way of doing this is to look at the introduction and the chapter headings. The introduction should let you know whom the book is targeted at, and what it seeks to achieve. Chapter headings will give you an overall view of the structure of the subject.

Ask yourself whether the book meets your needs. Ask yourself if it assumes too much or too little knowledge. If the book isn't ideal, would it be better to find a better one?

Strategy 2: Knowing how deeply to study the material

Where you only need the shallowest knowledge of the subject, you can skim material. Here you read only chapter headings, introductions and summaries.

If you need a moderate level of information on a subject, then you can scan the text. Here you read the chapter introductions and summaries in detail. You may then speed-read the contents of the chapters, picking out and understanding key words and concepts. At this level of looking at the document it is worth paying attention to diagrams and graphs.

Only when you need detailed knowledge of a subject is it worth studying the text. Here it is best to skim the material first to get an overview of the subject. This gives you an understanding of its structure, into which you can fit the detail gained from a full reading of the material. SQ3R is a good technique for getting a deep understanding of a text.

Strategy 3: Active Reading

When you are reading a document in detail, it often helps if you highlight, underline and annotate it as you go on. This emphasizes information in your mind, and helps you to review important points later.

Doing this also helps to keep your mind focused on the material and stops it wandering. This is obviously only something to do if you own the document! If you find that active reading helps, then it may be worth photocopying information in more expensive texts. You can then read and mark the photocopies.

If you are worried about destroying the material, ask yourself how much your investment of time is worth. If the benefit you get by active reading reasonably exceeds the value of the book, then the book is disposable.

Strategy 4: How to study different sorts of material

Different sorts of documents hold information in different places and in different ways. They have different depths and breadths of coverage. By understanding the layout of material you are reading, you can extract useful information much more efficiently.

- Reading Magazines and Newspapers:

  These tend to give a very fragmented coverage of an area. They will typically only concentrate on the most interesting and glamorous parts of a topic - this helps them to sell copies! They will often ignore less interesting information that may be essential to a full understanding of a subject. Typically, areas of useful information are padded out with large amounts of irrelevant waffle or with advertising.

The most effective way of getting information from magazines is to scan the contents tables or indexes and turn directly to interesting articles. If you find an article useful, then cut it out and file it in a folder specifically covering that sort of information. In this way you will build up sets of related articles that may begin to explain the subject.

Newspapers tend to be arranged in sections. If you read a paper often, you can learn quickly which sections are useful and which ones you can skip altogether.

- Reading Individual Articles:

  Articles within newspapers and magazines tend to be in three main types:

  - News Articles:

    Here the most important information is presented first, with information being less and less useful as the article progresses. News articles are designed to explain the key points first, and then flesh them out with detail.
  - Opinion Articles:

    Opinion articles present a point of view. Here, the most important information is contained in the introduction and the summary, with the middle of the article containing supporting arguments.
  - Feature Articles:

    These are written to provide entertainment or background on a subject. Typically, the most important information is in the body of the text.

    If you know what you want from an article, and recognize its type, you can extract information from it quickly and efficiently.

Strategy 5: Reading 'whole subject' documents

When you are reading an important document, it is easy to accept the writer's structure of thought. This can mean that you may not notice that important information has been omitted or that irrelevant detail has been included. A good way of recognizing this is to compile your own table of contents before you open the document. You can then use this table of contents to read the document in the order that you want. You will be able to spot omissions quickly.

Strategy 6: Using glossaries with technical documents

If you are reading large amounts of difficult technical material, it may be useful to photocopy or compile a glossary. Keep this beside you as you read. It will probably also be useful to note down the key concepts in your own words, and refer to them when necessary.

Usually, it is best to make notes as you go. The most effective way of doing this may be to use Concept Maps.

Key points:

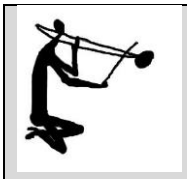
This section shows 6 different strategies and techniques that you can use to read more effectively. These are:

- Knowing what you need to know, and reading appropriately
- Knowing how deeply to read the document: skimming, scanning or studying
- Using active reading techniques to pick out key points and keep your mind focused on the material
- Using the table of contents for reading magazines and newspapers, and clipping useful articles
- Understanding how to extract information from different article types
- Creating your own table of contents for reviewing material
- Using indexes, tables of contents, and glossaries to help you assimilate technical information.

Procedure for the Reading Exercises

So that you will be familiar with the procedure to be followed in reading the practice passages during the course, there follows a short 'trial' exercise for you to attempt. The procedure for reading this and other passages – except where you are given different instructions – is as follows:

- Have your stopwatch, or a watch with a second hand, ready and, at a convenient point, begin timing and begin reading.
- Read the passage through once only as quickly as you can without loss of comprehension and note the time taken.
- Answer Sections A and B of the Comprehension Test.
- Convert the time taken to read the passage into 'words per minute'.
- Deal with Section C of the Comprehension Test.
- Set your watch and begin reading NOW.

	**Individual Activity 1:**

Flexibility and Techniques

Levels of Difficulty

No one would suggest for a moment that, in learning to become faster and better readers, we should allow ourselves to fall into the habit of reading everything we encounter at the same high speed. We must take account not only of our purposes in reading but also of the nature and level of difficulty of the material itself.

There are several factors, which determine the level of difficulty of any particular piece of material for any individual reader, and we must be aware of them if we are to approach our reading in a flexible and efficient manner.

Firstly, there is the effect of vocabulary. If the vocabulary used by a writer is wide and varied or if he uses many highly specialised or technical terms, this can make the material more difficult to read. The possession of an extensive vocabulary is therefore essential to the really efficient reader if he is to overcome this problem.

Some subjects are inherently more difficult to understand than others, especially those concerned with abstract ideas, so the subject matter must be taken into account. Similarly, some subjects are inherently more interesting than others, especially those dealing with human life and experience, like true-life adventure stories and biographies of famous people. The interest value of the material, then, is the third factor to consider.

As we have already said, our purpose in reading the material can contribute towards making things easier or more difficult to read. There are comparatively few purposes for which perfect comprehension is essential, but where it is required this makes reading more difficult. Moreover, what you hope to obtain from the material should coincide with what the material is offering, otherwise difficulties will arise.

The construction of material is important. A writer must at least be competent in expressing what he has to say, otherwise he creates difficulties for the reader by, for example, poorly organised material or insufficient care in the choice of words. To a significant extent, efficient reading depends upon effective writing, and this is particularly true with difficult subjects.

The layout of material effects the efficiency with which we can read it and here printers and publishers have a responsibility to fulfil. Typographical design, the length of the printed line, the quality and the colour of the paper can all raise or lower the level of difficulty for the reader. Duplicated material can be especially difficult to read because information is frequently crammed on to a sheet of paper in an attempt at economy.

Internal and external distractions at the time of reading, in the form of noise or people moving about, or even one's attention momentarily wandering from the task of reading, can affect one's concentration and thus make the material more difficult to read. Even the individual reader's personality can make material more difficult. Some people are naturally capable of becoming interested in almost everything, others tend to specialise, and the degree of interest on the part of the reader (as opposed to the interest arising out of the material itself) can raise or lower the level of difficulty. Wide and varied reading interests can help to overcome this problem to a large extent.

Before deciding how much time, attention and effort a reading task requires it is therefore necessary to decide whether you expect the material to be easy, of average difficulty or difficult to read. During the coming week you should pay particular attention to this aspect of the reading process in your efforts to select the most suitable technique for each piece of reading matter.

Use of 'Gears' in Reading Speeds

Flexibility involves making a conscious and deliberate choice of the most appropriate reading technique or 'gear' and, in fact, reading matter can be handled in one of four ways. It can be studied, read slowly, read rapidly, or skimmed. Whichever technique is the most appropriate on any particular occasion will depend partly upon your purpose in reading and partly upon the nature and level of difficulty of the material.

Briefly, the four 'gears' in reading speeds may be described as follows:

STUDYING involves reading, re-reading, making notes and considering the full meaning and implications of the material. Quite obviously, this takes time. It is, therefore, a technique to be

reserved for those occasions when the content of the material is difficult or unfamiliar and/or the material is sufficiently important for high quality of comprehension to be required. Speeds in study reading will range from a few words per minute (where a short passage is read several times, for example) to a maximum of about 200 w.p.m.

SLOW READING is, for most people who have no reading efficiency training, normal reading and is carried out at speeds ranging from 150 words per minute to 300 words per minute, approximately. The efficient reader uses slow reading where the material is fairly difficult or unfamiliar and/or a higher quality of comprehension than usual is required.

RAPID READING is the technique, or 'gear', which most adult readers are able to use for most purposes after a period of training such as the one provided in this book. It enables average or easy material to be dealt with at a comprehension level of 70-80 per cent, which is quite adequate for most purposes in reading. Speeds range from about 300 to about 800 w.p.m.

SKIMMING involves allowing the eyes to move quickly across and down the page, not reading every group of words or even every line. Effectiveness in skimming is greatly assisted by a clear sense of purpose, by paying particular attention to headings, sub-headings, the opening and closing sentences of paragraphs and by looking for key words and phrases. It is a suitable technique when a general outline, or 'overview', of the content of the material is required (800-1000 w.p.m.) or when the reader is trying to locate specific facts or ideas (1000+ w.p.m.). You have already begun to practise a form of skimming in your previewing of material before you read it and in your reviewing of material after having read it.

Since you will already be quite familiar with the technique of slow reading and since you are gradually developing the ability to read rapidly in your progress through this book, let us take a closer look at the techniques of skimming and studying.

A Closer Look at Skimming

Skimming, then, is a form of very fast 'reading'. Your eyes move quickly across and down the page, seeking out the important information that the writer is trying to communicate and discarding everything that is of secondary or minor importance. It can be used profitably when you are reading for specific details (we all skim when 'reading' a dictionary or a telephone directory) or are looking for certain key words' and phrases (for example, when skimming a journal article to ascertain the level at which the writer is treating his subject).

Skimming, therefore, is not reading in any normally accepted sense, but it is still a valid reading technique which can be used to obtain information from the printed page. Skilled skimmers find that they have to read in fill only difficult or important material, everything else can be skimmed without appreciable loss in comprehension. You will need to practise a great deal, however, if you are to emulate these natural skimmers. With practice, students have been known to skim at 2000 w.p.m. and even 3000 w.p.m. and still score highly on the kind of comprehension test in this book.

As you practise skimming, look for the main points the writer is making or for the answers to certain questions about the material which may be at the back of your mind. (What is he saying that is useful to me? What evidence does he give to support his statements?) Remember that you are here transferring the techniques that must be used to find information in dictionaries, telephone directories, handbooks and encyclopaedias to other types of material to acquire certain information only.

When you are skimming, make the fullest possible use of the headings and sub-headings provided and be particularly aware of key or 'topic' sentences in paragraphs. When you have the information you need, move on quickly. Pace yourself against the clock, just as you have been doing on the reading exercises in this book. Check your comprehension by noting down main points and check these afterwards against the material. If you require a more specific comprehension test, then practise skimming on some of the earlier passages in this book that you do not recall so clearly now. You can use newspapers, journals, reports and books for additional practice. You will also find some skimming exercises at the end of this chapter.

As you develop your skill in skimming you will find you are benefiting considerably from the other material the savings in time enable you to read and from not having your attention occupied by unimportant or irrelevant material. At first you may notice some apparent loss in comprehension, but, with a few days' practice, this will correct itself. After all, you are very probably skimming already when you read your daily newspaper (or do you read it all, even the advertisements?) All you are being asked to do here is to realise that there are many more occasions on which you can skim, and, providing you really know your purpose in reading, still understand the material well.

