



CANADA
4-H Ontario

www.4-hontario.ca

4-H ONTARIO PROJECT



Veterinary

REFERENCE MANUAL

Credits

The 4-H Pledge

I pledge my Head to clearer thinking,
my Heart to greater loyalty,
my Hands to larger service,
my Health to better living, for my club, my community,
my country, and my world.

The 4-H Motto

Learn To Do By Doing

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CANADA

4-H Ontario

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4-H Ontario is pleased to be able to provide project resource reference manuals for use by volunteers in clubs. 4-H Ontario screens and trains volunteers to equip them with the tools to serve as positive role models for youth. With so many topics to choose from, 4-H volunteers are trusted to use these resources to provide safe and quality programming while using their judgement to assess the appropriateness of activities for their particular group of youth. By downloading any 4-H resource, you agree to use it for 4-H purposes and give credit to the original creators. Your provincial 4-H organization may have restrictions on the types of 4-H projects or activities which can be completed in your region.

4-H Ontario grants permission to 4-H Volunteers to photocopy this 4-H project resource for use in their local 4-H program. All information presented in this Project Resource was accurate at the time of printing.

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4-H Inclusion Statement

4-H in Canada is open to all* without discrimination based on race, national or ethnic origin, colour, religion, sex, age or, mental or physical disability.**

4-H is dedicated to providing a safe and inclusive environment that allows for universal access and participation. Where barriers to participation are identified, 4-H will, with reasonable accommodation, adapt programs, rules, policies, or expectations to reduce or remove the barriers.

Any accommodations, changes or exceptions will be assessed on an individual basis, taking into account the individual experience of the member and their family. The physical safety and emotional well-being of members, leaders, staff and volunteers is 4-H's highest priority, and is the ultimate consideration in final decisions.

4-H Canada and local 4-H organizations consider inclusion a priority. Leaders are encouraged to work with individuals and their families to identify and discuss accommodations as required, and to reach out to provincial or national office staff for help with unresolved concerns.

**This applies to youth members (ages 6 to 21), volunteers, leaders, staff and professionals.*

***Definition of discrimination as per Canadian Charter of Rights and Freedoms.*

Déclaration sur l'inclusion des 4-H

L'adhésion aux 4-H au Canada est ouverte à tous les jeunes* sans discrimination fondée sur la race, l'origine nationale ou ethnique, la couleur de la peau, la religion, le sexe, l'âge ou le handicap mental ou physique. **

Les 4-H ont pour mission d'offrir un environnement sécuritaire et inclusif qui permet l'accès et la participation de tous. Lorsque des obstacles à la participation sont décelés, les 4-H adapteront, à l'aide de mesures d'adaptation raisonnables, les programmes, les règles, les politiques ou les attentes afin de réduire ou d'éliminer ces obstacles.

Toute mesure d'adaptation, modification ou exception sera évaluée au cas par cas, en tenant compte de l'expérience personnelle du membre et de sa famille. La sécurité physique et le bien-être émotionnel des membres, des animateurs et des animatrices, des membres du personnel et des bénévoles sont la priorité absolue des 4-H et constituent le facteur ultime à considérer lors de la prise des décisions définitives.

Les 4-H du Canada et les organisations locales des 4-H considèrent l'inclusion comme étant une priorité. Les animateurs et les animatrices sont encouragés à collaborer avec les personnes et leurs familles afin de définir et d'examiner les mesures d'adaptation, selon les besoins, et de communiquer avec le personnel du bureau provincial ou national pour obtenir de l'aide en cas de préoccupations non résolues.

**Ceci s'applique aux jeunes membres (âgés de 6 à 21 ans), aux bénévoles, aux animateurs, aux membres du personnel et aux professionnels.*

***Selon la définition de discrimination en vertu de la Charte canadienne des droits et libertés*

Welcome to Veterinary Project!

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Planning a Meeting

Plan your meetings well. Review all the information well in advance so you are prepared and ready!

Before Each Meeting

- Read the topic information and activities and photocopy any relevant resources for the members' Record Books.
- Be familiar with the topic information for each meeting. Think of imaginative ways to present the information to the members. Do not rely on just reading the information out loud. Review available resources, plan the meetings and choose activities and themes that complement the ages and interests of your members. Gather any equipment and/or resources that will be needed to complete the meeting.
- At least 12 hours of club meeting time is required for every project; including club business, specific project information and social recreation. The delivery format for that material is left to the discretion of the leaders. Before each meeting, create a timeline to ensure that you are providing an adequate amount of instructional time for club completion. **Note:** the best practice recommendation is that a club have multiple meeting times for each project. Included on the following page is a Leader's Planning Chart to help with the planning of meetings. In addition to the chart, keep track of what went well and what could be changed next time. That way, each time this project is run, the content of the meetings can be different!

When planning each meeting, a typical 4-H meeting agenda should include the following:

- Welcome & Call to Order
- 4-H Pledge
- Roll Call
- Parliamentary Procedure:
 - o Secretary's Report
 - o Treasurer's Report (if any)
 - o Press Report
 - o New Business: local and provincial 4-H activities/opportunities, upcoming club activities
- Meeting content and activities
- Clean-up
- Social Recreation and/or refreshments
- Adjournment

Judging and Communications

Each meeting must include either a judging or public speaking activity.

- Judging gives the members an opportunity to use judging techniques as part of the learning process. Through judging, members learn to evaluate, make decisions and communicate with others. They also develop critical thinking skills, confidence and self-esteem. Many examples are used in this reference manual but use your imagination! As long as members are setting criteria and critically thinking about where items fit within that set of criteria, they are learning the basic skills of judging!
- A communications activity has been provided for each meeting but can be included in the Roll Call or social recreation time. These activities do not need to involve the topic of veterinary medicine as the outcome is more about understanding the concepts of effective communication.

Electing Your Executive

Elections can be chaired by a youth leader, senior member or club leader. The person chairing the elections is not eligible for any positions.

Procedure:

1. All positions are declared vacant by the chairperson, who indicates this by saying “I’d like to declare all positions vacant.”
2. The group decides on the method of voting (i.e. show of hands, ballot or standing).
3. The chairperson accepts nomination from members for each position being filled. Nominations do not require a seconder. Nominations are closed by motion or declaration by the chairperson.
4. Each member nominated is asked if he/she will stand for the position. Names of members who decline are crossed off.
5. Voting takes place by selected method and majority rules (i.e. member with most votes).
6. Announce the name of the successful member. Offer congratulations and thank all others that ran for the position.
7. If ballots are used, a motion to destroy the ballots is required and voted on.

Steps in Making a Motion

The motion is a very important key to having good meetings. Motions are a way of introducing topics for discussion and allowing each member to speak and vote. Any member can make a motion.

Steps in Making a Motion:

1. Address the chairperson (i.e. raise your hand).
2. Wait for the chairperson to acknowledge you.
3. Make the motion: “I move that...”
4. Another person seconds the motion: “I second the motion.”
5. Chairperson states the motion.
6. Chairperson calls for discussion of the motion.
7. Chairperson restates the motion.
8. Chairperson calls the vote: “All in favour? Opposed?”
9. Chairperson announces the result of the vote: “Motion carried” or “Motion defeated.”

8 | Leader's Planning Chart

Mtg. #	Date/Place	Topics Covered	Activities	Materials Needed

As a club volunteer your responsibilities are to:

- Be a Volunteer in Good Standing by completing the volunteer screening process, attend a volunteer training session and adhere to the 4-H Code of Conduct.
- Notify the local association of the club, arrange a meeting schedule and participate in club meetings, activities and the Achievement program, assuring that all meetings and activities are accessible and inclusive for all participants.
- Review the project material in the Reference Manual to familiarize yourself with the information and adapt it to fit your group. Be well organized and teach the material based on your group's age, interest and experience level.
- Organize the club so members gain parliamentary procedure, judging and communication skills.
- Ensure that members are registered for the club using the online registration system.
- Review the Participant Agreement Form (PAF) that members will have completed when registering online. Ensure that all members, leaders and parent helpers know the appropriate actions during any emergency. Check with members for any food allergies or dietary restrictions and plan snacks accordingly.

As a club member your responsibilities are to:

- Participate in at least 2/3 of his/her own club meeting time. Clubs must have a minimum of 12 hours of meeting time.
- Complete the project requirement to the satisfaction of the club leaders.
- Take part in the project Achievement Program.
- Fill in and complete the Record Book.
- Complete any other project as required by the club leaders.
- Adhere to the 4-H Code of Conduct at all times.

Achievement Program Ideas/Suggestions

- Have members create an exhibit or enter a float in the parade at a local fair/show.
- Have members make a presentation at school about the 4-H Veterinary Project.
- Have members make a Tik Tok video that features a topic/technology from this project.
- Host an evening for your community with a guest speaker that highlights a topic related to veterinary medicine. Or, have 4-H club members do the presenting.
- Create a skit about some aspect of veterinary medicine and perform it at school, at a senior's home, at another organization's meeting, etc.
- Tour the Ontario Veterinary College in Guelph or any other post-secondary institution that offers a Veterinary Technician or related program.

Special Projects

These projects are done outside of meeting time and are for members interested in doing more – often senior members. Its up to you as the leader to decide if you will require members to complete a Special Project for club completion. Some ideas include:

- Create a display about a topic related to the 4-H Veterinary Project and display at a local fair or community event.
- Create a video about some aspect of veterinary medicine in this project. Post on YouTube.
- Interview a veterinarian or someone who works in the veterinary industry (e.g. veterinary technician, lab technician, pharmaceutical salesperson). Write a blog or an article for your local newspaper about some aspect of what they do in a day.
- Create a science experiment related to veterinary medicine and enter the 4-H Canada Science Fair competition.
- Ride with a large animal veterinarian or observe alongside a veterinarian in a clinic for a day.

The 4-H Pledge

I pledge

My head to clearer thinking,

My heart to greater loyalty,

My hands to larger service,

My health to better living,

For my club, my community,

my country, and my world.



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Nervous System

Meeting 1 - Nervous System 101

Setting Objectives:

To outline the parts of the nervous system, and to demonstrate how responses are generated within the body.

Suggested Lesson Outcomes:

- To explain the different parts of the nervous system (central nervous system, peripheral nervous system and autonomic nervous system).
- To differentiate between the parts of the cells involved (including the axons).
- To describe how the parts communicate.

Suggested Roll Call Questions:

- What is something you do without thinking about it?
- Name a component of the nervous system.
- Name a disease associated with the nervous system

SAMPLE MEETING AGENDA

Time: 2 hours 10 minutes

Welcome, Call To order, Pledge Review 4-H Code of Conduct		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Introductions, Elections And Business	20 minutes
Topic Information, Discussion	Key Players In the Nervous System	15 minutes
Activities Related To Topic	Activity #1 - Guess Who!	15 minutes
Topic Information, Discussion	Axons, Action Potentials And The Supporting Cast	20 minutes
Activities Related To Topic	Activity #2 - Nerve Impulse Telephone	20 minutes
Senior Member Project	Outline A Disease	10 minutes
Wrap Up, Social Time And Adjournment		10 minutes

Key Players in the Nervous System

The nervous system is the main control center of the animal's body. Think of it as a plane. The nervous system receives messages both from within the plane (altitude, passengers, flight attendants, speed), and outside the plane (air traffic controller or other planes). It thinks about the messages, and then the pilot responds keeping things running smoothly.