A Closer Look at Studying

We have already defined studying briefly but since it is a fundamental reading technique and since most people are unable to study effectively without instruction we shall now discuss it a little more fully.

As we have already said, studying involves reading and rereading material, making notes and giving careful consideration to the full meaning and implications of the material. It is important to remember that, whilst this process takes time and no little effort it usually results, in the long run, in savings in time. If material is sufficiently important or difficult to require studying, any attempt to find a short cut by being content simply to read the material will invariably result in the necessity for reading it again at a later date. If the material has been studied properly and methodically in the first place, the most you should normally have to do is to refer to your notes.

We all recognise this fact when we are studying for an examination and it is surprising, therefore, that we should fail to recognise that some of our reading at work poses us similar problems to those which the examination student's reading poses. After all, if a report, for example, is to be analysed and evaluated at a meeting, this is very similar to an examination situation. On many such occasions it is we, as well as the material, who are being examined on our abilities to reach effective decisions and conclusions by our colleagues or our superiors. we cannot afford to treat such a situation lightly.

To read effectively for study purposes, you should first of all skim through the material to obtain an 'overview', or general idea of the contents. Secondly, you should define your purposes in studying and your expectations from the material as clearly as possible. You will be familiar with the nature of both these steps from your work on previous chapters in this book.

The third step is to read the material at an appropriate speed, marking important words, phrases, sentences and paragraphs or noting their substance in a notebook. This is the longest, and to many readers the most irksome, stage of the study process, but it is inevitable if the material is very important or difficult to understand. It is this stage which most readers are tempted to omit in the belief that they can obtain a high level of comprehension without it. Or it may be left out because of laziness. Whatever the reason, its omission invariably leads to having to read the material in full a second time or to suffering the consequences of lack of comprehension of the material.

The fourth step is to check your notes against the material to see that nothing of importance has been missed and to make sure that your notes are an accurate and sufficient summary of the material. This check is most important if you are to have the confidence that when reference is made to the material in future, you need only, on most occasions, refer to your notes and do not have to re-read the material all over again. It is important that each step in the study process is completed conscientiously if the maximum benefit is to be derived from this reading technique.

On many occasions and for many purposes in reading, there will be three further steps which must be incorporated in the processes of studying. Frequently, you will need to revise the notes you have made or the passages you have marked for special attention to ensure that your grasp of the material remains of a high order. If this is so, you will find that the need for revision is reduced if you get into the habit of revising your notes the same day on which you made them. If you are studying in the evening revise your notes early the next day. You will find that this kind of immediate revision is an effective method of fixing the material more permanently in your mind.

You will also be well advised to attempt to relate what you have read and learned to its context in the problem being tackled, the work being done or the subject being studied and to what has been learned from previous reading and experience. Try to see connections wherever they exist and in this way, you will build up mastery of the subjects you study and establish a firm foundation for your future reading.

With the most important and the most difficult material you have to deal with, you may find it necessary to add a final step in the form of regular revision of your notes. This is particularly true if you are studying material for, say, a high-level policy meeting or some kind of examination. For complete mastery you need to follow revision done immediately after reading and your attempts to relate what you have read to your previous knowledge with continuous and progressive revision until you are thoroughly familiar with the material. Regular revision is another aspect of study reading which is frequently neglected and particular attention should be given to this. You will find that if you have followed all the previous steps in the study process then revision becomes much easier and is carried out quicker. Revision only becomes difficult and time-consuming when you have not carried out the other steps in the process.

Handling Written Materials Systematically

One of the basic inefficiencies of the slower reader is that he tends to read slowly all the time. Flexibility is the key to efficiency in reading. Not every piece of writing is of equal importance, and some require much more time, care and effort than others. You should reserve your energies for more demanding material. To encourage flexibility and the intelligent use of 'gears', ask yourself the following questions:

- Am I spending enough, or too much, time reading this material?
- Am I taking enough, or too much, care over my reading on this occasion?
- Am I making enough, or too much, effort to understand what I am reading?

As a general principle, the efficient reader will read everything as quickly as his purpose, the material and conditions permit. Thus, he is assured that at any time he is reading as efficiently as he is capable of reading. To achieve the kind of systematic flexibility required, you should also ask yourself, every time you read:
Am I reading as quickly as my purpose, the material and conditions permit?
Is there anything I should be doing in order to read more efficiently?
Am I ready to speed up or slow down if the material suddenly becomes easier or more difficult or if my purpose in reading it changes?

You should never be 'just reading', except when you are using reading merely as a time-filler.

By being flexible, you improve your ability to handle written materials systematically and to make the best possible use of the reading techniques or 'gears' open to you. The following table gives an approximate guide to the kind of reading situation in which each of the four 'gears' is usually used by efficient readers.

Purpose	Material		
	Easy	Average	Difficult
Outline only	4	4	3
General Understanding	4	3	2
Detailed Understanding	3	2	1

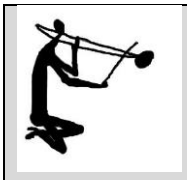
Key: 1 – Studying
2 – Slow reading
3 – Rapid reading
4 – Skimming

Of course, you are the only person who can make the final decision about how to deal with a particular piece of reading matter. You may find that, for most purposes in reading, the preview-read-review approach is quite adequate.

Developing Flexibility

The passage which now follow will provide you with greater opportunities than the previous exercise for developing your flexibility in approaching reading materials and for doing this systematically along the lines we have discussed in this chapter.

The passage will require you to summarise the content and this should enable you to avoid trying to 'spot' possible comprehension questions, leaving you free to put the principles of flexible, efficient reading into practice.

	**Individual Activity 2**

Conducting Basic Research, Analysing and Presenting Findings

Identifying and defining scope of topic

Research is nothing more than finding out what you need to know. It can be done in different ways from looking up the meaning of a word to conducting an opinion poll. Depending on what you want to find out, you can ask experts in the field their opinion, do experiments, interview eyewitnesses, analyse photographs, or observe the behaviour of people who are not aware that they are being watched.

Any organised investigation can be referred to as research. Research is important to your writing as you will not always know enough on your own about the subject you will be writing on.

To identify and define the scope of your research project you should consider the following aspects:

- Subject
- Audience

- Voice
- Information and opinion
- Length
- Sources

Subject

Frame your research task in the form of a question that you want your investigation to answer. You may explore any subject that arouses your interest. Before attempting to answer the question, you have to analyse and break it down into its logical segments. Only then will a clear pattern emerge. In other words, you need a plan for your writing. In the process of identifying a scope you need to decide what will be included in you research project and what will be excluded from it.

The scope statement is a short paragraph that describes in terms as simple as possible the principal deliverables and the limits or boundaries of the project. It should be short and should contain as many active verbs as possible, because it will later serve as a basis for creating the outline of your research.

A good scope statement has three components:

- The principal deliverables of the research project.
- The objectives, which are measures of the success of the research project.
- A justification for the research project. The scope statement captures the goal of the research project and it also defines the limits of the project in very succinct terms. When choosing your subject, you can consider the following:
- Choose a subject that relates to your immediate environment. It will be easier to access information.
- Topical issues are an important source as they are relevant to current situations.
- When you read research articles you will often notice recommendations for further research mentioned at the end of the article.
- You can speak to experts in the field of study as they can come up with ideas that might help.
- Contemporary issues that are debatable can be found in letters that readers write to newspapers and magazines.
- You might find discrepancies between theory and practice.

Avoid a subject that too wide in scope or that is too technical.

Audience

Understanding readers and their needs is a key factor in creating useful research report. Although all elements of audience analysis or identification hinge on some basic stereotypes, and relying entirely on stereotypes for any purpose is dangerous, these four basic elements of audience analysis might, nevertheless, affect how you would write your document:

- Use of information

  Most readers read workplace documents to help them perform their jobs and want to know rather quickly how any given document concerns them. Thus, you must determine whether your audience will use your document to make decisions, understand the history of an idea or position within your organization, gain insights about related matters, perform a task, fulfil a requirement, or accommodate a policy. Therefore, job-related factors that determine how the reader will use the information you provide will help you decide what kinds of content to include for your audience.
- Level of education

  Generally, the more education audience members have, the stronger their reasoning skills, the more advanced their vocabulary, the greater their familiarity with metaphors and other comparisons, and the greater their capacity for following complex and even theoretical arguments. Thus, knowing your audience's level of education will allow you to make some decisions about the style of your writing and the appropriate sophistication of your argument or explanation.

Voice

You have to honestly present what you have learned in you research. Remember that your reader's interests have to come first. You are allowed to share ideas and opinions of your own. Whatever point of view you take, should be made clear to your reader from the start.

Length

A typical research paper is six to twelve pages long. The length of your paper should be determined by the nature of your subject.

Sources

Your research should be based on a variety of research methods. You can include secondary sources such as books, periodicals, newspapers, as well as electronic media such as the Internet. It can also include interviews you have had with experts in the field.

Planning and Sequencing your Research Steps

First, think about how much time you can spend on the project. Then, begin as early as possible in order to allow time for Interlibrary Loan, recalling books, and other snags. And, most importantly, choose a topic that is MANAGEABLE. Manageable means that the topic isn't too broad or too narrow so that you would need more time or so you can't find enough information.

Think about the things listed below BEFORE you start to choose a topic. Although deciding on a topic sounds simple, you'll regret it later if you choose one quickly without doing some looking around first.

Writing a research paper involves a lot of work. You have to:

- choose the topic,
- explore it,
- chase down leads,
- take notes,
- consult different sources,
- think,
- jot down ideas,
- narrow your projects focus,
- write a first draft,
- revise and revise again.

As you can see, a research project cannot be done in a day or two. You need to plan to enable you to have enough time to undertake each step of the process. The following schedule is an example of planning the research process:

Research Project	
Principal Deadlines	**Due Dates**
1. Research scope due, including a statement of my research topic and a working bibliography.	.....
2. Note cards and preliminary outline due.	.....
3. Editing of completed draft.	.....
4. Typed good draft due.	.....
5. Final draft due.	.....

Research Plans Depend on Information You Need and Available Resources

Often, organization members want to know everything about their products, services, programs, etc. Your research plans depend on what information you need to collect in order to make major decisions about a product, service, program, etc. Usually, you're faced with a major decision due to, e.g., ongoing complaints from customers, need to convince funders / bankers to loan money, unmet needs among customers, the need to polish an internal process, etc. The more focused you are about what you want to gain by your research, the more effective and efficient you can be in your research, the shorter the time it will take you and ultimately the less it will cost you (whether in your own time, the time of your employees and/or the time of a consultant).

There are trade-offs, too, in the breadth and depth of information you get. The more breadth you want, usually the less depth you'll get (unless you have a great deal of resources to carry out the research). On the other hand, if you want to examine a certain aspect of a product, service, program, etc., in great detail, you will likely not get as much information about other aspects as well. For those starting out in research or who have very limited resources, they can use various methods to get a good mix of breadth and depth of information. They can understand more about certain areas of their products, services, programs, etc., and not go bankrupt doing so.

Key Considerations to Design Your Research Approach Consider the following key questions when designing your research plan:

- For what purposes is the research being done, i.e., what do you want to be able to decide as a result of the research?
- Who are the audiences for the information from the research, e.g., funders / bankers, upper management, employees, customers, etc.

- What kinds of information are needed to make the decisions you need to make and/or to enlighten your intended audiences, e.g., do you need information to really understand a process, the customers who buy certain products, strengths and weaknesses of the product or service or program, benefits to customers, how the product or service or program failed some customers and why, etc.?
- From what sources should the information be collected, e.g., employees, customers, groups of employees or customers, certain documentation, etc.?
- How can that information be collected in a reasonable fashion, e.g., questionnaires, interviews, examining documentation, observing staff and/or clients in the program, conducting focus groups among staff and/or clients, etc?
- When is the information needed (so, by when must it be collected)?
- What resources are available to collect the information?