In animals, the final response from the nervous system can be a very complex movement, like a horse jumping a gate, or a dog swimming to retrieve a stick. But it could also be a very simple reflex, like blinking or breathing.

Key Players

Think of the nervous system as having three main compartments or locations that work together:

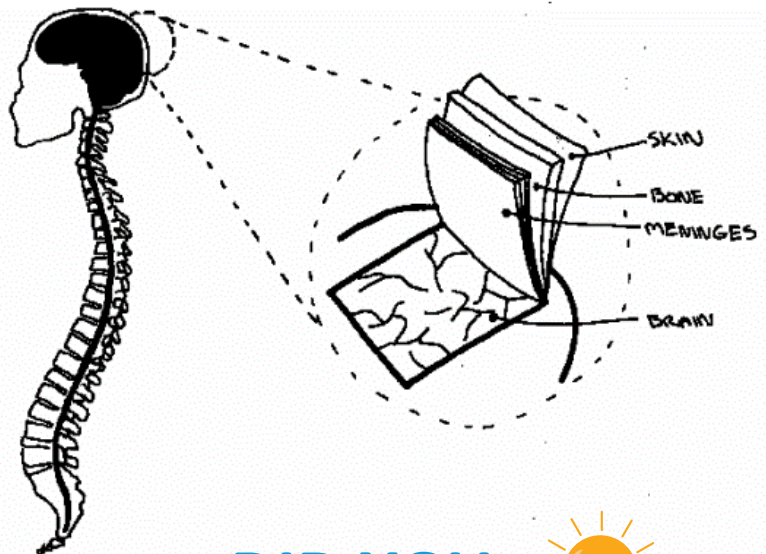
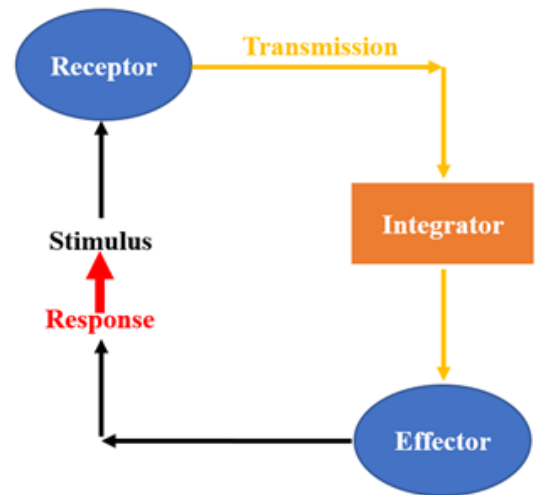
- The Central Nervous System – (CNS)
- The Peripheral Nervous System – (PNS)
- The Autonomic Nervous System – (ANS)

These are big terms for very simple ideas. The CNS is the central or “thinking” location. The PNS is the secondary or “away from the center” location. The ANS is the place where involuntary actions commence.

If we return to our example of the plane, the CNS is the main control computer and pilot. The engine computer, which oversees the proper running of all the other parts of the plane, is the PNS. The engine computer always reports to the computer and pilot and receives its commands from there. The engine itself can be considered the ANS because without the engine the ship would not move.

Central Nervous System

The CNS is made up of the brain and the main nervous pathway, the spinal cord. Both structures are delicate. To protect them from injury, they are covered by a bony skull or backbone (spine). That's not all. Three membranes or meninges provide extra cushioning against shocks. The middle meninx is also filled with fluid, so that the brain and spinal cord float in their protective cushions.



DID YOU KNOW?



The spinal cord is the largest part (by length) of the CNS. It starts at the brainstem and goes to the end of the backbone. Nerves from the PNS join it all along the backbone, and messages to and from the CNS move through here.

Peripheral Nervous System

The PNS include all the nervous system structures that arise from or attach to the CNS. The spinal nerves and cranial nerves are examples of the PNS. The PNS is the SENSE and ACTION area of the nervous system. It includes the thousands of nerves throughout the body.

Think About It!

Think of all the impulses that control the cheetah's muscles as it leaps to catch its prey while running at 65 mph!

Specialized endings of the Peripheral Nervous System form the receptors that act as sensors and attach to muscles causing them to contract. The brain sends out positive and negative signals to different muscles so that just the right amount of force is exerted on the limb, causing a smooth controlled movement. This is called coordination.

Autonomic Nervous System

Another part of the nervous system looks after the involuntary actions necessary for the animal to stay alive. These are the actions that the animal does not “think” about doing. They are done automatically by the Autonomic Nervous System from centers in the brainstem.

Blood pressure, heartbeat and digestion are functions that your body does without thinking. These are autonomic or involuntary actions.

Experience It!

Do you think about your breathing? You probably just realized that you were subconsciously doing it but often do not think about it. That is the role of the autonomic nervous system.

Activity #1: Guess Who!

Do	<p>Time: 15 minutes</p> <p>Materials needed:</p> <ul style="list-style-type: none">• Quiz sheet and Answer Key (no cheating!) <p>Instructions:</p> <ul style="list-style-type: none">• The quiz on the next page can be answered by members or as a team. Special consideration should be made by pairing younger members with senior members so that way they can gain more from the quiz. <p>After members answer their quiz, get members to discuss their responses if they are open to it and give members the answers to each of the questions.</p>
Reflect	<p>Learning Outcomes:</p> <ul style="list-style-type: none">• The objective of this activity is to identify the different parts of the nervous system responsible for each of the listed actions.
Apply	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• Were their answers that surprised you?• How interconnected is the body?

Guess Who!

Question	Answer
What part of the nervous system is the spinal cord a part of?	
Movement of the ingesta through the intestines is part of what system?	
I am the boss of the central nervous system!	
Micturition (urination) is controlled by what system?	
This system controls everything you do.	
I am the sense and action area of the nervous system!	
Nerve cells are called?	
True/False: Some nerves are so long that they connect your spinal cord to your feet?	
True/False: The ANS controls your heartbeat.	
How do signals travel through the body?	
True/False: All aspects of the nervous system work independently.	
Name the 5 senses!	

Guess Who! - ANSWER KEY

Question	Answer
What part of the nervous system is the spinal cord a part of?	Central Nervous System (CNS)
Movement of the ingesta through the intestines is part of what system?	Autonomic Nervous System (ANS)
I am the boss of the central nervous system!	Brain
Micturition (urination) is controlled by what system?	ANS and CNS
This system controls everything you do.	CNS
I am the sense and action area of the nervous system!	Peripheral Nervous System (PNS)
Nerve cells are called?	Neurons
True/False: Some nerves are so long that they connect your spinal cord to your feet?	True
True/False: The ANS controls your heartbeat.	True
How do signals travel through the body?	Nerves
True/False: All aspects of the nervous system work independently.	False
Name the 5 senses!	Touch/Feel
	Taste
	Smell
	Hearing
	Vision/Sight

Axons, Action Potentials and The Supporting Cast

The entire system contains tiny nerve cells called neurons. There are 12 billion of them in the brain alone! Packed in tightly around the neurons are other cells – they are called the Glial cells. They act as the support structure.

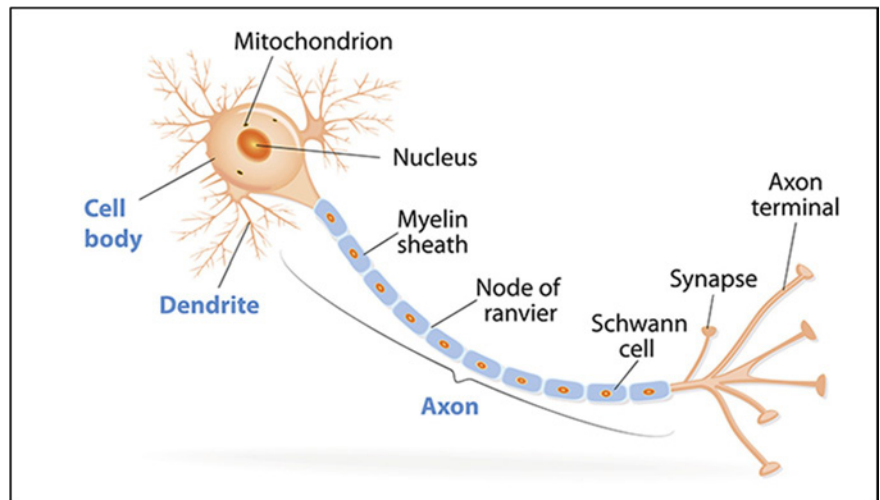
Neurons are so tiny that you cannot see them unless you look at nervous tissue through a microscope. If you did, you would see something like this:

Discuss It!

How is the nervous system organized to do the different jobs?

Neurons and the Supporting Cast

Breaking down the picture above, each neuron has a body (cell body as pictured above). Inside the cell body is the nucleus which is like the brain of the neuron (it is the main processing center of the cell). Surrounding the nucleus are the mitochondria which provide the energy required for nerve cells to complete their task. The dendrites are extensions of the cell body and receive the message from other neurons (think of this like a chain reaction). The cell body then transmits the signal to its next destination. When millions of these axons are bundled together, they form a



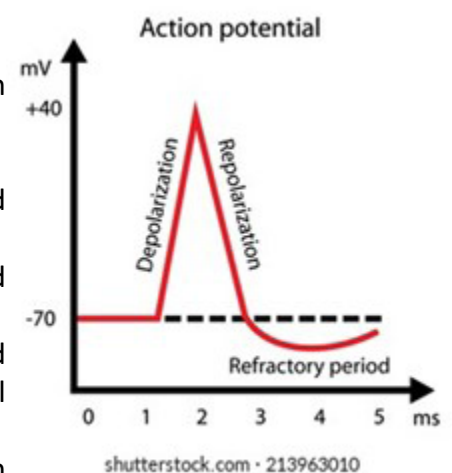
Source (modified from): Queensland Brain Institute- University of Queensland

long, white structure called a nerve. Their colour comes from the protective coating that surrounds the outside of the axon that is known as a myelin sheath. The myelin sheath helps to speed up the rate of the transmission by insulating the message (think of this as jumping like leapfrog). After the axon is the axon terminal where signals are transmitted on to the next nerve in the chain or the effector muscle. This occurs through the synapse.

Action Potentials

Signals are passed through the nerve with a phenomenon known as action potential. Think of this like an e-mail you would like to send:

1. First there is a stimulus- equivalent to you starting up your computer and getting into your emails.
2. Next sodium channels open and ions flow into the membrane (called depolarization)- this is like typing up the email.
3. Following this there are more ions on one side of the channel as compared to the number of ions on the other side of the channel- when your email has been composed and you press the send button.
4. The sodium channels then close and potassium channels open (called repolarization) – like getting ready for the next email to send.
5. At the same time, the email or message is transmitted down the line until it reaches its final destination.
6. The result of the repolarization of the membrane is the refractory period- like a server needing time to send the email. This prevents mixed messages from being sent.
7. At the end of the nerve the synapse transmits the message to the appropriate next step (nerve or muscle) and the server on the other side receives and transmits the email.