Research techniques

Gathering information

Do some preliminary research to explore the topic you are considering.

- Learn more about your topic by reading about it in encyclopaedias and other general reference sources. If the topic seems appropriate, take notes and see if you can narrow your focus to a specific question.
- See if your topic is researchable by assembling a working bibliography of about a dozen sources that you intend to consult. Use a variety of search tools. Include books, periodicals, newspapers, and electronic media, as appropriate for your topic. If, for example, you are writing about a recent event, newspaper articles will be a significant source of information. On the other hand, if you are writing about an event from ancient history, you may not discover any newspaper sources.
- If adequate sources are not available, see if you can broaden your topic or switch to another one. If you find too many sources, read more about the subject and narrow your paper's focus within more manageable limits.
- Make sure your sources are available. Find out if the library has the periodicals and newspapers you are seeking. Check books out. If necessary, order books from other libraries through Inter-Library Loan. Ask the circulation desk to recall desired books that have been checked out by others. If most of the books are gone, however, someone else is probably writing on your topic, and the sources you need may not become available in time. If so, avoid needless frustration by switching now to another topic.

- Do some quick reading in your sources to learn more about your topic. It might be wise to ask a professor or some other authority on your subject for suggestions about the topic and for further research sources.
- Decide what additional sources can provide valuable information for your project.
- Write letters to request information, if necessary. Arrange interviews in advance by setting up appointments.
- Be sure to record your discoveries, questions, and other experiences with locating sources in your research notebook.

Interviewing

In addition to print sources, interviews with experts can provide valuable material for your paper. Because the people you interview are primary rather than secondary sources, the first-hand information they provide is exclusively yours to present – information that readers will find nowhere else. Therefore, interviewed sources can make a favourable impression, giving readers the sense that they are getting expert testimony directly and reliably.

Your own reliability and credibility may also be enhanced, since you demonstrate the initiative to have extended your search beyond the usual kinds of sources. In your work situation colleagues and subject matter experts are an accessible source of expert information. Being familiar with research in their individual fields, they also can suggest published and unpublished resources you might not have found in your library research. You may also find experts living in your local community. Other valuable sources include participants and eyewitnesses. If you were researching, say, the War in Southwest Africa before it became Namibia, you could interview relatives and neighbours with experience in the military. Be resourceful in considering interviewees who can contribute to your knowledge and understanding. Conducting interviews may not be the first order of business in your research project, but because interviews require advance planning, it is important to set up appointments as early as possible-even before you are ready to conduct them.

Conducting the Interview

Some interviews may consist of a simple question or two, designed to fill specific gaps in your knowledge about your topic. Others may be extended question-and-answer sessions about a variety of topics. The success of your interviewing depends on your preparation, professionalism, and interpersonal skills. The following guidelines should be followed when you conduct an interview.

Before the interview:

Be well prepared. The most important part of the interview takes place before the questions are posed. Become as informed about your subject as you can so that you can ask the right questions. Use your reading notes to prepare questions in advance.

Dress appropriately for the interview. How you dress can influence how the interviewee behaves toward you; people are most comfortable talking with someone who dresses as they do. Business and professional people, for example, are more likely to take you seriously if you are wearing standard business attire. On the other hand, formal attire would be inappropriate when interviewing striking factory workers, who might be reluctant to speak freely with someone who looks like management.

Arrive on time for your appointment. Not only is arriving on time a matter of courtesy, but also it is essential in assuring the interviewee's cooperation.

During the interview:

Take careful and accurate notes. If you intend to quote your source, you must be certain that you have copied the person's words exactly. A tape recorder can give you an accurate transcript of your interviews.

Behave politely and ethically. Be certain you have the interviewee's permission if you tape-record the conversation. If you take notes, offer to let the interviewee check the transcript later to ensure accuracy (doing so may elicit further elaborations and additional statements that you can use).

Be relaxed and friendly. People who are not accustomed to being interviewed are often nervous at first about having their comments recorded. By being friendly and relaxed, you can win their confidence and put them at ease. The most fruitful parts of interviews occur when interviewees become absorbed in what they are saying and forget they are being recorded. Begin with general questions that can be answered with ease and confidence. Later introduce more specific and pointed questions. (For experienced interviewees, these precautions may not be necessary.)

Make your recording as unobtrusive as possible. Many people will not speak freely and naturally when constantly reminded that their comments are being recorded. Place the tape

recorder out of the interviewer's direct line of sight. Do not write constantly during the interview; write down key phrases and facts that will allow you to reconstruct the conversation immediately after the interview.

Be interested in what the interviewee says. People will speak much more freely with you if they sense that you are responsive to their comments. It is a mistake for an interviewer to read one prepared question after another, while barely listening to the interviewee's responses. Such wooden interviewing produces an uncomfortable atmosphere and strained responses.

Stay flexible. Do not be a slave to your prepared questions. Listen with real curiosity to what the person says and ask further questions based on what you learn. Request explanations of what is not clear to you. Ask probing questions when a topic is raised that you would like to learn more about.

Let the interviewee do the talking. Remember that it is the interviewee's ideas that you are interested in, not your own. Avoid the temptation to state your own opinions and experiences or to argue points with the interviewee.

After the interview:

End the interview professionally. Check your notes and questions to determine if any gaps still need to be filled. Thank the interviewee. Ask if the person would like to check your use of statements and information for accuracy, and whether you can call again if you have further questions. Offer to send the interviewee a copy of your paper when it is completed.

Be fair to the source. When you write the paper, be certain that any ideas or statements you attribute to the source are true reflections of the sound and spirit of the person's answers and comments. Be accurate in quoting the person, but eliminate slips of the tongue and distracting phrases like uh and you know.

Send a thank-you note. Whether or not you send a copy of your paper to the interviewee, you should send a note expressing your appreciation for the help that the person provided.

Sifting Information for Relevance

Sifting and sorting is the process of keeping only gathered information that meets the established criteria. When sifting information for relevance you should consider the following elements:

- Currency
- Reliability
- Coverage
- Accuracy
- Objectivity

Currency

How up to date is the information source? Does it cover recent developments? Has it been updated (in the form of a new edition or update) to deal with changes in knowledge or corrections? This is more important in some areas (e.g., the sciences) than others (e.g. literature).

Be aware that dates can be misleading: Books – It can take up to two years for a book to be published, so the information in a 1999 book may already be out of date. Some dates represent the year a book was republished (as a paperback, or after being out of print for some years). Journals – Journal articles are usually printed more quickly than books, but there can still be a delay of over a year (depending on the journal) before you see it, especially considering that many journals are sent to Australia by sea. Web pages – Many are updated constantly, but there is no guarantee that the date given (if given at all) is accurate.

Reliability

Is it clear who is the author? What are the author's credentials? What qualifications do they have for writing the piece? Are they backed by a reputable or traceable organisation? Information that does not conform to these criteria is not necessarily flawed or unreliable, but you should use it with caution. Remember that the web in particular is open to anyone who can write anything they want. Look carefully for evidence of bias, omissions or unsupported statements of "fact".

Coverage

When considering whether an information source is going to be useful you need to look at the range it covers. You also need to consider whether it consists of primary or secondary source material. Primary material contains new information or a new interpretation of previously known

information. Secondary material is interpretation and comment on primary material by others. Does it have the detail you need? Does it supplement other sources you have read or merely confirm information you already knew? You may need to cover a variety of different viewpoints.

If your essay is on a broad topic don't try to absorb every detail you can find. Start with an article from an encyclopaedia or find a book that gives a general overview of your topic. When you need detailed information, an academic article is more likely to help you than a general overview.

Accuracy

Can you check the information elsewhere? Are the sources of any facts clearly and correctly listed? Do you have faith in the spelling and other proof-reading aspects of the work? Key dates, facts and other figures should always be verified from alternative sources to ensure that they are correct. Check that they come from the source cited in the work. An incorrect citation may imply that the facts are not correct. While spelling and proof reading may seem trivial, consistent misspellings may mean that facts and figures are also typed or printed incorrectly. They may also imply that the information has not been thoroughly checked for inaccuracies.

Objectivity

This is the most difficult area to judge because virtually all sources are subjective in some way. Good academic work considers all viewpoints and uses material from many sources to show a depth of research and consideration of all aspects of a question. Some tips for recognising bias in information sources:

- Use of emotive or derogatory language
- Omissions in the information presented
- Contradictions to other material you have read
- Viewpoints that seem extreme to you
- You may disagree with some sources, but you need to show your familiarity with them, and demonstrate why you disagree with them.

Further questions to ask yourself:

- Is the article relevant to the current research project? A well-researched, well written, etc. article is not going to be helpful if it does not address the topic at hand.
- Ask, "is this article useful to me?"
- If it is a useful article, does it:

- support an argument
- refute an argument
- give examples (survey results, primary research findings, case studies, incidents)
- provide "wrong" information that can be challenged or disagreed with productively.

Classifying, Categorizing and Sorting Information

Classifying and Categorising

Questions that help you classify or categorize information:

- How are these ideas alike? How are the ideas different?
- Which ideas belong together?
- How are the ideas related?
- How would you group the facts from the selection?

Classification is an inherent part of creating a document. Every time you write a heading, you are in fact creating a classification. If the document is long (more than 600 words) you should have sub-headings. These are sub-classifications underneath the heading classification.

Good internal classification has three key objectives:

- To organize the document in such a way that maximizes its ability to communicate knowledge.
- To allow the reader to quickly find specific parts of the document.
- To allow the reader to extract specific parts of various documents, and in so doing create a new document. For example, the reader might compile the summaries of ten documents dealing with the South African car industry.

Classification experts tend to focus on organizing complete documents, books, music and other content. They classify for two reasons:

- To organize the content so that it can be found quickly.
- To place the content in context so that it becomes part of a cohesive body of knowledge.

Here are some general rules of classification:

- **Establish clear objectives**. What do you want to use your email software for? Is it for personal use, for business use, or for both? Your objectives will frame the type of classifications you require.
- **Design classification like it will be 'written in stone**.' You don't want to be changing your classification every six months. This will mean a lot of work and will create confusion.
- **Design for the total content environment**. Don't just design for the content you have today. Try to have a long-term perspective. This will result in a much more robust classification.
- **Be practical**. Your classification should be lean and mean. Overdoing classification can be as bad as not doing it at all.
- **Avoid duplication**. Creating two classifications that are essentially the same leads to confusion.
- **Test**. You should do as much testing as possible. Get feedback, particularly where you are creating a classification that you want other people to use.
- **Take your time**. Speed is the enemy of quality classification. Don't rush. Consider each classification carefully. Your efforts will pay handsome dividends in the long-term.

Sorting

One important kind of sorting is arranging items of information in alphabetical sequence according to some pre-defined ordering relation (sort key by each group of lists), e.g., when one sorts the books in a library by title, subject or author (all alphabetically sorted normally in ascending order).

The resulting order may be either ascending or descending, because essentially all sorting is numerical sorting. Now if you sort on different keys, then you get different lists of header information (such as the author's name) with the appended tailing records (such as title or publisher).

The main purpose of sorting information is to optimise its usefulness for specific tasks. In general, there are two ways of grouping information:

- By category e.g., a shopping catalogue where items are compiled together under headings such as 'home', 'sport & leisure', 'women's clothes' etc. and

- By the intensity of some property, such as price, e.g. from the cheapest to most expensive.

This is illustrated by the following story:
Managers are on a course of basic computer terms and they are explained the meaning of sorting. The lecturer comes in and throws hundreds of various nails and screws, new, old, rusty and crooked, of different size and material on the table. S/he then tells them to, sort! The student in no time create a dozen or so heaps each with relatively homogenous members, and with some undecided cases left. The lecturer picks up a straight and strong nail, and hammers it in the wall with his/her shoe sole. "You failed to ask sort what for, or what to sort on" – s/he would tell the puzzled audience.

In the book Information Anxiety by Richard Saul Wurman, he proposes that the most common sorting purposes are Name, by Location and by Time (these are actually special cases of category and hierarchy). Together these give the acronym LATCH (Location, Alphabetical, Time, Category, Hierarchy) and can be used to describe just about every type of ordered information.

Analysing and Presenting Research Findings

Analysis is the process of finding out what your information means and what conclusions it will support. For survey information, item mean scores generally suffice. For behavioural indicators, such as absences and tardiness, frequency counts or percentages will do the job. These analyses are descriptive and comparable. You can use them to measure your progress from year to year.

Analysing quantitative and qualitative data is often the topic of advanced research and evaluation methods courses. However, there are certain basics which can help to make sense of reams of data.

Always start with your research goals

When analysing data (whether from questionnaires, interviews, focus groups, or whatever), always start from review of your research goals, i.e., the reason you undertook the research in the first place. This will help you organize your data and focus your analysis. For example, if you wanted to improve a program by identifying its strengths and weaknesses, you can organize data into program strengths, weaknesses and suggestions to improve the program. If you wanted to fully understand how your program works, you could organize data in the chronological order

in which customers or clients go through your program. If you are conducting a performance improvement study, you can categorize data according to each measure associated with each overall performance result, e.g., employee learning, productivity and results.

Basic analysis of "quantitative" information (for information other than commentary, e.g., ratings, rankings, yes's, no's, etc.):

- Make copies of your data and store the master copy away. Use the copy for making edits, cutting and pasting, etc.
- Tabulate the information, i.e., add up the number of ratings, rankings, yes's, and no's for each question.
- For ratings and rankings, consider computing a mean, or average, for each question. For example, "For question #1, the average ranking was 2.4". This is more meaningful than indicating, e.g., how many respondents ranked 1, 2, or 3.
- Consider conveying the range of answers, e.g., 20 people ranked "1", 30 ranked "2", and 20 people ranked "3".

Basic analysis of "qualitative" information (respondents' verbal answers in interviews, focus groups, or written commentary on questionnaires):

- Read through all the data.
- Organize comments into similar categories, e.g., concerns, suggestions, strengths, weaknesses, similar experiences, program inputs, recommendations, outputs, outcome indicators, etc.
- Label the categories or themes, e.g., concerns, suggestions, etc.
- Attempt to identify patterns, or associations and causal relationships in the themes, e.g., all people who attended programs in the evening had similar concerns, most people came from the same geographic area, most people were in the same salary range, what processes or events respondents experience during the program, etc.
- Keep all commentary for several years after completion in case needed for future reference.

Interpreting information

- Attempt to put the information in perspective, e.g., compare results to what you expected, promised results; management or program staff; any common standards for your products or services; original goals (especially if you're conducting a program evaluation); indications or measures of accomplishing outcomes or results (especially if

you're conducting an outcomes or performance evaluation); description of the program's experiences, strengths, weaknesses, etc. (especially if you're conducting a process evaluation).

- Consider recommendations to help employees improve the program, product or service; conclusions about program operations or meeting goals, etc.
- Record conclusions and recommendations in a report, and associate interpretations to justify your conclusions or recommendations.

Reporting Results

- The level and scope of content depends on to whom the report is intended, e.g., to funders / bankers, employees, clients, customers, the public, etc.
- Be sure employees had a chance to carefully review and discuss the report. Translate recommendations to action plans, including who is going to do what about the research results and by when.
- Be sure to record the research plans and activities in a research plan which can be referenced when a similar research effort is needed in the future.

Contents of a Research Report -- An Example

Ensure your research plan is documented so that you can regularly and efficiently carry out your research activities. In your plan, record enough information so that someone outside of the organization can understand what you're researching and how. For example, consider the following format:

- Title Page (name of the organization that is being, or has a product/service/ program that is being researched; date)
- Table of Contents
- Executive Summary (one-page, concise overview of findings and recommendations)
- Purpose of the Report (what type of research was conducted, what decisions are being aided by the findings of the research, who is making the decision, etc.)
- Background About Organization and Product/Service/Program that is being researched
    1. Organization Description/History
    2. Product/Service/Program Description (that is being researched)
        a. Problem Statement (in the case of non-profits, description of the community need that is being met by the product/service/program)
        b. Overall Goal(s) of Product/Service/Program

c. Outcomes (or client/customer impacts) and Performance Measures (that can be measured as indicators toward the outcomes)
d. Activities/Technologies of the Product/Service/Program (general description of how the product/service/program is developed and delivered)
e. Staffing (description of the number of personnel and roles in the organization that are relevant to developing and delivering the product/service/program)
f. Overall Evaluation Goals (e.g., what questions are being answered by the research)
g. Methodology
    i. Types of data/information that were collected
    ii. How data/information were collected (what instruments were used, etc.)
    iii. How data/information were analysed
    iv. Limitations of the evaluation (e.g., cautions about findings/conclusions and how to use the findings/conclusions, etc.)
h. Interpretations and Conclusions (from analysis of the data/ information)
i. Recommendations (regarding the decisions that must be made about the product/service/program)

Appendices:

Content of the appendices depends on the goals of the research report, e.g.:

- Instruments used to collect data/information
- Data, e.g., in tabular format, etc.
- Testimonials, comments made by users of the product/service/program
- Case studies of users of the product/service/program
- Any related literature

Some Pitfalls to Avoid

- Don't balk at research because it seems far too "scientific." It's not. Usually, the first 20% of effort will generate the first 80% of the plan, and this is far better than nothing.

- There is no "perfect" research design. Don't worry about the research design being perfect. It's far more important to do something than to wait until every last detail has been tested.
- Work hard to include some interviews in your research methods. Questionnaires don't capture "the story," and the story is usually the most powerful depiction of the benefits of your products, services, programs, etc.
- Don't interview just the successes. You'll learn a great deal by understanding its failures, dropouts, etc.
- Don't throw away research results once a report has been generated. Results don't take up much room, and they can provide precious information later when trying to understand changes in the product, service or program.

Conclusions and Recommendations

Although you may have learned in other writing classes that summaries are appropriate conclusions for papers, summaries are typically offered as front matter (prefatory material) in research documents. Therefore, a summary is a weak, redundant ending for a research document. You may, of course, offer a few summary statements to orientate your reader, but effective conclusions do far more than recap information you have already offered in the prefatory material, the introduction, and the discussion of your document.

These endings are all based on the idea that you should draw conclusions, not just conclude. In short, they depend on your explaining "What does this mean for us?" One of the most useful conclusions for many workplace documents is a section offering recommendations or solutions. Such a conclusion is most typically used for problem/solution reports, but it can also be used for cause/effect, comparison/ contrast, and other organizational schemes. In this section, you may recommend which of several solutions is most likely to solve the problem, is most feasible, or is least disruptive.

Although instincts are important in the workplace, a reader will rarely be satisfied that they are the best grounds on which to base important decisions. Thus, you must explain the criteria on which your recommendations are based. Furthermore, your criteria must match the reader's expectations and needs. Imagine how embarrassing it would be to offer recommendations based on a sense of urgency and moving from immediate-to-remote implementation stages when your readers think your recommendations are based on costs. In other words, you might lose all your

credibility if you have proposed an expensive plan because it offers the most immediate relief for the problem, but your readers expect you to offer the most cost-efficient plan.

Your recommendations may correspond to the following criteria:

- Costs or other budget matters
- The mission of the organization
- Space
- Human Resources needs
- Deadlines (legal, business, environmental, or other forms of deadlines)
- Tax structures
- Immediate-to-remote implementation schedules
- Equipment or technological needs
- Materials availability
- Locations

Lead and Function in a Team

Meetings – basic rules

- Plan - use the agenda as a planning tool (see 'POSTAD TV' acronym below)
- Circulate agenda in advance
- Run the meeting - keep control, agree outcomes, actions and responsibilities, take notes
- Write and circulate notes
- Follow up agreed actions and responsibilities

Meetings come in all shapes and sizes, and for lots of purposes. Meeting purposes include:

- Giving information
- Training
- Discussion (leading to an objective)
- Generating ideas • Planning • Workshops
- Consulting and getting feedback
- Finding solutions/solving problems
- Crisis management
- Performance reporting/assessment

- Setting targets and objectives
- Setting tasks and delegating
- Making decisions
- Conveying /clarifying policy issues
- Team building
- Motivating
- Special subjects - guest speakers
- Inter-departmental - process improvement

The acronym POSTAD TV shows you how to plan effective meetings, and particularly how to construct the meeting agenda, and then notify the meeting delegates:
Priorities, Outcomes, Sequence, Timings, Agenda, Date, Time, Venue.

Meeting priorities

What is the meeting's purpose? Always have one; otherwise, don't have a meeting. Decide the issues for inclusion in the meeting and their relative priority: importance and urgency. You can avoid the pressure for 'Any Other Business' at the end of the meeting if you circulate a draft agenda in advance of the meeting, and ask for any other items for consideration. ('Any Other Business' often creates a free-for-all session that wastes time, and gives rise to new tricky expectations, which if not managed properly then closes the meeting on a negative note.)

Meeting Outcomes

Decide what outcome (i.e., what is the purpose) you seek for each issue, and put this on the agenda alongside the item heading. This is important, as people need to know what is expected of them, and each item will be more productive with a clear aim at the outset. Typical outcomes are:

- Decision
- Discussion
- Information
- Planning (e.g. workshop session)
- Generating ideas
- Getting feedback
- Finding solutions

- Agreeing (targets, budgets, aims, etc.)
- Policy statement
- Team-building/motivation
- Guest speaker – information, initiatives, etc

Meeting sequence

Put the less important issues at the top of the agenda, not the bottom. If you put them on the bottom you may never get to them. Ensure any urgent issues are placed up the agenda. Non-urgent items place down the agenda – if you are going to miss any you can more easily afford to miss these. Try to achieve a varied sequence – don't put all the heavy controversial items together – mix it up.

Meeting timings (of agenda items)

Decide the length of the meeting, and allocate a realistic time slot for each item. Do not try to pack too much in – keep it realistic – things generally take longer than you think. Long meetings involving travel for delegates require pre-meeting refreshments 30 minutes prior to the actual meeting start time.

Put lots of breaks into long meetings. Unless people are participating and fully involved, their concentration begins to drop after just 45 minutes. Breaks don't all need to be 20 minutes for coffee and cigarettes. Five minutes every hour for a quick breath of fresh air and leg-stretch will keep people attentive.

Unless you have a specific reason for arranging one, avoid formal sit-down restaurant lunches – they'll add at least 30 minutes unnecessarily to the lunch break, and the whole thing makes people drowsy. Working lunches are great, but make sure you give people 10-15 minutes to get some fresh air and move about outside the meeting room. If the venue is only able to provide lunch in the restaurant arrange a buffet, or ensure delegates' menu choices are decided well before lunchtime.

Running the meeting

The key to success is keeping control. You do this by sticking to the agenda, managing the relationships and personalities, and concentrating on outcomes. Meetings must have a purpose. Every item must have a purpose. Remind yourself and the group of the required outcomes and steer the proceedings towards making progress, not hot air.

Politely suppress the over-zealous, and encourage the nervous. Take notes as you go, recording the salient points and the agreed actions, with names, measurable outcomes and deadlines. Do not record everything word-for-word, and if you find yourself taking over the chairmanship of a particularly stuffy group which produces reams of notes and very little else, then change things. Concentrate on achieving the outcomes you set the meeting when you drew up the agenda.