Activity #2: Nerve Impulse Telephone

Do	<p>Time: 20 minutes</p> <p>Materials needed:</p> <ul style="list-style-type: none">• Object• A coin <p>This activity involves two games:</p> <p>Game 1 (The Signal):</p> <p>Instructions:</p> <p>Create two groups of the same size and have them stand in a line holding hands. At one end of the human chain, the leader can toss a coin which only the first person of each team can see. If it lands on heads, then the signal is fired. If tails, then nothing happens.</p> <p>If the signal is fired, the first person squeezes the hand of the second person (no talking or other signals) and the message carries on down the chain until the last person. The last person completes the action by trying to grab the object from the ground (could be a spoon). The goal is to be the faster team getting the information (heads was tossed), through the chain. If an incorrect signal is communicated and the team grabs the spoon when tails was tossed then the other team gets the point.</p> <p>Play to 5 points.</p> <p>Game 2 (Broken Telephone):</p> <p>Instructions:</p> <p>The leaders come up with a phrase that they communicate with the first person in line. The message is then said quietly down the chain until the last person says the line out loud. This is meant to compliment game 1.</p>
Reflect	<p>Learning Outcomes:</p> <ul style="list-style-type: none">• The objective of this activity is to show how signals are transmitted between neurons to show how communication processes work.
Apply	<p>Discuss The Following Prompts As a Group:</p> <p>In the first game:</p> <ul style="list-style-type: none">• Did you ever transmit a signal that wasn't correct and then it passed through the chain? What would be the effect of this miscommunication for a nerve?• Did you ever have a signal that did not make it down the line? Why did it happen? What might be the reason that this might happen in an animal? <p>In the second game:</p> <ul style="list-style-type: none">• How clear was the message at the end?• How might this apply when more people are added to the chain?

Senior Member Project - Outline a Disease

Do

Time: 10 minutes

Materials needed:

- Disease Outlines
- Example Factsheets

Instructions:

In this activity, senior members will pick a disease affecting the nervous system, research it and present it at the sixth meeting.

Presentations can be any medium of the members choosing but should be age appropriate and geared towards younger members so that way they can learn complex materials from their peers.

You may also get senior members to create new fact sheets that are not supplied on the next page. However, this is an optional activity for members who might not be able to present.

If a group is mature this can be done as a group as a whole and treated as an achievement project.

Reflect

Learning Outcomes:

The objective of this activity is to examine diseases and syndromes that affect the nervous system.

What Is Rabies?

BACKGROUND

Rabies is a disease caused by a virus that can infect any warm-blooded animal. Skunks and foxes are the two most common carriers. The disease is transmitted through the saliva of an infected animal. The virus enters the body through an area of damaged skin. This could be a bite, wound, scratch, or any other open injury. The virus then travels along nerve tissue, peripheral nerves and the spinal cord to the brain. This means that the closer the wound is to the brain, the less time the disease takes to reach the brain.

This process can take anywhere from a few days to a few months, but 80% of infected animals will show the signs of rabies and die within 2 weeks of infection.

WHAT ARE THE SIGNS OF RABIES?

Animals can show different clinical signs of rabies. In fact, rabies can show up in one of two general ways.

1. **Furious Rabies** - The animal shows unpredictable and aggressive behavior. It may thrash about. It may attack anyone or anything. These signs are probably what you think of when you hear the word rabies.
2. **Dumb Rabies** - The animal is inactive, listless, and quiet. It might appear paralyzed. This is not what most people think a rabid animal would look like, but it is just as dangerous. Do not approach a wild animal acting cute and quiet. This animal is not acting normally.

IDENTIFICATION

Farm animals and pets that have rabies may show any of the following signs:

- Drooling saliva
- Aggressive behavior
- Lameness
- Restlessness
- Uncoordinated or Jerky movements
- Bellowing
- Straining to pass manure

PREVENTION

1. Vaccinate your dog and cat regularly for rabies.
2. In some areas, farm managers have their livestock vaccinated.
3. Talk to your veterinarian if you suspect one of your animals has been exposed to an animal with rabies.
4. Human vaccine is available for those at risk (veterinarians, shelter workers).

What Is Tetanus?

BACKGROUND

Tetanus is a disease that is often fatal, and it is caused by a bacterium called, *Clostridium tetani*. Tetanus is not contagious. It can infect all animals, but humans, horses and sheep are most at risk. Tetanus bacteria are commonly present in the soil. They infect cuts and wounds and produce a powerful toxin or poison that causes rigidity and spasmodic contraction of the voluntary muscles.

An infected animal becomes stiff in the muscles. Walking is more and more difficult. The jaw “locks” into position. (This is why tetanus is called lockjaw.) The tail may be rigid. Eventually, the animal dies because it cannot breathe. Rigid backward extension of the legs is a typical tetanus clinical sign.

PREVENTION

1. Cleaning all wounds well will reduce the risk of tetanus.
2. Humans and horses, including foals, should be routinely vaccinated.
3. Castration (removal of the testicles) and docking (cutting tail) of animals should be done as cleanly as possible, with sterilized instruments.
4. Use of disinfectants.

Spinal Cord Disorders

Type of Disorder	Animal	Description	Prevention
Meningitis	All Animals	Often develops in association with viral or bacterial disease, or due to head injury. An inflammation of the membranes covering the brain and spinal cord. Absolute quiet and professional treatment is required.	Prompt treatment of generalized bacterial infections.
Epilepsy	Dogs	A nervous disorder with sudden loss of consciousness and muscular convulsions. Causes include trauma, infection, heart disease. Some epilepsy is congenital (dog is born with the disease).	There is no prevention. Treatment with drugs is often successful in controlling the disease.
Listeriosis (Circling disease)	Farm Animals, Rodents, Dogs, Humans	A bacterial infection that causes abscess of the brainstem, and abortion in cattle. Signs may look like some of rabies. Infection is spread by urine, milk, feces and contaminated tissue. Can be found in feed.	Keep diseased animal away. Dispose of aborted fetus immediately. Disinfect areas where diseased animal was kept, if possible. (Not practical on livestock farms.) Often found in silage, so management of silage is important. Also seen in goats and very susceptible when being fed silage.
Hydrocephalus	Horse, Dog, Cow, Humans	Large amount of fluid collects in brain cavity. Often present before birth, and animal is stillborn. Can occur after meningitis.	There is no prevention. If meningitis is the cause, fluid may be drawn out.
Warbles	Cattle	A small fly larva causes inflammation around the spinal cord. Cattle become uncoordinated and eventually can't get up.	Administer an insecticide to the animal before Dec. 1. This kills the larva within the animal before it has a chance to migrate to the spinal cord.
Wobbler Syndrome	Horses and Large Dogs	Because of an instability in the vertebral column, affected animals have pressure on their spinal cord in the neck. This causes the animal to become uncoordinated.	There is no prevention. They may be born with a predisposition to this problem.
Getting Hit by Cars	All Animals	A common cause of spinal cord injury.	Supervise your pets.
Intervertebral Disc Disease	Dogs	This is common in older, overweight, short legged dogs. It is also found in humans. The soft material between the bones in the backbone ages and pushes up onto the spinal cord. Medical treatment and often surgery is needed. Many animals do not recover and become paralyzed.	Don't over feed your pet. Basset Hounds, Dachshunds and Lhasa Apso are often susceptible. Jumping or falling off chairs or beds is a cause.

Meeting 2 - The Processing Centre

Setting Objectives:

To identify the different subdivisions of the brain, the importance of the cerebral spinal fluid and the layers of the central nervous system.

Suggested Lesson Outcomes:

- To explain the different subdivisions of the brain and differences between common species.
- To describe the components of the central nervous system.
- To describe the importance of the cerebral spinal fluid in protecting the central nervous system from trauma.

Suggested Roll Call Questions:

- How might you protect yourself from a fall?
- Look up a section of the brain. Give its name and one responsibility it has.

SAMPLE MEETING AGENDA

Time: 2 hours

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	10-15 minutes
Topic Information, Discussion	Basic Subdivisions Of The Nervous System and Brain	20 minutes
Activities Related To Topic	Activity #1 - Use Your Brain!	20 minutes
Topic Information, Discussion	Importance Of Structure	10 minutes
Activities Related To Topic	Activity #2 - Egg Helmet	30 minutes
Wrap Up, Social Time And Adjournment		10 minutes

Basic Subdivisions of the Nervous System and Brain

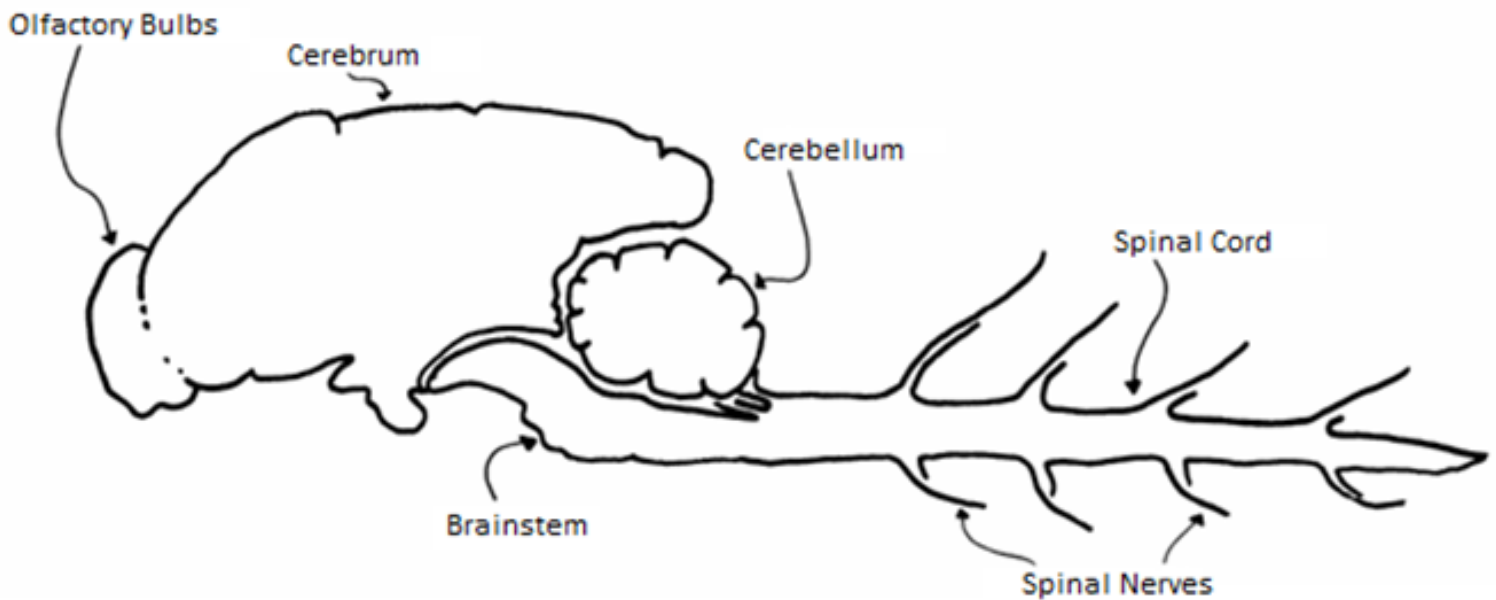
Basic Parts of the Central Nervous System

As mentioned previously, the central nervous system is made up of the brain and the spinal cord.

The main part of the CNS is the cerebrum. It is responsible for interpretation of sensory impulse and the exercise of emotion and thought. In humans, the cerebrum is highly developed. It is divided into halves, and at the front of each half is an olfactory bulb.

The olfactory bulb is where your sense of smell is found. Animals with large olfactory bulbs have — you guessed it — a good sense of smell!

The cerebellum comes next. It is responsible for the regulation and coordination of complex voluntary muscular movement for balance and coordination. An example would be, moving your arms. Just below the cerebellum is attached to the brainstem. Not a lot of thinking takes place here, but this is the heart of the body's life support system. All major bodily functions such as breathing, growth and heartbeat are controlled here. It works by receiving messages coming into the brain, and then sending out messages to control the body functions.