Avoid racing away with decisions if your aim was simply discussion and involving people. Avoid hours of discussion if you simply need a decision. Avoid debate if you simply need to convey a policy issue. Policy is policy and that is that. Defer new issues to another time. Practice and use the phrase 'You may have a point, but it's not for this meeting – we'll discuss it another time.' (And then remember to do it.)

If you don't know the answer say so – be honest – don't waffle – say that you'll get back to everyone with the answer, or append it to the meeting notes. If someone persistently moans on about a specific issue that is not on the agenda, quickly translate it into a simple exploratory or investigative project, and bounce it back to them, with a deadline to report back their findings and recommendations to you. Use the rules on delegation to help you manage people and tasks and outcomes through meetings. Always look at how people are behaving in meetings – look for signs of tiredness, exasperation, and confusion, and take necessary action.

As a general rule, don't deviate from the agenda, but if things get very heavy, and the next item is very heavy too, swap it around for something participative coming later on the agenda – a syndicate exercise, or a team game, a quiz, etc.

Negotiation strategy

- Separate the People form the Problem
- Focus on Interests behind positions
- Invent Options for mutual gain
- Insist on using Independent Standards
- Develop your Best Alternative to a Negotiated Agreement (BATNA)

Handling Perception Problems

- Put yourself in their shoes
- Don't blame
- Help them become involved
- Help them save face 4

Handling Emotions

- Recognize, understand, and make explicit the emotions – yours and theirs.
- Allow the other side to let off steam
- Don't react to emotional outbursts
- Consider apologizing

Communicating Effectively

- Listen actively
- Speak about yourself, not about them
- Speak for a purpose

Useful phrases for handling people problems

"Let me see if I understand what you just said …"

"I can appreciate why you feel like that..."

"I see it this way … How do you see it?"

"I would like your advice about ...?"

Questions to uncover Interests

"Help me to understand why this is really important to you."

"What concerns do you have?"

"What's the real problem?"

"What would be wrong with …?"

"Why not this …?"

"What are your fears concerning this?"

Successful Inventing

- Invent before you judge.
- Invent a wide range of options.
- Dovetail.
- Use imaginative procedures.

Killer phrases

- A good idea, but …
- Against company policy
- Be practical
- All right in theory, but …
- The boss won't go for it
- Are you serious?

Differences that can be dovetailed

- Different interests
- Same interests, different priorities
- Different values placed on time
- Different forecasts
- Different aversion to risk
- Different beliefs

Independent Standards

A standard is a measuring stick, independent of the will of the other side, for choosing among conflicting options.

Examples of standards

- Consumer Price Index
- Ability to pay
- Equal treatment laws
- Industry standards
- Market value
- Precedent
- Tradition
- Reciprocity
- Costs
- Efficiency

Search for possible independent standards. Be open to reason. Never yield to pressure, only to reason.

Questions to arrive at standards:

- "How did you arrive at that?"
- "What's the theory behind this?"
- "What makes that fair?"
- "How are others handling the same problem?"

Making Offers

- Present offers rather than state positions
- Present offers in terms of gain
- Include specific items that appeal to their interests
- State benefits to them

Negotiation Phases

Entry

- Be soft on the people; hear them out
- Set objective for the meeting
- Inquire as to the other's authority

Exploration

- Focus on Interests behind positions
- Invent Options for mutual gain
- Use independent standards

Bargaining

- Present Offers, not positions
- Caucus
- Sum up areas of agreement and disagreement

Closing

- Make sure agreement is better than your BATNA.
- Make agreement clear and specific, in writing.
- Reaffirm relationship.

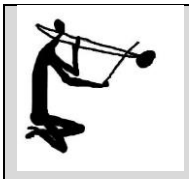
Countering Dirty Tricks

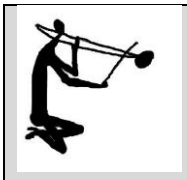
- Recognize the tactic
- Bring it up
- Negotiate
- Walk out – don't be a victim

Common Dirty Tricks

- Lock-ins
- Good guy / bad guy
- No authority

- Threats
- Add-ons
- Phoney acts

	**Individual Activity 3:**

	**Individual Activity 4**

Unit Standard	
119462	Engage in sustained oral communication and evaluate spoken texts
Specific Outcomes	
SO 1: Respond critically yet sensitively as a listener. SO 2: Analyse own responses to spoken texts and adjust as required. SO 3: Use strategies to be an effective speaker in sustained oral interactions. SO 4: Evaluate spoken discourse. SO 5: Lead and function in a team. SO 6: Reflect on how characteristics of the workplace and occupational context affect learning.	
Learning Outcomes	
Identifying	Science
Organising	Communicating
Demonstrating	Contributing
Collecting	Working

CONFLICT MANAGEMENT

Verbal communication

The communication process takes place when information sent by a person (the sender) is received by a second person(s) (the receiver), decoded and reacted upon.

Importance

Effective communication only takes place when the reaction of the receiving person is positive, according to the expectations of the sender. For example, by altering the intonation of the voice a customer may either receive the message that a waiter is really pleased to see and help him or that he is merely another nuisance to be served. Effective internal and external verbal communication has a direct effect on a company's image and success in the following ways:

- Good, clear, concise communication eliminates time wastage in trying to resolve confusion, errors and conflicts.
- Customers/guests/patrons like feeling important and will return and recommend the establishment to others if they are treated with politeness and helpfulness. This promotes return business.

Staff with positive attitudes, who speak to each other with respect, reflect a positive company image. This gains customer confidence in the establishment.

Types of verbal communication

Internal

Internal verbal communication may be categorised as follows:

- Intra-personal communication is communication with one's self. Talking to one's self is an example.
- Extra-personal communication (as illustrated above) refers to communication to an inanimate object or non-human (plant or animal).

  For example, talking to a cat/dog or saying: "You naughty table!" after a toddler bumps his head on it.

- Interpersonal communication refers to an ordinary conversation on a one-on-one basis, or a very small group. It may also refer to communication between groups of individuals (group discussions or informally in a crowd).

  For example, communication within and between departments in an organisation.

The experience in business has been that, generally, as the size of the organisation increases, communication decreases and morale declines. The ever-increasing size of organisations means

that lines of communication are further and further extended. The more communication "centres" (e.g., departments within an organisation) a message has to pass through, the greater the chance of distortion or breakdown.

Instead of trying to improve communication abilities of all employees, there are steps that may be taken to alleviate the situation:

- Open channels for feedback should be established.
- Policy and procedure for communication should be laid down.
- Top management should communicate directly to all staff using the public-address system or public notice.

External

This refers to communication with an audience or people outside of an organisation.

For example: Suppliers, Cleaning Services, and Out-sourced Facilitators conducting lectures in a corporation.

Face-to-face

When communicating face-to-face, body language plays a vital role in conveying the appropriate messages.

Eye Contact

In the business culture, it is imperative to make eye contact if one wishes to make a positive impression with guests and maintain a relationship based on trust. Consider the following:

- Maintain eye contact without staring, as this is arrogant and threatening.
- Avoid blinking too much as this communicates nervousness and can be interpreted as an indication of dishonesty.
- Try to keep eye level on the same level as the guest. Stand if the guest is standing. If the guest is seated, accommodate this by standing back a little.

Facial Expressions

Be aware of facial expressions when speaking to people. Professional service providers who deliver excellent service have alert, lively and appropriate facial expressions. Avoid the following facial expressions:

- An expressionless or deadpan face showing no emotion in response to what guests say makes them feel uncomfortable. This may be interpreted as boredom, rudeness or indifference.
- An arrogant or stern expression creates the impression of being superior to others.
- Grinning continually makes one look stupid. It creates the impression of misunderstanding what is being said or done. It may also create the impression of being deliberately unhelpful.

Gestures

Head and hand movements are common during speech: Smooth and wide gestures with palms facing upwards, are warm and welcoming. People react positively to friendliness and helpfulness. Guests are naturally drawn to people who use calming gestures.

Sharp, short gestures with palms facing downwards, are aggressive and negative. People react by wanting to either dispute or avoid. When upset or if there is a need to discuss problems, gestures should be controlled. Problems are never resolved through aggressive gestures.

Posture

The way the speaker stands, sits or walks, indicates a great deal about the speaker's attitude, mood and self-esteem. A correct posture entails the following:

- Stand upright with arms comfortably at sides
- Keep shoulders dropped and slightly back
- Stand with feet slightly apart to maintain balance
- Walk briskly because it creates a professional impression
- Sit upright with shoulders back. Slouching looks lazy
- When speaking to guests, either face them or turn the body slightly sideways towards them
- Avoid leaning against walls or furniture
- Avoid folded arms – they create the impression of being shy or arrogant
- Standing with hands on hips looks arrogant
- Swinging when speaking to people suggests a lack of self-confidence
- Resting the face on hands while leaning on counters looks lazy.

Personal space

This refers to the space each person has around him/her and into which intrusions are unwelcome. The exact size of the area around each person differs and depends on a variety of factors including, personality, culture, family background and even the type of sport played. Shy people usually need a wider personal space than outgoing people do. People instinctively indicate when their space is invaded - they either move away slightly, look uncomfortable, blink their eyes to show their discomfort, or look behind the speaker to avoid eye contact.

Causes of conflict

Most psychology books suggest that conflicts come from two tendencies: approach and avoidance. To approach is to have a tendency to do something or to move in a direction that will be pleasurable and satisfying. To avoid is to resist doing something, perhaps because it will not be pleasurable or satisfying. These two categories produce three kinds of conflicts:
Approach-Approach Conflict - this is due to the pursuit of desirable but incompatible goals.
Approach-Avoidance Conflict - here is a desire both to do something and not to do it.
Avoidance-Avoidance Conflict - here there are two alternatives, both of which may be unpleasant.

Other causes of conflict are:

- A lack of communication,
- A lack of understanding,
- Ambiguous lines of authority,
- Conflict of interest,
- Disagreement on issues,
- The need for agreement,
- Generational differences, x Religious disagreements,
- Diversity in perspective,
- Majoring in minors,
- Environment and a lack of relationships.

Myths about conflict

Myth #1: Conflict can never lead to anything positive
While confrontation is a risk, it is often a learning experience for those involved.

Myth #2: Conflicts are the result of clashing personalities

Personalities do not conflict, behaviours do! Different people can work together for years without having conflict - until their behaviour conflicts. Differentiating personality from behaviour makes conflict manageable because if conflict is based on personalities, we can do little else but bear it.

Myth #3: Conflict and anger go together
Conflict with people does not mean that there is anger involved. There are whole ranges of emotions that surface in conflict situations.

Defining conflict levels

Conflict can be experienced in three ways
(1) Intra-personal conflict (when a person has internal conflict);
(2) Interpersonal conflict (when personalities clash); and
(3) Substantive conflict (disputes over facts, values, goals and beliefs).

There are four levels of substantive conflict:

Level 1: Facts or Data – This level of conflict occurs when two parties simply have different information. This is the easiest kind of conflict to resolve. To resolve this conflict leaders simply ensure that both parties have the same information.

Level 2: Processes or Methods – This level occurs when there is a difference of opinion over how things should be done. Because the issue here is "how do we get there?" rather than "where should we go?" compromise is usually a realistic option.

Level 3: Goals or Purpose – On this level parties cannot agree on a common goal. Negotiations at this level take patience and skill. Often youth leaders withdraw from this kind of conflict because they are not of the temperament to work through the hard issues and avoid the uncomfortable dialogues that accompany the resolution of conflict at this level.

Level 4: Values – The deepest and most serious conflict relates to values – the parties disagree about basic meanings. Any resolution at this level is almost impossible.

Defining the level of conflict can lead to the selection of appropriate responses to conflict resolution. But often what leaders think is the level is just a screen for a deeper level of conflict. One situation may include several different levels of conflict.

Conflict handling styles

As with leadership styles, different writers present models of conflict handling style and it seems that there is not a best conflict handling styles but a best style for a given situation. A few models will be considered, together with an indication of when the style is most appropriate:

Model 1. Here we can distinguish between five styles

1. The Problem Solver – refuses to deny or flee the conflict, presses for conversation and negotiation of the conflict until a satisfactory conclusion is reached. Most effective with groups that share common goals and whose conflict stems from miscommunication.

2. The Super Helper – they constantly work to help others and give little though to self. This is the 'Messiah' who is often passive in their own conflicts but always assists others to solve their conflicts. This style is to be avoided as one must deal with personal conflicts to effectively help others.

3. The Power Broker – For this person, solutions are more important than relationships. Even if a person leaves the group, as long as a solution was achieved, they are satisfied. It can be used when substantive differences are so contradictory that mutually inclusive goals are not possible.

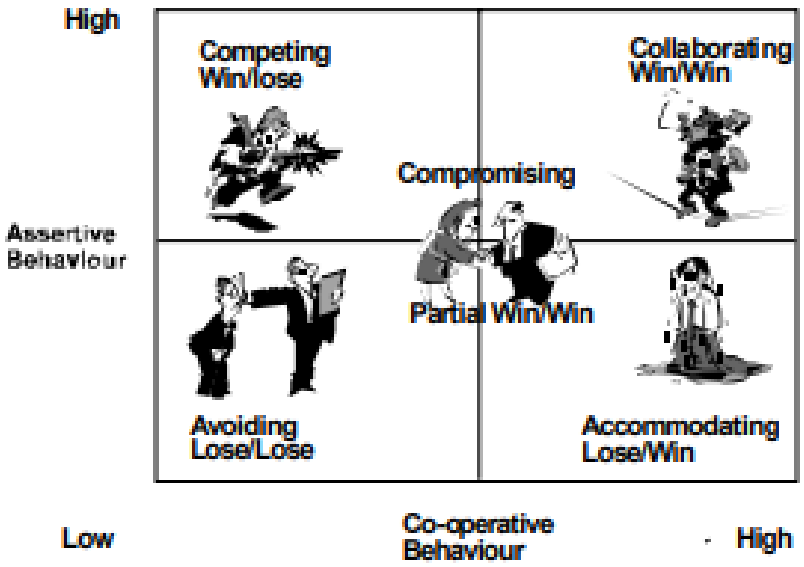
4. The Facilitator – they adapt to a variety of situations and styles in order to achieve a compromise between competing factions. It is effective for conflicts where differences are attitudinal or emotional.

5. The Fearful Loser – this person runs from conflict probably because they are personally insecure. This tends to produce hostility and a weakening of leadership in the group.

B. Speed Leas, in Discover Your Conflict Management Style, mentions six styles

1. Persuading – trying to change another's point of view, way of thinking, feelings or ideas. Techniques used include;e rational approaches; deductive and inductive arguments; and other verbal means. Persuade when there is great trust; when one party is admired; when goals are compatible; and when one party does not have strong opinions on the subject.

2. Compelling – the use of physical or emotional force, authority or pressure to oblige or constrain someone to act in a desired way. Use compelling infrequently; when you are threatened or under attack; when rights are being violated; when you have authority to demand compliance; when there is inadequate time to work through differences; and when all other means have failed.



3. Avoiding – This is actually a category that combines four styles: avoidance (to evade or stay away from conflict); ignoring (act as if the conflict is not going on); fleeing (actively remove oneself from the arena in which conflict might take place); and accommodation (going along with an opposition to keep the relationship). Strategies include: procrastination; saying yes to requests but not acting on them; showing concern for the other without responding to the problem; resigning; and studying the problem with no intention of doing anything about it. Avoid this style when people are fragile or insecure; when they need space to cool down; when there is conflict on many fronts simultaneously; when differences are trivial; when parties are unable to reconcile differences; and when the relationship is unimportant.

4. Collaborating – This is a process of co-labouring with others to resolve difficulties that are being experienced. It is also called joint or mutual problem solving. Collaborate when people are willing to play by collaboration rules; when there is plenty time for discussion; when the issue lends itself to collaboration; where resources are limited, and negotiation would be better; and when conflict and trust levels are not too high.

5. Negotiating – Also called bargaining, this involves collaborating with lower expectations. It is a process where both sides try to get as much as they can, realising there must be give and take. Where collaboration is a "win/win" strategy, negotiation is a "sorta-win/sorta-lose" strategy. Negotiate when there is something that can be divided or traded; when compelling is not acceptable, and collaboration has been tried and failed; when all parties are willing to bargain; when the different parties have equal power; and when trust is high.

6. Supporting – Here one person will provide a support to the person who is experiencing conflict. It involves strengthening, encouraging or empowering one party so they can handle their difficulties. Support when the problem is the responsibility of someone else; when a party brings problems outside of your relationship with them; and when one party in the conflict is unwilling to deal with issues.

Tension between relationships and goals

A third model focuses on the tension between relationships and goals in conflict handling. When a leader becomes engaged in a conflict there are two major concerns to deal with:
(a) achieving personal goals and
(b) preserving the relationship.

The importance of goals and relationships affect how leaders act in a conflict situation. Given these two concerns the following five styles of managing conflict are found:

1. Withdrawing – people with this style tend to withdraw to avoid conflicts. They give up their personal goals and relationships; stay away from the issues over which the conflict is taking place and from the people they conflict with; and believe it is hopeless to try to resolve conflicts. They believe it is easier to withdraw (physically and psychologically) from a conflict than to face it.

2. Forcing – people in this category try to overpower opponents by forcing them to accept their solution to the conflict. Their goals are highly important, but the relationship is of minor importance. They seek to achieve their goals at all costs; are not concerned with the needs of other people and do not care if other people like or accept them. They assume that one person winning and the other losing settle conflicts. While winning gives them a sense of pride and achievement, losing gives them a sense of weakness, inadequacy, and failure. They try to win by attacking, overpowering, overwhelming, and intimidating other people.

3. Smoothing – for those who fall into this category, the relationship is of great importance, while their own goals are of little importance. They want to be accepted and liked by other people; they think that conflict should be avoided in favour of harmony and believe that conflicts cannot be discussed without damaging relationships. They are afraid that if the conflict continues, someone will get hurt and that would ruin the relationship. They give up their goals to preserve the relationship. They try to smooth over the conflict in fear of harming the relationship.

4. Compromising – people with this style are moderately concerned with their own goals and about their relationships with other people. They seek a compromise. They give up part of their goals and persuade the other person in a conflict to give up part of their goals. They seek a solution to conflicts where both sides gain something.

5. Confronting – people in this category highly value their own goals and relationships. They view conflicts as problems to be solved and seek a solution that achieves both their own goals and the goals of the other person in the conflict. They believe conflict improves relationships by reducing tension between people. By seeking solutions that satisfy both themselves and the other person they maintain the relationship. They are not satisfied until a solution is found that achieves their own goals and the other person's goals and they want all tensions and negative feelings to be fully resolved.

Conflict handling

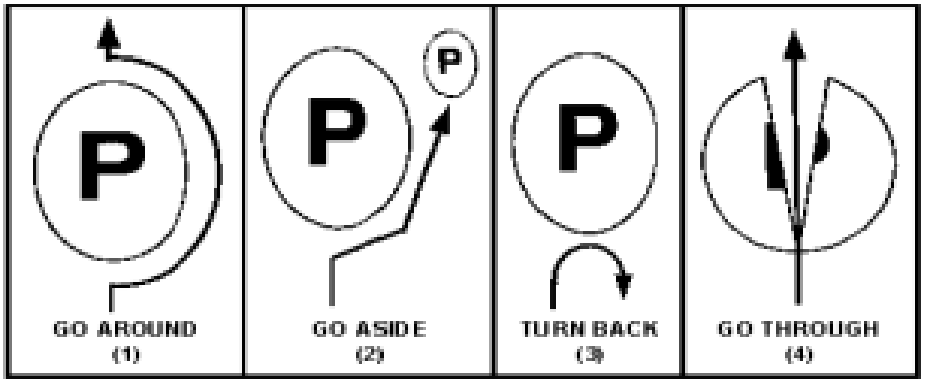
There are two dimensions to handling conflict: prevention and management.

A. **Prevent Conflict**

Applying good management principles in ministry and building quality relationships with people will help to prevent or at least lessen conflict.

B. **Manage Conflict**

In spite of the best efforts at prevention, conflict does arise. The secret is to learn to cope positively with conflict, and not to see it as an enemy to peace, but an opportunity for growth in relationships.



The conflict resolution process

Parties should be asked to describe recent disagreements. What were the issues, who were involved, and how was the conflict handled? What are the differences between conflicts that were handled efficiently and those that were not? Can you see conflict styles evolving? With

answers to questions like these the parties will be ready to work on clarifying goals, reconciling differences, and finding ways to resolve conflicts.

Clarify goals

When people are in conflict they usually share many of the same goals despite their differences. Both sides usually want to see the conflict resolved in a way that will be mutually agreeable, beneficial to both, and inclined to enhance the relationship so that future communication will improve. The youth leader should try to discourage bargaining over positions and work from the basis of the common goals that people are striving for. People should first be reminded of the goals that they share, and then their differences discussed.

Reconcile differences

The guidelines for reconciling differences are:

Step 1: Take the initiative and go to the person who has wronged you This should be done in person and in private. In making this move, it is best if the person goes with a spirit of humility, with a willingness to listen, with a determination to be non-defensive and to forgive.

Step 2: Take witnesses If the person will not listen or change, a return visit with one or two witnesses becomes necessary. These people are to listen, evaluate, determine facts and try to arbitrate and bring a resolution to the dispute.

Resolve conflicts

When individuals or groups are in conflict, they have four main choices about the direction they will take. They may avoid conflict, maintain, escalate, or reduce it. Sometimes people do not want conflict resolution and may decide to go in different directions.

Conflict resolution will involve the youth leader in negotiation and mediation. It is not always wise for leaders to get involved in someone else's conflict even when they are asked to do so, as they will feel pressurised to take sides; be required to make quick analytical decisions; and be responsible for keeping communication open.

When youth leaders do choose to get involved they should try to: show respect for both parties; understand both positions without taking sides; reassure people and give them hope; encourage open communication and mutual listening; focus on things that can be changed; try to keep the conflict from escalating; summarise the situation and positions frequently; and help the parties find additional help if the mediation is not effective.

We propose that you use the following four-step method in conflict resolution:

Step 1: Separate the people from the problem

This means treating one another with respect, avoiding defensive statements, or character judgments, and giving attention instead to the issues. Each side should be encouraged and helped to understand the other's fears, perceptions, insecurities and desires. Parties should think of themselves as partners in a side-by-side search for a fair agreement, which is advantageous to each side.

Step 2: Focus on the issues, not the positions

When people identify the real issues, and stop trying to defend rigid positions they are on their way to resolve their conflict.

Step 3: Think of various options that might solve the problem

In the beginning there is no attempt to evaluate the options or to arrive at a single solution. Each side makes suggestions in a brainstorming session. After many creative and perhaps new alternatives have been proposed, each option can be evaluated.

Step 4: Insist on objective criteria

Conflict is less likely to occur if both sides agree beforehand on an objective way to reach a solution. If both sides agree to abide by the results of a coin toss, a judge's ruling, or an appraiser's evaluation, the end results may not be equally satisfying to both parties but everybody agrees on the solution because it was determined by objective, fair and mutually accepted methods.