The spinal cord is the largest part (by length) of the CNS. It starts at the brainstem and goes to the end of the backbone. Nerves from the PNS join it all along the backbone, and messages to and from the CNS move through here.

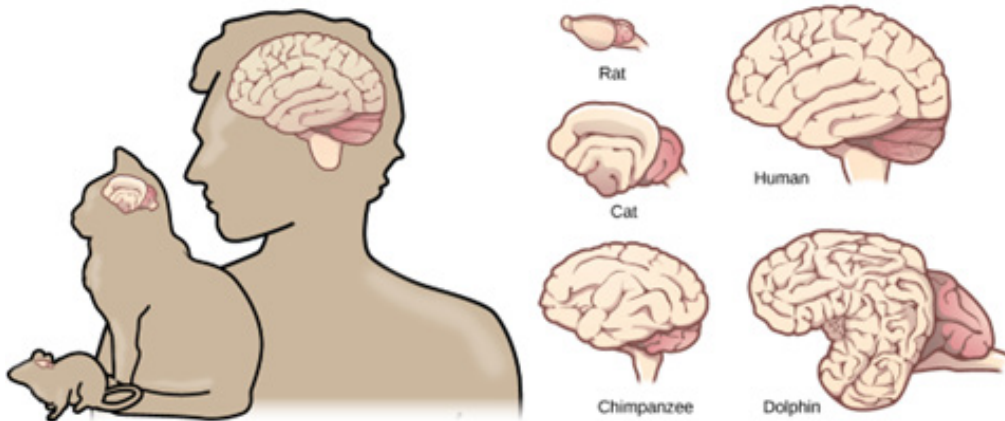
DID YOU KNOW?



A leech has 32 sections each with its own brain!

Differences Between Species

As mentioned previously, every species has a different size and composition when it comes to brains. Different species have different intellectual capabilities based on the composition of their brain. Think of what a human or chimpanzee can do compared to a rat! Each individual's brain (within species) is unique. For example, you may be creative and artistic while your friend is a wizard at spelling bees!

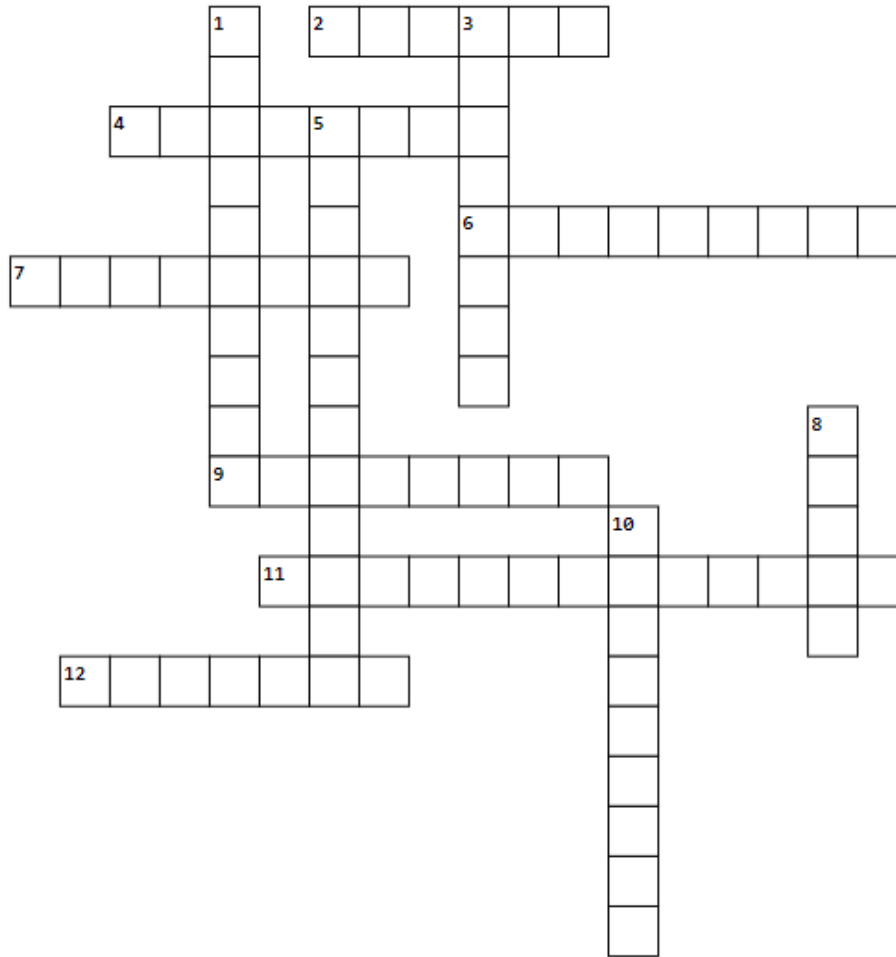


Source: Wikipedia

Activity 1# - Use Your Brain!

Do	<p>Time: 20 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Cross word Activity• Answer Key <p>Instructions:</p> <p>Provide the crossword game to the youth and play the game in small groups. Pair older and younger members together and try and figure out the parts of the central nervous system. You can also help members with words that they may not know by giving them hints about certain letters.</p> <p>At the end of the activity go over the game and clarify any questions that members might have.</p>
Reflect	<p>Learning Outcomes:</p> <ul style="list-style-type: none">• The objective of this activity is to learn more about the central nervous system while completing a fun game!
Apply	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• Were there any that you did not know?• What is something you learned?

Use your Brain Crossword!



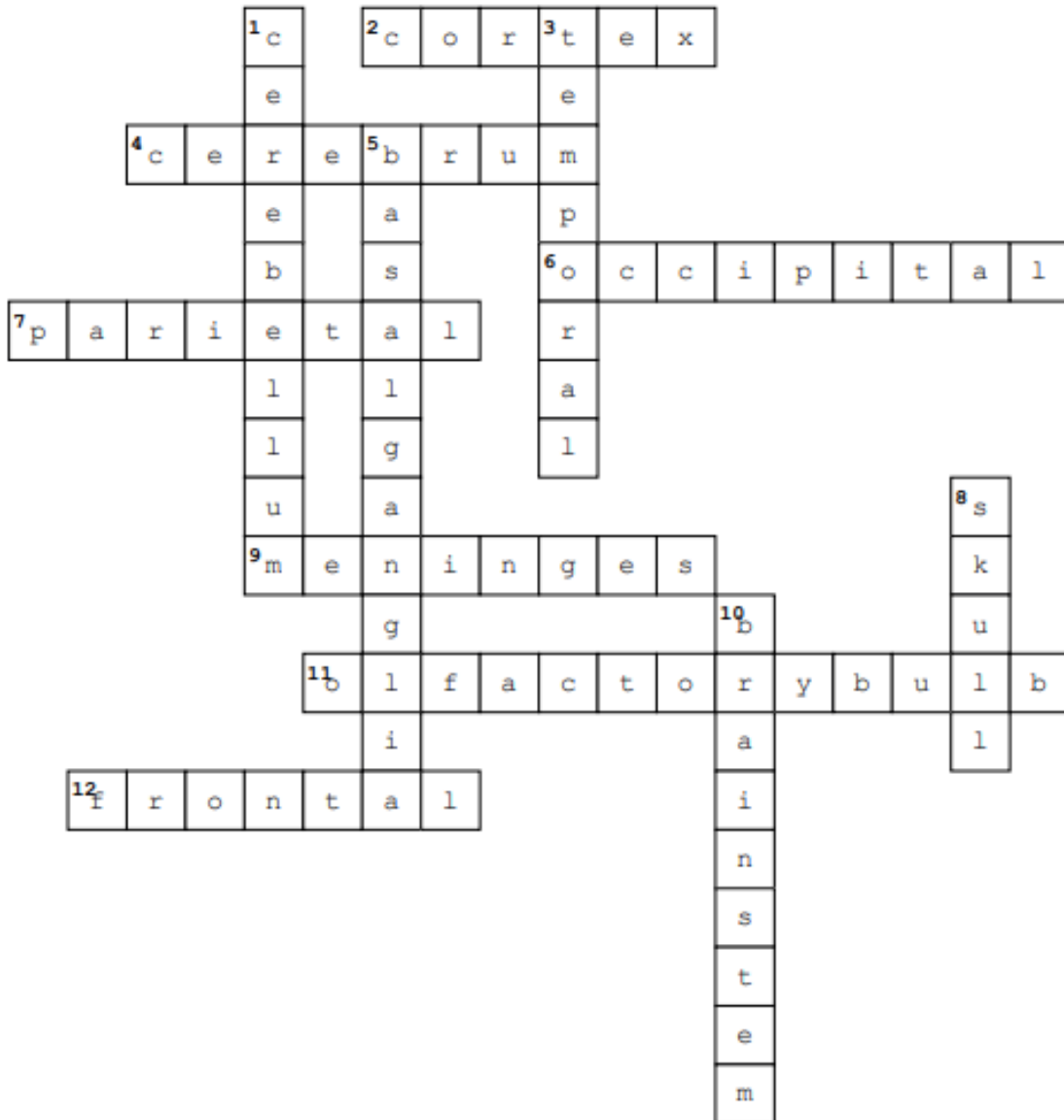
Across

2. I am the outermost layer of brain cells
4. I am the main part of the CNS
6. I am responsible for the brain's visual processing.
7. I manage sensation and body position
9. The brain is surrounded by a layer of tissues called...
11. I am where you get your sense of smell
12. I am the lobe responsible for problem-solving and judgment

Down

1. I am responsible for the regulation and coordination
3. I am involved with memory and hearing
5. I coordinate messages between different brain areas
8. What hard collection of bones protect the brain from injury?
10. I lie between the spinal cord and the brain

Use your Brain Crossword! - ANSWER KEY



Across

2. I am the outermost layer of brain cells
4. I am the main part of the CNS
6. I am responsible for the brain's visual processing.
7. I manage sensation and body position
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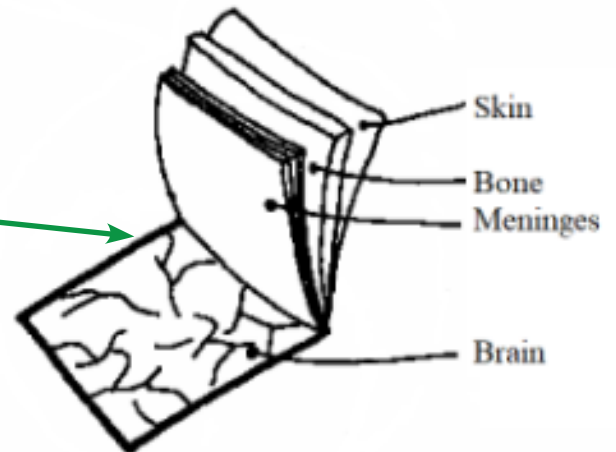
Down

1. I am responsible for the regulation and coordination
3. I am involved with memory and hearing
5. I coordinate messages between different brain areas
8. What hard collection of bones protect the brain from injury?
10. I lie between the spinal cord and the brain

Importance Of Structure

As mentioned previously in this section, the central nervous system is composed primarily of the spinal cord and the brain. However, the structural components of the central nervous system are almost more important than the functional components. For example:

The brain is surrounded by layers of membranes that keep it from moving around and a hard shell (bones of the skull or cranium) that provides protection from trauma.