Identifying and responding to vocal qualities

Every time we speak, our voice reveals our gender, age, geographic background, and level of education, native birth, emotional state, and our relationship with the person spoken to. Other people can read these cues accurately. We send important information about ourselves; when we listen to others, we can receive important information about others. In this lesson you will look at using the qualities of your voice to identify the emotional state or feelings of the speaker and to use your voice to respond appropriately.

	**Group Activity 1**

	**Group Activity 2**

	**Group Activity 3**

FURTHER READING: Forms of communication - Speech and Language

Language helps us to make ourselves understood through using a united system of words. We take our language for granted until we suddenly cannot find the right words to explain ourselves, or when someone asks us to explain what we mean. Have you ever tried explaining yourself to someone who is not a first language speaker of your language? It is much easier to be misunderstood. Even when you are not speaking out loud, you are using language to think and create meaning. We call this intra-personal communication. i.e. interpersonal communication happens between you and others, and intra-personal communication happens within yourself.

Speech and language includes but is not limited to:

- Verbal or spoken communication
- Written communication
- Art, e.g., poetry, music, literature

Non-Verbal

The term "nonverbal communication is used when we refer to communication that is not written or spoken. Researchers have found that when we interact with each other, we interpret more meaning through non-verbal behaviour than through the verbal message. In

fact, they claim that as much as 65% of the meaning is understood though non-verbal communication.

Body movement, posture and gestures

Body movements are strong indicators of how you feel. You can tell how your boss is feeling sometimes just by the way she is walking! Some people walk as if they are in a daze (research tell us that those are the ones who are likely to get mugged first – they are communicating: "come and get me!"), others walk with purpose. Sometimes you can see if a person is feeling dejected (sad) by the way they walk.

Your posture can also communicate a lot about your personality, your status, how you are feeling today, your self-image, and your gender. Have you ever noticed how a tall person who is uncomfortable with being tall may slouch their shoulders, whilst some 6-foot models "strut their stuff" on the catwalk? Do you see how this shows a difference in their self-image? But remember, a slouch may just be a temporary indication of a person's emotional state for the day – perhaps they only feel dejected now, and will bounce back when they have overcome their emotional hurdle. We must be careful not to generalise our interpretations. Gestures are movements of hands, arms, legs and feet. Hand gestures commonly describe or emphasise verbal descriptions or communicate attitudes.

Facial Expressions and eye contact

Facial expressions are said to communicate how we are feeling and our reactions to the messages we are receiving. These are generally the real sign to how strongly we feel about the message we have received. Have you ever received unwelcome news, and you did not want to show people your reaction, but your face and eyes gave you away? After all it is said that "the eyes are the mirror of the soul".

The way we use our eyes is also a way of interpreting meaning. Who will be viewed as more confident?

(a) A public speaker who does not look at her audience or

(b) A public speaker who looks up during her speech.

I am sure you answered (b). Sometimes, if someone is not being truthful they cannot look you in the eye. Can you think of other instances when people do not maintain eye contact?

Perhaps you are aware that in some African cultures, it is respectful to drop your head in conversation with a superior. Or did you think of someone who is distracted or bored? They will find it very difficult to maintain eye contact if they are not concentrating on what you are saying or the presentation at hand. Share any additional ideas with your fellow learners.

Use of space

People convey messages about themselves by using space. Consider for example whether a new student decides to sit in the back or front of the class, or if a staff member sits far from the head of a table or at the head of a table during a meeting. Most teachers will tell you that the mischief-makers will sit at the back of the class and the more serious students choose a position near the front

Use of touch

Use of touch can also communicate the nature of the relationship between people.
Beware that touching behaviour is different for people of different cultures, but we also need to be very aware of what makes other people uncomfortable and what is inappropriate. Also find out what touching behaviour could be understood as sexual harassment.

Use of time

People can use other people's use of time to interpret messages. If someone phoned you at three am, you would probably expect it to be bad news. Similarly, if you do not return a client's call within a time frame that he thinks is appropriate, he may interpret your non-verbal behaviour as an indication that you do not care about his business. Time is often a reflection of status, the higher your status, the more control you have over time. For example, the executives in your organisation will control how long you will wait for an appointment. Different cultures and personality types view time differently, often resulting in misunderstandings. Organisations therefore need to have company standards for time keeping that everyone adheres to.

Personal appearance

Personal appearance includes the way you look, including but not limited to:

- the clothes you wear,
- your personal grooming,
- the symbols you wear (badges, tattoos, etc.),
- your sense of style, etc.

It can influence first impressions, job interviews, consumer buying behaviour and even courtroom decisions. Your personal appearance can give away cues about your age gender, identity, personality, attitudes, social standing, and income, to name but a few.

A job seeker looking for a position as a professional in a leading investments company who arrives for an interview wearing jeans and "tekkies", will probably not get the job, even if he has all the right qualifications and experience because the interviewer may interpret that the candidate is not professional. What do the appearances of the people below communicate to you?

"Ones perception is ones reality".

The above saying means that even if someone else's perception of you is incorrect or unfair, it is real to the person who perceives it. Our role is to manage other people's perceptions of ourselves. This can be done very much through taking care of our physical appearance, without compromising our unique individuality.

Vocal qualities

In South Africa we have a variety of accents and ways in which people speak. This adds to the diversity of our nation and we do not want to make everyone a clone of the other. Only when our vocal qualities lead to miscommunication, do we need to work on refining it. We need to use or vocal qualities to enhance the meaning of our message. Therefore, we change our vocal qualities according to our situation:

Volume

Some people speak softer or louder than others. We can increase or decrease the volume of our speech to change our meaning.

- A client will use a louder voice to exclaim his dismay at having his call transferred for a third time.
- A soft voice would be used to show sympathy towards a client who has called in to enquire about benefits after her spouse has passed away.
- You have to speak louder when you are interacting with a client if the air conditioning unit is faulty and making a noise.
- Note: Speaking too loudly in inappropriate situations can be irritating, and interfere with meaning. Speaking too softly can make it difficult for listeners to hear and understand you.

Inflection

Inflection is the rise and fall of the voice. People who do not use inflection in their voices have a monotonous "drone". However, overusing inflection can create childlike speech. You would typically use more inflection when you are talking about something exciting.

Pitch

When interpreting emotions from the highness or lowness of the voice, we can typically infer a range of emotions from calmness, cosines, lack of interest through to depression from a low-pitched voice. A high pitch can indicate extreme emotions such as fear or excitement. x Resonance This is the quality and fullness of your voice, or how pleasant or unpleasant your voice sounds to the listener.

Rate

Rate refers to the pace of your speech. Speaking quickly usually indicates excitement, anger, volatility, whilst a slower speech would indicate being relaxed, trying to make a point, depression, lack of interest, etc. Note: Speaking too quickly can cause your listeners not to hear all your words, and speaking too slowly can be monotonous and boring for your listeners.

Clarity

Clarity refers to the clearness of your pronunciation. Your accent is acceptable provided that the listener can understand what you are saying. A final note on vocal qualities: For some of these vocal qualities the emotions indicated are very opposite for the same vocal characteristic.

Listening for information

Introduction

Research has shown that the quality of listening for information is related to our intelligence, motivation, and listening habits. We probably cannot improve interpersonal listening by becoming smarter, but we can make significant improvements in motivation and listening habits.

1. Clarify the purpose for listening: You will not be motivated to listen if you believe that the information given by the other person is unhelpful or irrelevant. You may need to let the person know what your purpose is: "Could you explain X to me?" "I want you to tell me how to X correctly." "I'd like you to describe what happened." If the other person initiates the information, then ask about his or her purpose: "What is your purpose in telling me this?"

2. Maintain active involvement in the interaction: When we feel involved, the process of interacting with others is enjoyable. When we feel uninvolved, the danger of daydreaming and pseudo-listening increases. Involved listening requires giving feedback. Feedback can improve the quality of information, which the other person provides. Nonverbal cues and back channel comments ("yes," "uh-huh") shows interest, paraphrasing material clarifies understanding, and asking questions to bring out further information. Often it is important for us to make comments about the information and to reveal relevant information of our own.

3. Keep the purpose for listening in mind: The purpose will help focus our attention on what is important. It will also help monitor the direction of the discussion. We can then steer the discussion back on tract and in productive directions: "A few minutes ago you were saying X; I'd like to know a little more about that."

The guidelines above will help maintain motivation for listening and quality of interacting. Motivation itself is a major factor in concentration, and will help listen effectively even under adverse conditions. However, more steps may be taken to increase concentration:

4. Make the environment conducive for listening: The optimal environment feels pleasant, allows us to sit as close as is comfortable to the other person, features few distractions, and places us out of hearing of others who are not part of the interaction. If the selected

environment is too distracting, change position, remove the distraction, or suggest a different environment.

5. Look at the other person: An important part of the other person's message is sent through nonverbal communication. Looking at the person helps receive the entire meaning. In addition, it avoids potential outside distractions and signals interest to the other person, as discussed above.

6. Recognize your own concerns and feelings: Outside concerns which we bring to the discussion may compete for our attention. Feelings aroused by the other person may threaten to distort the message. Concerns and feelings will not go away by attempting to ignore them. If the situation is informal and we know the other person well enough, discussing our concerns and feelings is an effective way of managing them. However, just silently recognizing and accepting that they are there is a helpful step toward to listening through them.

7. Make sure to understand the other person's point before evaluating it: Critically analysing ideas and information is important, but not while the person is speaking. Arguing in our minds or preparing responses while the speaker is talking are habits which interfere with our concentration on the message. A critical response will form as we begin our turn to speak.

The preceding suggestions are aimed primarily at improving concentration on the message sent by the other person. Effective informational listening also calls for internal processing to increase the usefulness and retention of the information being received.

8. Relate new information to past knowledge and experience: That does not mean distorting new information to fit prior expectations; in fact, it may mean contrasting it with what we already know. The point is that information is not useful or memorable in a vacuum; we must tie it to things we already know. When the details are descriptive, visualizing them also helps remember them.

9. Organize the information in a way that makes sense: People often talk in a stream of consciousness. The apparent connections between pieces of information may be understandable at the time, but these connections quickly evaporate from our memories. If the information is reorganized in relation to a familiar pattern, such as time, space, or a learned

system of concepts, it will be more useful and memorable and help guide our questions and feedback.

10. Select key words or phrases which pull details together. It's usually a mistake to try to remember everything that another person says. Short-term memory does not hold much; new details tend to push out the ones which came just before. We remember more immediately afterward if we recall key phrases. Trying to keep everything in mind leads to frustration and the possibly of giving up listening.

11. Rehearse silently or jot down key phrases while the person is speaking. In many interpersonal situations, taking notes would appear rude or suspicious. In those situations, silent rehearsal and verbal paraphrase are the best ways to retain the information until you have a chance to write it down. However, even when note taking is acceptable, such as in a formal interview, extensive notes hurt concentration and rapport with the other person.

12. Write out notes as soon after the discussion as possible. No matter how vivid the key phrases are, the associated detail will begin immediately to fade from memory. If the details are important to remember, they must be written down for future reference and study.

	**Individual Activity 4**

Questioning

Having established the initial contact with your client, and listened to their query, your first response will be to question him/her to ensure that you have understood the query correctly and to reach consensus for further action. With relevant, insightful questions you will be able to manage the client interaction and reach a conclusion.

The Ask & Listen stage of the client interaction can be thought of as "examining the patient." If you expect to be respected as a professional, it's a step you can't skip or even gloss over. Take time to learn the different types of questions and practice using them. By developing your questioning skills, you will build credibility with you clients and enhance the client image of your organisation.