The spinal cord is surrounded by spinal column which provides a hard shell to protect the sensitive nerves.

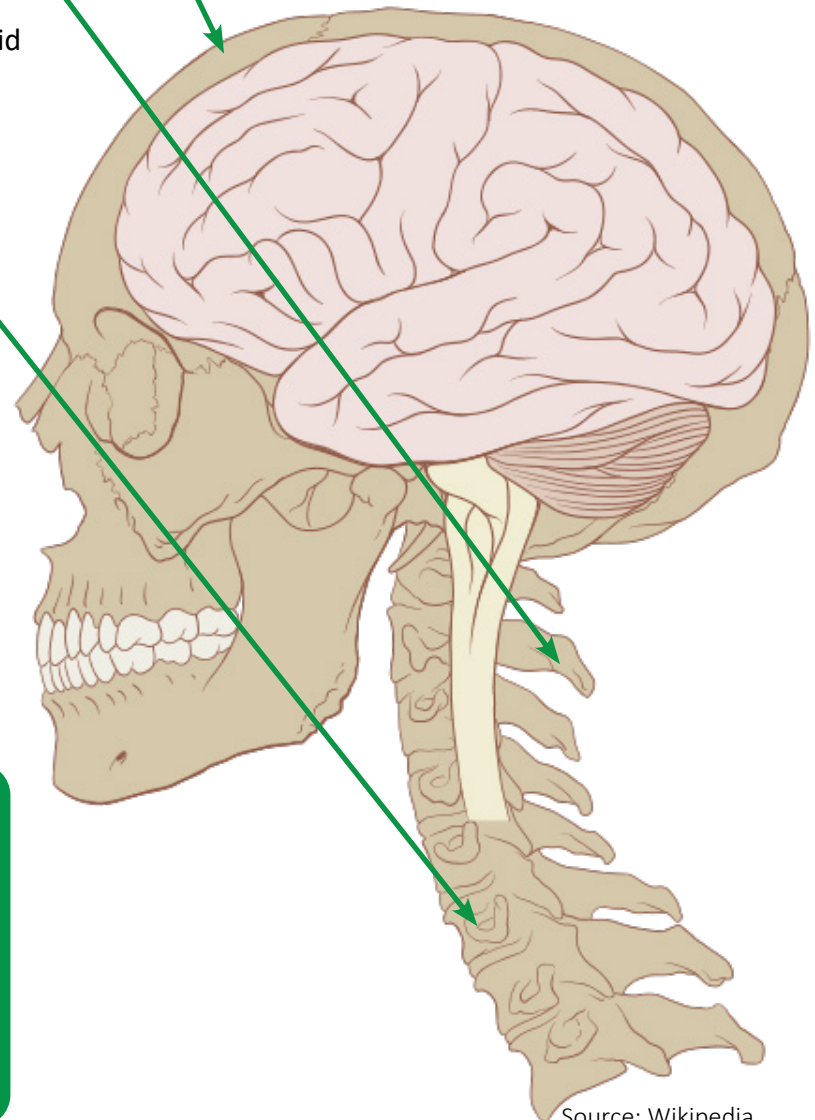
A fluid-filled spaces below the bones, contained a fluid which also helps in shock absorption.

This mass amount of protection is very important for several reasons but the biggest is that the central nervous system cannot be repaired after injury (at least at the time of writing this manual). The problem is that the components of the CNS are so specialized that they cannot divide any further.

Additionally, the protection that the structural components can also hurt the CNS. When injuries occur, there is very little space for normal swelling leading to the potential for more damage. For this reason, it is very important that special attention is paid to preventing injuries as damages can often not be fixed.

Try It!

Put a raw egg into a small plastic container that is slightly larger than the egg (the container represents the skull). Cover the container with a tight fitting lid and shake it. Members should notice that shaking the "brain" results in "damage" (a broke egg). Repeat this experiment with a new egg. Fill the container with water, which represents the cerebrospinal fluid. Members should notice that shaking the container does not cause the "brain damage" as before – the fluid has cushioned the brain from injury.



Source: Wikipedia

Activity 2# - Egg Helmet

Do	<p>Time: 30 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Pipe cleaners• Toothpicks• BBQ skewers• Cardboard• Tape• String• Balloons <p>Instructions:</p> <ul style="list-style-type: none">• Start by introducing the activity and explaining how a raw egg can break easily when it is dropped on the ground. Ask members if they can design something that prevents the egg from breaking out of the materials provided. <p>Give members 20 minutes to create the contraption based on the materials provided.</p> <p>Members are to have their egg on the inside of what they created, ready for the drop test.</p> <p>When 20 minutes are done, members will drop their eggs from a standard height (one senior member or leader) and see if their egg breaks. If it does not, keep going higher. Ideally you should be able to create a cushion for your egg that will handle a significant drop. This is an engineering (STEM) challenge!</p>
Reflect	<p>Learning Outcomes:</p> <ul style="list-style-type: none">• The objective of this activity is to create a cushioned fall for the egg while teaching a valuable lesson about the role of the cerebral spinal fluid and structure of the skull and vertebrae.
Apply	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• Think about the activity! What worked best? What provides the most cushion? Were all groups successful?• How do you think that the structure of your egg helmet might closely link to the structure of the vertebrae or the skull? How about the spinal fluid?• Why are the structural aspects so important to the central nervous system?• What is one takeaway you will have from this activity?

Meeting 3 - The Touchy Feels

Setting Objectives:

To identify the role of the peripheral nervous system in sensing touch, pain and the importance of reflexes

Suggested Learning Outcomes:

- To identify the different parts of the peripheral nervous system and how they work together.
- To describe how one might feel something in one part of their body and move as a result.
- To describe the importance of evaluating reflexes as a part of a regular exam.

Suggested Roll Call Questions:

- What does the term reflex mean to you?
- What do you use your sense of touch do?

SAMPLE MEETING AGENDA

Time: 1 hour 45 minutes

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	10-15 minutes
Topic Information, Discussion	Overview Of The Peripheral Nervous System	10 minutes
Topic Information, Discussion	Focus On The Senses: Touch	10 minutes
Activities Related To Topic	Activity #1 - What's In The box?	15 minutes
Topic Information, Discussion	Reaction Time And Reflexes!	15 minutes
Activities Related To Topic	Activity #2 - Test Your Reflexes!	15 minutes
Wrap Up, Social Time, And Adjournment		10 minutes

Overview Of The Peripheral Nervous System

The Peripheral Nervous System (PNS) includes all the components that arise from or attach to the CNS. Some examples of the PNS are the cranial nerves (the nerve that is involved in pupil constriction/dilation or feeling the tip of your nose) and spinal nerves. Spinal nerves are paired, meaning that they have both a left and a right side. The PNS is responsible for the SENSE and ACTION part of the nervous system. It involves thousands of nerves that are spread out throughout the body. In areas where there is a high concentration of nerves (for example, all the nerves that enter your arm need to go through a small space near your armpit to reach their various destinations in the arm), they form plexuses.

The specialized endings of the PNS form receptors that act as sensors and attach to muscles causing them to contract. The brain ultimately sends out positive or negative signals to the different muscles so that the right amount of force is exerted on the limb, creating a smooth and controlled movement. For example, think of trying to pick up a 15 kg weight with your hand compared to picking up a teacup. These actions both require similar muscles but different amount of force and delicacy to complete the actions. This is called coordination.

Think About It!

Think of all the muscle impulses required to control the cheetah's muscles as it leaps to catch its prey while running at 120 km/h.

The PNS is not only involved in voluntary (somatic) movements but is also involved with the Autonomic Nervous System (ANS). The ANS looks after the involuntary actions that keep the animal alive. The animal does not have to think about doing these actions, they just happen! The ANS is ultimately controlled in centres in the brainstem. Examples of the ANS actions include your heartbeat, blood pressure and digestion, all being autonomic or involuntary actions! The ANS is broken down into 2 systems: The Sympathetic and the Parasympathetic system. The Sympathetic system is the “fight, flight or freeze” system, whereas the Parasympathetic system is the “relax and digest” system. Both are vital to ensuring an animal's survival based on the situation that it finds itself in!

Focus on the Senses: Touch

The skin is the largest organ of the body due to its ability to protect and provide support to the organs while also sensing the interactions with the outside world. The sense that the skin is responsible for is touch!

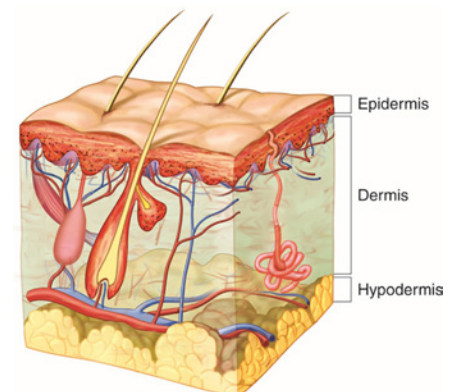
The sense of touch allows us to identify items in our world but also allows for avoidance of pain, and determination of environmental conditions (temperature- either hot or cold). These are very important for a species to survive.

The skin is composed of three layers that each have a specific role in sensing objects and protecting the body:

- Epidermis (where epi means upon or over)- This layer is composed of primarily dead skin cells and contains melanin which protects against the sun's rays.
- Dermis- contains the hair follicles (if applicable), sweat glands, nerve endings, and touch receptors (to name a few).
- Subcutaneous Tissue or Hypodermis- composed of fat and connective tissue that keeps the body warm and together.

The sense of touch comes from one of two types of receptors:

- Mechanoreceptors- these nerves perceive sensations (such as pressure, vibrations, and texture).
- Chemoreceptors- these nerves perceive sensation related to temperature.



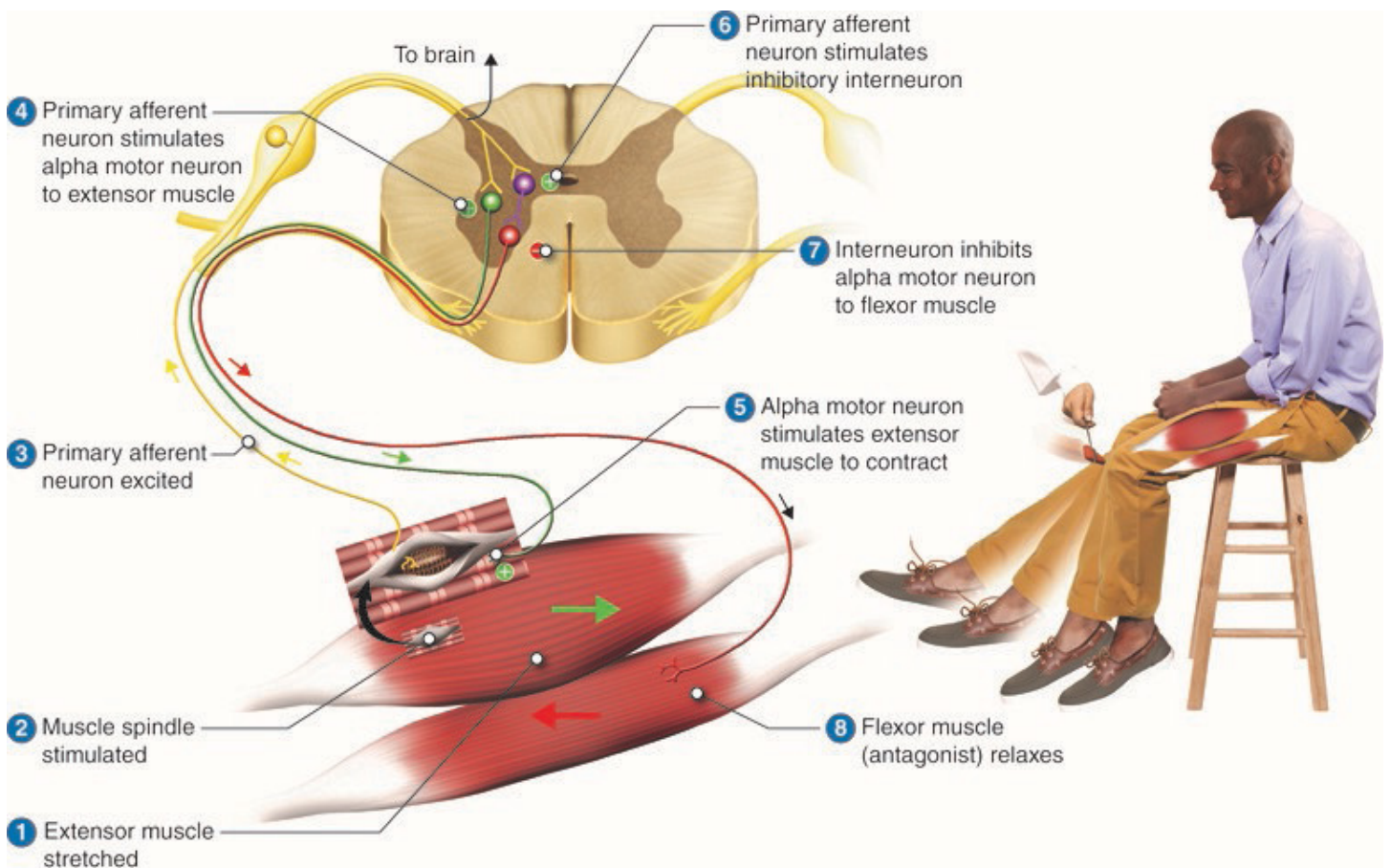
Integumentary Structures and Functions.
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Tips

Overall, both receptor types are designed to prevent injury to the body which is the primary role of the bodies sense of touch. However, there are other advantages of a keen sense of touch. The ability to use touch along with other senses allows animals to create memories and identify objects quicker. This will be explored in the next activity! (What's in the box

Activity 1# - What's In The Box?

Do	<p>Time: 15 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Random Objects (at least 5; examples could include hammers, feathers, cans, etc.), cardboard box, scrap paper, pencil or pen <p>Instructions:</p> <p>Before the meeting, get a cardboard and (1) Cut a hole in the top box, (2) get the objects ready and hidden from members view.</p> <p>When it is time for this game, explain that members are trying to identify objects in the box without being able to see them. Get members to touch each of the items in the box and write down their guess (in a simple list on a scrap piece of paper). Then move on to the next item.</p> <p>When complete, get members to give their answers on the items and provide the official answer while holding it up.</p>
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to identify the importance of the sense of touch and to identify items that are both novel and known.</p>
Apply	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• How easy was it to identify the objects that you knew?• Where there any that were hard to identify?• Did you recognize the object when it was shown to you?• How important is our ability to combine our senses to generate our understanding of the object?• For objects that you might not have known, how did you describe the object when you first touched it?

Reaction Time And Reflexes!



Stretch Reflex. When a muscle is stretched (1), muscle spindles (2) send information to the spinal cord (3) where it synapses on motor neuron of the same muscle (4) causing it to contract (5). At the same time, stimulation of an inhibitory interneuron (6) prevents contraction of the antagonistic muscle (7 and 8). This work by Cenveo is licensed under a Creative Commons Attribution 3.0 United States (<http://creativecommons.org/licenses/by/3.0/us/>).

Dexterity is a manual skill. The reflexes of an animal, which are manual skills are very important to its survival. A reflex is a quick reaction that we have very little control over. Reflexes happen without you even thinking about them! Animals and humans have very similar reflexes. They can be used to test the proper functioning of different parts of the nervous system. For example, if you mistakenly touch a hot pot with your hand while boiling a pot of water on the stovetop, you will immediately withdraw your hand away from the contact point without even thinking about the action. Only later would you realize that you had touched something hot (and might have the feeling of pain where the burn is). Other examples of reflexes are:

1. If a dog does not react to a loud noise, it may have a nervous system disorder, or it could be deaf (loss of hearing).
2. If a sow (mother pig) does not feel pain in her hind legs, she likely has a nervous system disorder in her spinal cord inhibiting her pain sensation.

Activity 2# - Test Your Reflexes!

Do	<p>Time: 15 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Pen Light <p>Instructions:</p> <ol style="list-style-type: none">1. Can you make a friend blink? Sure you can! Be careful, do not make contact with the other members.2. When you support a dog's hind leg under the thigh and tap below the knee, it will kick. You will too! (depending on the group this might be good to show a video of).3. An animal's pupil (the opening in the center of the eye) will get smaller when the eye is exposed to light. Your eye will do this too! (be careful to not expose your eyes to bright lights for too long).4. If a friend spins round and round, they'll get dizzy. Quickly get them to stop spinning and look at their eyes. They should be "flicking" in the opposite direction. This is a reflex action of the inner ear attempting to maintain balance.
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to learn more about the different reflexes of the body in a fun, active way!</p>
Apply	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• Did your partner flinch as well as blink? How might this be influenced by the partners knowledge of the action?• Why does this reflex occur? What is the purpose? How can we use this one to evaluate a dog's nervous system?• This natural adaptation protects the retina. Why might the body want to prevent the damage of this sensitive vision organ?• How might the inner ear maintain balance through this compensatory reflex?

Meeting 4 - Taste And Smell

Setting Objectives:

To identify the players of the smell and taste senses.

Suggest Lesson Outcomes:

- To identify how taste and smell signals are transferred.
- To identify the importance of smell and taste to animals.
- To explore these senses through fun activities.

Suggested Roll Call Questions:

- What is one thing that you love the smell of?
- Name something that you can taste when you smell it?

SAMPLE MEETING AGENDA

Time: 1 hour 45 minutes

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	10-15 minutes
Topic Information, Discussion	Focus on the Senses: Making Sense Of Scents	10 minutes
Activities Related To Topic	Activity #1 - What's That smell?	20 minutes
Topic Information, Discussion	Focus On The Senses: Taste	15 minutes
Activities Related To Topic	Activity #2 - Taste Buds – Friends Or Foes?	20 minutes
Wrap Up, Social Time And Adjournment		10 minutes

Focus On The Senses: Making Sense Of Scents

In the animal kingdom, many species share the same ability to detect changes in scents of their environment (called olfaction). The ability to smell is one of the five special senses and is responsible for detecting hazards (for example: gas leaks or rotten smelling food) or pheromones (signals that a species communicates through).

While hazards come in all shapes and sizes, the ability for animals to identify these provides a great evolutionary advantage as animals can flee before one becomes a problem. The evolutionary advantage also extends to pheromones, as animals that can detect these can ward off rivals or communicate with a potential mate.

Smell is also essential for an animal's sense of taste but that will be covered later in this meeting.

How Does The Sense Of Smell Work?

The sense of smell works using the receptors in the nasal cavity. When an odor or pheromone enters this space, it binds to an olfactory receptor which signals a response to the brain.

As mentioned previously, those species with larger olfactory bulbs can usually detect smells better than other species. Dogs use this ability to locate food, dogs, or other scents.

Chemoreceptors are what create the signals that are processed in the brain. These signals interact with parts of the brain typically associated with smell identification, memory, and emotion.

Activity 1# - What's That Smell?

Do	<p>Time: 20 minutes</p> <p>Materials Needed:</p> <ul style="list-style-type: none">• Strands of licorice• Colouring mini marshmallows (for a healthier alternative, use fruit)• Toothpicks• DNA code (found on the next page) <p>Instructions:</p> <ol style="list-style-type: none">1. Dogs have a great sense of smell! The hound dog has between 125 and 200 million olfactory receptors as compared to a humans 5 million.2. To prepare for this activity you will need to prepare some jars with some different scents.3. Get the members to close their eyes and walk around the table. On a scrap piece of paper, get the members to write down their guess for each jar.4. After you complete the game, reveal the answers.
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to learn more about how the sense of smell works and to use the sense of smell to identify scents.</p>
Apply	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• What was the easiest smell to detect?• Have you ever smelt something that you knew the taste of before you had any?• Were there any scents you didn't know and potentially guessed on?

Focus On The Senses: Taste

Taste is very important to animals. It helps them to distinguish what is okay to eat or whether it could be bad for them. Animals have very different senses of taste when compared to each other. While all vertebrates have tongues, their taste buds differ. Taste buds convey what each taste is through olfactory receptors. The number of taste buds varies for each species. For example, birds have very few taste buds (typically around 30 for a chicken), whereas humans have lots of taste buds (around 10,000). Cows are even more impressive with over 25,000!

There are 5 primary flavours that taste buds can detect. They are the following:

1. Umami: “Essence of deliciousness” is savoury and meaty flavour associated with meats and cheeses.
2. Salty: Helps animals to adjust their diet to consume the right electrolytes.
3. Bitter: Alarm for potential toxins.
4. Sour: Conventionally acidic substances.
5. Sweet: Indicates an energy-dense item.

These flavours get conveyed from the taste buds to the brain where they are processed, and the animal recognizes whether the food is good or bad. They will then continue to eat or leave it alone.

**DID YOU
KNOW?**



Cats can't taste sweet things! No
desserts for your kitties!

Activity 2# - Taste Buds - Friends Or Foes?

Do	<p>Time: 20 minutes</p> <p>Materials Needed:</p> <ul style="list-style-type: none">• Jellybeans (ideally the Mystery ones), or gummy candy with various flavours• Styrofoam cups• Paper plates <p>Instructions:</p> <p>Before the meeting, set aside a set number of candies per each member (based on the supplies available – ideally between 3-5 candies per member). Place the candies on the paper plates with the Styrofoam cup covering them. Have the members divide into pairs.</p> <p>Have each partner take turns completing the following:</p> <ol style="list-style-type: none">1. With their eyes open, take turns tasting the candies. For this round, have the partner that is not tasting the candies select the candy for the partner tasting to try. Have the tasting partner try to guess what the flavour of the candy was. Switch partners and do the same thing.2. With their eyes closed, take turns tasting the candies. For this round, have the partner that is not tasting the candies select the candy for the partner tasting to try. Have the tasting partner close their eyes and then try to guess what the candy flavour was based on taste alone. Switch partners and do the same thing.3. With their eyes closed, take turns tasting the candies. For this round, have the partner that is not tasting the candies select the candy for the partner tasting to try. Have the tasting partner close their eyes, plug their nose and then try to guess what the flavour of the candy was based on taste alone. Switch partners and do the same thing.
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to learn more about the different senses that contribute to an individual's ability to taste.</p>
Apply	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• How many candies did you correctly guess the flavour of? Were there any candies that did not taste good?• Which round was the most difficult to correctly distinguish the correct flavour of the candy? Why do you think this was?• Why is taste so important to humans? Why would taste be important in animals?

Meeting 5 - A 4-Her Hears And Sees A Who?

Setting Objectives:

To identify the parts and role of both the sense of hearing and vision.

Suggested Learning Outcomes:

- To identify the various structural components of the sense of hearing and eyesight.
- To identify differences in hearing and vision ability across different species.