Types of questions for client relationships

There are two main dimensions to questions: Openness and Directness. Openness ranges from open questions, where there are unlimited response possibilities, to closed questions where response is limited to yes, no, or a few options. Directness ranges from totally direct where the intent of the question is obvious, to Indirect where intent behind the question is not so apparent. Another factor affecting questions is bias. Biased questions have only one right answer, which exposes to clients that the question is really not a question at all. Instead, it is a manipulative way of getting the client's agreement.

Closed Questions

While open questions have a whole choice of possible responses, closed questions limit the possible responses to a simple one-word answer like yes, or no, a number (policy number, date of birth, etc), or to a few options, like today or Thursday. Closed questions often begin with: Do, Are, Is, Which, Have. "How many," and "How often".

Although closed questions limit possible responses, they have several uses and can be extremely useful in the hands of the right person.

- In the Financial Services environment, we usually use them to verify who the client is and if they are entitled to the policy information.
- E.g., “what is your policy number, your date of birth, identity number, your address”
- It is also used to help focus the client back to business.
- E.g., "This is very interesting, but can I help you resolve your concern?"

Closed probes can also be used to confirm your understanding of a point your client has made or to confirm needs.

You might ask:
"Then, we can assume you will deposit last month's contribution today, right?"
"If I understand you then, you'd like to take additional medical cover without increasing your contribution, is that accurate?"

When you ask questions to confirm needs, your questions should be asked so that your client can answer with a yes or no response"
"Would you be interested in?"
"Will it be important to you to?"
"Do you want to?"

When you need specific information, closed questions are effective.
"How many times did you try to contact your agent?"
"On what date were you burgled?"
"What is your new address?"

Open questions:
Open questions typically begin with words like: what, how, why, where, who and how. They can also be statements.
"Can you tell me more about?"
"What happened when?"
"How did you hear about?"

You will typically use open probes to explore your client's situations and to identify needs. They are great icebreakers to get people talking. They are especially advantageous, because they are open to a large range of responses, indicating what's on the client's mind.

Open probes can also be used to clarify your understanding of what your client has said. When you clarify, you ask questions to understand what your client has said and why he or she has said it.

Direct vs. Indirect Questions
Questions can also be direct or indirect. Direct questions go straight to the point and their intent is obvious. "Are you the legal owner of the contract?" or "How old are you?" and "How much are you willing to spend?" are direct questions. The problem with them is obvious. They

can be off-putting and embarrassing, but their bigger problem is they bluntly expose your intent. They usually produce either incorrect information or none.

A better approach is using indirect questions. With indirect questions, the intent is not so obvious. For example, to determine if someone s the legal owner of the contract: “What is your identity number?” or someone's age: "what is your date of birth?”

Indirect questions are softer and more comfortable for clients to answer. Information gained from them is usually honest and useful. Unfortunately, they may not leap to mind at just the moment you need them. So, plan some indirect questions in advance that will help you learn what you need to know about your clients. Also, raise your sensitivity to when you are asking direct and indirect questions. To help you get started, in the next activity, we will review two lists of sample questions, the first are direct, the second, indirect. Think about what makes them direct or indirect, how they would make you feel as a client, and if they would be useful to add to your own questioning repertoire.

Direct Questions

"Why is that important?"

"Did you make that decision?"

"Do you really want to devalue your policy by taking those loans?"

Open & Indirect Questions

"What do you feel will be most important in the decision?"

"Where would you normally go for help with this type of project?"

"What would you like the outcome of this conversation to be?"

"What are your long-term financial goals?"

"What do you wish you could change?"

Biased / Leading Questions

If you are not careful and conscious of it, your questions may carry bias. Bias is when the wording or tone of your questions indicates what the correct answer should be. "You want me to increase your monthly contributions by R200 then, don't you?" and "You'd have to agree our product is better than our competitors, wouldn't you?"

Bias reduces your credibility and makes clients feel they are being manipulated. And depending on how asked, can be terribly insulting, especially if the client does not share your opinion. Raise your awareness to biased-sounding questions and don't let them creep into your discussions with clients. Here are some additional questions that you should not ask:

"You wouldn't expect our competitor to recommend us, would you?"

"You do care about the environment, don't you?"

"You wouldn't want your children be left destitute, would you?

"Saving money is important to you, isn't it?

	**Group Activity 5**

Additional reading:

The importance of REALLY listening

Are you listening?

Esther Derby

This summer I had a rare-for-me experience. I had the opportunity to be THE CLIENT on a software development effort. I don't mean buying a box of off-the-shelf software - you know, MS Office, Adobe Acrobat, Quicken - I mean a real development project for my Web site. I say opportunity because it never happened. Here's the way my conversation went when I contacted Web site specialist Cecil about the project.

"Hi, Cecil. I'd like to add a search capability to the articles page on my website," I said. Cecil launched: "Well, the thing about search engines is that you have to register with each one and re-submit…"

"Ahem," I interrupted. "Perhaps I wasn't clear. I want people who come to my site to be able to search for articles on my site. I want site visitors to see a list of all the articles and be able to choose one to read—just like I have it now—but I also want them to be able to search for articles on a certain topic." "Oh, well, then what you want is a self-administered database," Cecil said. "I'm not sure I need a database. I've been doing fine uploading the articles with FTP. Plus, there's only one author since it's my site," I said.

"I know I've seen other sites with search capabilities. Can't the visitor's search by topic without the whole database thing?" "You don't understand," Cecil said "We're database gurus! We could convert your entire website to a database and then you could update the content…." "Thanks, Cecil. I'll get back to you," I said. I hung up the phone and sighed. It felt like Cecil hadn't heard much of what I'd said, and wasn't interested in what I needed or wanted. I was frustrated and discouraged. If you notice your clients seem frustrated when you are defining requirements (or worse, after you've delivered the system), consider making a shift in how you go about understanding client needs.

Ask wide open questions to explore

Open-ended and context free questions can help us explore what our clients want:

1. What problem are you hoping to solve?
2. What does a successful solution look like?
3. How will the system be different from what you have now?

These questions may seem sort of wide open … and they are. These are good questions to ask at the beginning a project to understand where the client is coming from and where they want to go.

Manage expectations

Chances are you won't be able to deliver on everything your client wants. But when you have the information, you can begin to manage expectations. I had a client back in the early 80s who wanted to be able to talk to the computer and have it do what he asked it to do. Speech recognition was just coming out of the research labs, and there was no way I could deliver what he wanted with the resources available ($20,000 and a CICS mainframe system with dumb terminals!). But because I knew that was what he really wanted; we were about to have the conversation about whether that was achievable. He still wanted speech recognition, but because he had been listened to, he accepted that it wasn't possible at that time.

Understand priorities

What is most important to the client? If you can deliver the top 10 items on a 50- item list will the client be satisfied? If you get to the other 40, that's great; if you don't, you've still delivered value. But if you start with item 35 or 49, no matter how nifty it is, the client won't be satisfied. By the way, I still don't have a search capability on my website. I decided Cecil would lead me

down a rabbit trail of nifty technology that was more than I needed and not what I wanted. Maybe he'll read this article.

Rephrasing and paraphrasing

As an active listening response, paraphrasing or rephrasing, clarifies understanding of what your client has said. Rephrasing is repeating to the speaker, in your own words, what you heard them say. This may sound basic and like a waste of time. After all, if they just said it, why repeat it? Rephrasing is one of the most powerful listening techniques available to you, and it is one of the easiest to learn. Simply think carefully about what you just heard, put it in your own words, and say it back to them in the form of a question.

Rephrasing shows the other person that you really understand their situation. It also gives the person a chance to repeat and expand upon their concern, which makes them feel better about it and gives you the chance to identify something you can do to make a difference. Keep in mind that a rephrase must be sincere. Artificially posing a rephrase does more damage than good. If you mindlessly repeated their sentence like a parrot, the client would probably get irritated.

Some good ways to begin rephrasing questions are the following:
"As I understand it . . ."
"Do you mean . . ."

Reflecting feelings

Clients also have feelings. They may phone in or visit your offices in a bad mood, or feeling angry, upset, or hurt. Something you may say might irritate them, sometimes company procedures are an irritation to them. Reflecting feelings feeds back the emotion communicated nonverbally by the client. When effective, reflecting feelings means you have grasped the implication of what the client just said. An example is when the client says he has had a busy week, and you say: "You must be glad it is Friday."

When your reflection on the implication is sincere and shows concern, it will be effective in communicating your interest. Use this listening technique with friends and family to gain a comfort level, then try it on clients. Before long, you'll be surprised to find yourself doing it naturally without even thinking about it.

Successful use of reflecting feelings entails focusing attention on the other person and repeating the feelings revealed. Avoid mentally processing how you think the person should be feeling, and use reflecting feelings sparingly. Usually reflecting feelings should be brief and stated in the second person:

"You look relieved,"

"You sound irritated."

"You seem embarrassed."

"You appear angry."

	**Individual Activity 6**

Verbal expression

Use of language

In writing and speaking we can use different types of language. In discussions at work, with clients, strangers, etc. there are unwritten rules that are followed. These unwritten rules are called "register use". Register use can help you communicate effectively. Incorrect register use can cause problems at work, cause people to ignore you, or, at best, send the wrong message. Of course, correct register use is very difficult for many learners of English. This feature focuses on different situations and the correct register used in the various situations. To begin with, let's look at some example conversations.

Formal

In the business environment it is customary to address your client in a formal register. If you see your client more frequently, the degree of your formality may decrease.

Informal

You use this type of language with people who are familiar to you. You may make good use of this register in verbal communications with clients, but you need to first find out whether your client would not be offended by your use of this register.

Slang

Slang is used by a specific group of people who understand the meaning of the words that are used. Different geographic communities may use words that are only understood in that community. For example, a group of friends may have made up their own words and "group language" which outsiders will not be able to understand. In an organisation, slang is company-specific jargon that is NOT formally accepted. Slang may be appropriate to use in interacting with your colleagues, but is not acceptable for use with clients.

Jargon

Jargon is language that is used by a specific group of people, which is normally not clear to others who are not part of this group. Jargon is useful when speaking to experts and members of the groups as it avoids long-winded explanations. But when dealing with a non-layperson, avoid jargon and use language that explains the concept to them clearly.

Verbal Mannerisms

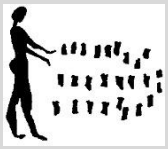
Verbal mannerisms are the unconscious phrases we use such as "uhm", "well", "you know". "er". Sometimes we use these to "buy time, when we are thinking about an appropriate answer, "uhm" or to lead into a subject – "well…". Sometimes we use them if we are nervous. Beware that they can interfere with meaning, give away a lot about your emotional state and be distracting for your listener.

Plain Language

Don't use convoluted words. See! "Convoluted" is a word that shows off my vocabulary but could cause misunderstanding. To ensure that understanding happens first time around use plain language that is simple to understand. Let's start again. Don't use words that are difficult or complex when a plain word will do. This is not to say that you should not build your own vocabulary, to ensure that you understand people who do not use plain language.

These are common words that we tend to use instead of their plain counterparts.

INSTEAD OF THIS	**USE THIS**
whilst	**while**
terminate	**end**
regarding	**about**
purchase	**buy**
Prior to	**before**
persons	**people**
Per Annum	**a year**
particulars	**details**
In the event of	**if**
In respect of	**for**
In excess of	**more than**
forward	**send**
consequently	**so**
commence	**start**
advise	**tell**
Go to http://www.plainenglish.co.uk/A-Z.html for a free A-Z of "plain English alternatives to the pompous words and phrases that litter official writing".	



Summative Activity 6

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