Suggested Roll Call Questions:

- What are ways you protect your hearing or vision?
- How do you think your sense of hearing or vision works?

SAMPLE MEETING AGENDA

Time: 2 hours 5 minutes

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	10 minutes
Topic Information, Discussion	Focus On The Sense: Hearing	20 minutes
Activities Related To Topic	Activity #1 - Riding A Wave!	20 minutes
Topic Information, Discussion	Focus On The Senses: Vision	20 minutes
Activities Related To Topic	Activity #2 - Blindfolded Picasso	30 minutes
Wrap Up, Social Time And Adjournment		5 minutes

Hearing

An animal's ears are an integral part of their life that they use to be able to survive. The auditory system is what allows them to be able to convert pressure waves into sounds that they can understand.

An ear has many different parts, each contributing a valuable role to hearing. These include the outer ear, middle ear and inner ear.

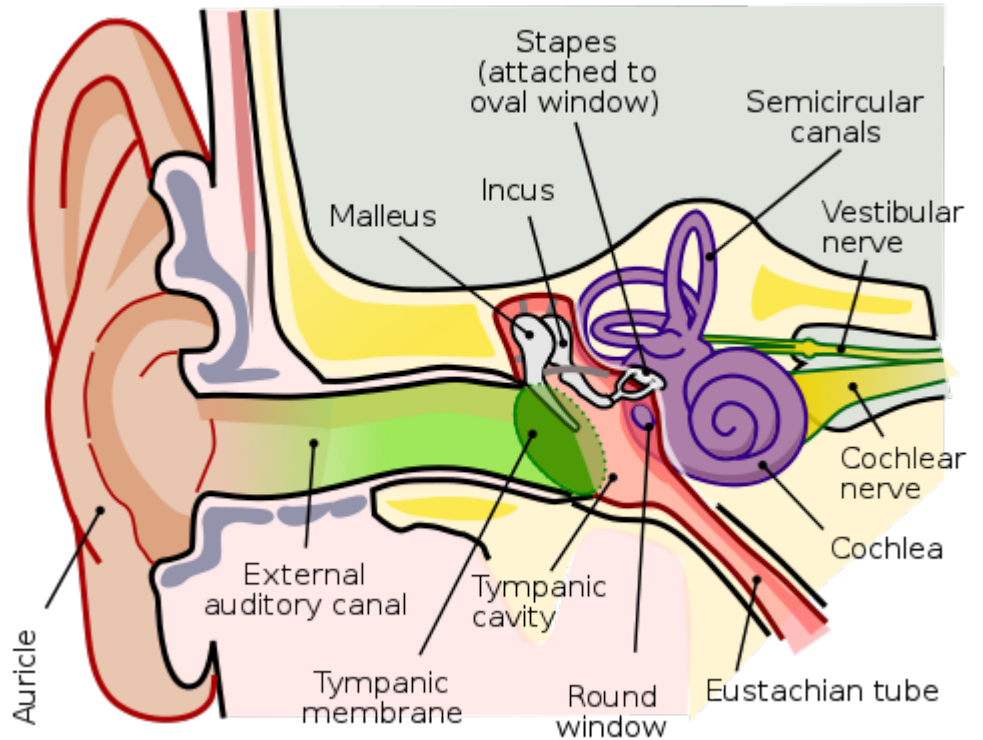


Image from Wikimedia Commons
https://commons.wikimedia.org/wiki/File:Anatomy_of_the_Human_Ear.svg

DID YOU KNOW?



Malleus means hammer!

The first part of the ear is the pinna or the auricle. This is the external part of the ear that collects sound waves and directs them further down through the auditory canal to meet the tympanic membrane. The tympanic membrane separates the outer ear and the middle ear and gets vibrated by the sound waves coming in through the canal. These vibrations of the tympanic membrane are translated to the 3 tiny bones of the middle ear, known as the malleus, the incus and the stapes and are transmitted to the inner ear.

The eustachian tube is what allows for air pressure to equalize between the ear and the outside environment, as it connects from the middle ear to the pharynx. The inner ear is surrounded by fluid and consists of 2 main parts: the semicircular canals and the cochlea. The semicircular canals are bony fluid-filled loops responsible for balance of the body. The cochlea (snail-shaped structure) houses the Organ of Corti (true organ of hearing) which changes the vibrations into nervous impulses that are picked up by the auditory nerve and transferred to the brain for interpretation.

Activity #1 - Riding A Wave!

Do

Time: 20 minutes

Materials:

First Part:

- 2 different size spoons
- String or yarn

Second Part:

- Rice
- Saran (plastic) wrap
- Glass bowl
- Metal pan
- Metal spoon

Third Part:

- Full water bottle

Instructions:

First Part:

1. Get members to create a loop in the middle of the yarn or string and insert the handle of one of the spoons.
2. Loop the string around your fingers (with enough slack that you can touch your ears with the ends of the string) and position yourself in a surface close to a hard surface (table).
3. Next gently tap the spoon against the table (you should hear an initial ring) but if your fingers on attached to your ears you should hear a vibration.
4. Try this activity with the other spoon and see if you can notice a difference.

Second Part:

5. First fit the plastic wrap over the glass bowl.
6. Pour the rice on top of the plastic wrap.
7. Bring the metal bowl close to but not touching the wrapped bowl.
8. Hit the sheet with the metal spoon and watch what happens to the rice on the plastic wrap.

Third Part:

9. Get members to start with a full plastic water bottle. Slowly empty the water bottle and demonstrate how members can make sound with different levels by blowing across the top.

Reflect

Learning Outcomes:

The objective of this activity is to learn more about how the sense of hearing uses sound waves to identify stimulus.

Apply

Discuss The Following Prompts As a Group:

First Part:

- You heard sound waves going through the string. How different was the sound traveling through the string from the sound you would expect to hear from hitting it on the table?
- Did this activity surprise you?
- How do you think you heard sound regardless of not being able to hear that sound without the fingers on your ears?

Second Part:

- What happened with the rice?
- How did it happen?

Third Part:

- What happened as you got less water in the bottle?

Overall:

- How have these activities improved your understanding of sound waves and the organs involved with hearing sound?

Vision

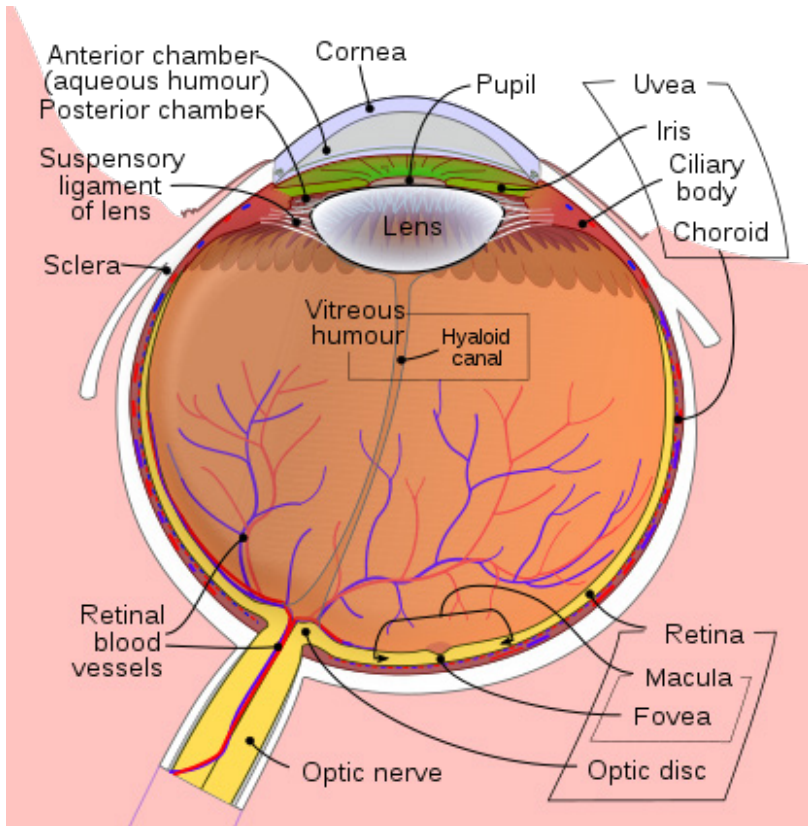


Image from Wikimedia Commons
https://commons.wikimedia.org/wiki/File:Schematic_diagram_of_the_human_eye_en.svg

After the light makes it through the pupil, the light waves will go through the lens of the eye which provides focus. The lens is what allows animals to see near or far objects. The light waves then make it all the way to the back of the eye, known as the retina. The retina is the light-sensitive inner lining of the eye made up of photoreceptor cells called rods and cones. These cells allow us to see colour, make out details and give us spatial resolution. The rods and cone cells converge and exit through the very back of the eye through the optic nerve. The optic nerve is what transmits the visual information just taken in by the eye to the brain. The optic nerve from the 2 eyes converges at a spot known as the optic chiasm. This is where the information from the right eye crosses over to go to the left side of the brain and the left eye information crosses over and goes to the right side of the brain. Once inside the brain, the information is processed and made sense of.

Animal's vision quality is highly variable between species. For example, eagles have phenomenal long-distance vision allowing them to see up to 8 times as far as a human can see. This is valuable to their ability to survive, as they need to be able to see small animals from far away to be able to hunt them. Their vision is very sharp, allowing them to really focus on their prey from above. This is contrasted starkly by the star-nosed mole, who is born completely blind and relies almost exclusively on their sense of touch to navigate the world.

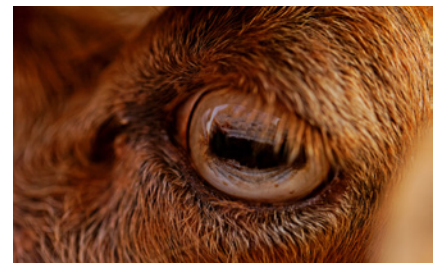
The parts of an animal's visual system are what allows them to navigate through the world and interact with their environment. There are many parts of the visual system. The first part that usually comes to the top of mind when thinking about vision is the eye.

Light waves first encounter the cornea, which is a transparent first layer of the eye allowing the light waves to enter the inner parts of the eye. If you look in the mirror, the coloured part of the eye is known as the iris. Light waves then travel through the small opening of the eye called the pupil. The pupil can adjust how much light goes through by becoming larger (dilated) or smaller (constricted). Typically, when there is a lot of light in an environment, the pupil will become constricted and when an environment is dark, the pupil will become dilated.

DID YOU KNOW?



Goats have rectangular pupils!



Activity #2 - Blindfolded Picasso

Do	<p>Time: 30 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• A blank piece of paper (one for every member)• Markers• Bandanas/blindfolds (optional) <p>Instructions:</p> <ol style="list-style-type: none">1. Get members to pair up. Have the members decide amongst themselves who will draw first. Have the member who will draw first put on a blindfold/bandana covering their eyes or just close their eyes.2. The other member will be verbally instructing the blindfolded members what to draw (using only descriptive language that informs them of the shape they need to draw (i.e., circle, straight line, triangle, etc.). They cannot physically touch the blindfolded member or give them clues about what they are drawing.3. Assign the guiding members a thing to draw. Some examples include bird, tractor, cow, swing, pig, dog, house, barn, etc.4. Give each member about 10 minutes to be able to draw/instruct. Switch and allow the other member an opportunity to do the other task.
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to learn more about how the valuable the sense of sight is in being able to draw and for spatial awareness.</p>
Apply	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• Have each member show the group their drawing and have the group guess what their prompt was.• How difficult was it to draw these images? Did you struggle to gauge where your marker was on the paper?• How did you and your partner change your communication throughout the activity to make drawing easier?• What are some activities that would be very difficult to do if you lost some of your vision? What could be done to make these activities or tasks easier?

Meeting 6 - Putting It All Together!

Senior Member Project Presentations

Setting Objectives:

To discuss neurological disorders that affect the senses!

Suggested Learning Outcomes:

- To present neurological disorders that were examined by older members.
- To identify clinical signs from case scenarios associated with neurological disorders.

Suggested Roll Call Questions:

- What is one of the best things you have learned in this club?
- Can you name a neurological disorder or a way you can impair one of your senses?
- Pick a sense. How can an impairment to that sense affect an animal?

SAMPLE MEETING AGENDA

Time: 1 hour 45 minutes

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	10 minutes
Senior Member Project Presentations	Outline A Disease	30-60 minutes
Topic Information, Discussion	Neurological Impairments And Disorders	15 minutes
Activities Related To Topic	Activity #1 - Identify The Cause!	10 minutes
Wrap Up, Social Time And Adjournment		20 minutes

Senior Member Project - Outline A Disease

Do	<p>Time: 30-60 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Materials for the presentation <p>Instructions:</p> <p>In this activity, senior members picked a disease affecting the nervous system, researched it and now will present it at this meeting.</p> <p>Presentations can be any medium of the members choosing but should be age appropriate and geared towards younger members so that way they can learn complex materials from their peers.</p> <p>Get members to present their projects.</p>
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to examine diseases and syndromes that affect the nervous system.</p>
Apply	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• Was there anything surprising that you learned about the diseases?• How might you use this information in the future?

Neurological Diseases And Disorders

The next pages outline some of the neurological diseases, and disorders that are relevant to the field of veterinary medicine. Some of these conditions might have been covered by the members as their senior members' project, however, details are provided to give all members a background. This background will be needed for the next activity where members will be presented with cases and asked if they can identify the cause.

The terms disease and disorder are commonly used in veterinary medicine but so are clinical sign and syndrome!

Define It!

What is the difference between the term's clinical signs, syndrome, disorders and disease? A clinical sign is the first things we notice (changes in the animal or subject), a syndrome is a group of clinical signs that occur together, a disorder is characterized by a functional impairment and a disruption from normal (usually used when there is not enough evidence to confirm a disease), and a disease is distinct and measurable.

What is Rabies?

BACKGROUND

Rabies is a disease caused by a virus that can infect any warm-blooded animal. Skunks and foxes are the two most common carriers. The disease is transmitted through the saliva of an infected animal. The virus enters the body through an area of damaged skin. This could be a bite, wound, scratch, or any other open injury. The virus then travels along nerve tissue, peripheral nerves and the spinal cord to the brain. This means that the closer the wound is to the brain, the less time the disease takes to reach the brain.

This process can take anywhere from a few days to a few months, but 80% of infected animals will show the signs of rabies and die within 2 weeks of infection.

WHAT ARE THE SIGNS OF RABIES?

Animals can show different clinical signs of rabies. In fact, rabies can show up in one of two general ways.

1. Furious Rabies - The animal shows unpredictable and aggressive behavior. It may thrash about. It may attack anyone or anything. These signs are probably what you think of when you hear the word rabies.
2. Dumb Rabies - The animal is inactive, listless, and quiet. It might appear paralyzed. This is not what most people think a rabid animal would look like, but it is just as dangerous. Do not approach a wild animal acting cute and quiet. This animal is not acting normally.

IDENTIFICATION

Farm animals and pets that have rabies may show any of the following signs:

- Drooling saliva
- Aggressive behavior
- Lameness
- Restlessness
- Uncoordinated or Jerky movements
- Bellowing
- Straining to pass manure

PREVENTION

1. Vaccinate your dog and cat regularly for rabies.
2. In some areas, farm managers have their livestock vaccinated.
3. Talk to your veterinarian if you suspect one of your animals has been exposed to an animal with rabies.
4. Human vaccine is available for those at risk (veterinarians, shelter workers).

What Is Tetanus?

BACKGROUND

Tetanus is a disease that is often fatal, and it is caused by a bacterium called, *Clostridium tetani*. Tetanus is not contagious. It can infect all animals, but humans, horses and sheep are most at risk. Tetanus bacteria are commonly present in the soil. They infect cuts and wounds and produce a powerful toxin or poison that causes rigidity and spasmodic contraction of the voluntary muscles.

An infected animal becomes stiff in the muscles. Walking is more and more difficult. The jaw “locks” into position. (This is why tetanus is called lockjaw.) The tail may be rigid. Eventually, the animal dies because it cannot breathe. Rigid backward extension of the legs is a typical tetanus clinical sign.

PREVENTION

1. Cleaning all wounds well will reduce the risk of tetanus.
2. Humans and horses, including foals, should be routinely vaccinated.
3. Castration (removal of the testicles) and docking (cutting tail) of animals should be done as cleanly as possible, with sterilized instruments.
4. Use of disinfectants.

Spinal Cord Disorders

Type of Disorder	Animal	Description	Prevention
Meningitis	All Animals	Often develops in association with viral or bacterial disease, or due to head injury. An inflammation of the membranes covering the brain and spinal cord. Absolute quiet and professional treatment is required.	Prompt treatment of generalized bacterial infections.
Epilepsy	Dogs	A nervous disorder with sudden loss of consciousness and muscular convulsions. Causes include trauma, infection, heart disease. Some epilepsy is congenital (dog is born with the disease).	There is no prevention. Treatment with drugs is often successful in controlling the disease.
Listeriosis (Circling disease)	Farm Animals, Rodents, Dogs, Humans	A bacterial infection that causes abscess of the brainstem, and abortion in cattle. Signs may look like some of rabies. Infection is spread by urine, milk, feces and contaminated tissue. Can be found in feed.	Keep diseased animal away. Dispose of aborted fetus immediately. Disinfect areas where diseased animal was kept, if possible. (Not practical on livestock farms.) Often found in silage, so management of silage is important. Also seen in goats and very susceptible when being fed silage.
Hydrocephalus	Horse, Dog, Cow, Humans	Large amount of fluid collects in brain cavity. Often present before birth, and animal is stillborn. Can occur after meningitis.	There is no prevention. If meningitis is the cause, fluid may be drawn out.
Warbles	Cattle	A small fly larva causes inflammation around the spinal cord. Cattle become uncoordinated and eventually can't get up.	Administer an insecticide to the animal before Dec. 1. This kills the larva within the animal before it has a chance to migrate to the spinal cord.
Wobbler Syndrome	Horses and Large Dogs	Because of an instability in the vertebral column, affected animals have pressure on their spinal cord in the neck. This causes the animal to become uncoordinated.	There is no prevention. They may be born with a predisposition to this problem.
Getting Hit by Cars	All Animals	A common cause of spinal cord injury.	Supervise your pets.
Intervertebral Disc Disease	Dogs	This is common in older, overweight, short legged dogs. It is also found in humans. The soft material between the bones in the backbone ages and pushes up onto the spinal cord. Medical treatment and often surgery is needed. Many animals do not recover and become paralyzed.	Don't over feed your pet. Basset Hounds, Dachshunds and Lhasa Apso are often susceptible. Jumping or falling off chairs or beds is a cause.

Activity #1 - Identify The Cause!

<h1>Do</h1>	<p>Time: 10 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Case provided with this activity <p>Instructions:</p> <p>This activity is best done with a vet who might have specific cases that they might be able to provide that this book does not.</p> <p>Discuss the cases and go over the questions to figure out a diagnosis. There are three cases, each one can take up to 10 minutes but due to the variable length of the senior member project, only one might be possible.</p> <p>Case 1:</p> <p>A dog presents to your veterinary clinic by a concerned owner Sandy. The dog has been losing consciousness suddenly and having muscular convulsions. The dog has had this problem ever since they were young but the owners have noted a higher frequency of this behavior since the dog lost consciousness and tumbled down the stairs.</p> <p>Case 2:</p> <p>Your 15 lb, 8 year old Dachshund seems in pain when she walks up the stairs. Her right hind leg is dragging on the ground and her hind end seems uncoordinated.</p> <p>Case 3:</p> <p>Your friend's cattle appear uncoordinated and some of the cattle seem like they are unable to get up.</p> <p>Case 4:</p> <p>Your dog brings in a fox carcass from the outside, you are unsure about what your dog has received for vaccines and when it received its last.</p>
<h1>Reflect</h1>	<p>Learning Outcomes:</p> <p>The objective of this activity is to review cases and identify potential diagnosis for the cases based on the neurological disorders you noted previously.</p>
<h1>Apply</h1>	<p>Discuss The Following Prompts As a Group:</p> <p>Case 1:</p> <ul style="list-style-type: none">• What are the clinical signs of the dog?• When did it start? (since it was young but has gotten worse since trauma)• What is the likely cause? (epilepsy)• Are there any preventative measures that can be taken? <p>Case 2:</p> <ul style="list-style-type: none">• What are the clinical signs of the dog?• What is the likely cause? (Intervertebral Disc Disease)• Are there any preventative measures that can be taken? (yes, do not overfeed).

Apply

Discuss The Following Prompts As a Group:

Case 3:

- What are the clinical signs of the cattle?
- What is the likely cause? (Warbles)
- Are there any preventative measures that can be taken? (yes, administer an insecticide to the animal before December 1st.).

Case 4

- What are the clinical signs of the dog? (none yet)
- What is a potential problem with this scenario? (unknown vaccination status and rabies potential)
- Are there any preventative measures that can be taken? (yes, ensure vaccination and avoid distance from potential rabies sources).



Musculoskeletal, Teeth, Antlers, Horns and Hooves

Meeting 1 - Providing Structure And Support

Setting Objectives:

To identify the role of bones and explore different types of bones throughout the body.

Suggested Learning Outcomes:

- To identify the various structural components of bones.
- To introduce the names of common bones.
- To explore radiographs and how they contribute to diagnostics in animal health.

Suggested Roll Call Questions:

- Why are bones so important?
- Name a bone and point to the location in which it is located on your body.
- Have you ever had a broken bone? How was it treated?

SAMPLE MEETING AGENDA

Time: 2 hours 15 minutes

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	10-15 minutes
Topic Information, Discussion	Form And Function Of Bones	15 minutes
Activities Related To Topic	Activity #1 - Hollow Strength	20 minutes
Activities Related To Topic	Activity #2 - Guess That Bone!	20 minutes
Topic Information, Discussion	Introduction To Bone Injury And Radiography	15 minutes
Activities Related To Topic	Activity #3 - Broken Bones	25 minutes
Wrap Up, Social Time And Adjournment		10 minutes

Form And Function Of Bones

Bones are involved in the support and the protection of the organs of the body. In addition to providing structure for the body, bones are also involved in the storage of many types of minerals, producing blood cells and allowing the body to move in conjunction with the muscles. Bones are made up of dense connective tissue, blood vessels, nerves, epithelium, and bone marrow. Bone tissue can either be compact/cortical, or spongy/cancellous. Typically, the compact bone is what is found on the outside of the bone and spongy bone is found on the inside of the bone.

Bones are:

- Living and always changing
- Can die if severely injured
- Provide a support framework for the body
- Protect the internal organs like the heart, lungs, etc.

A Body's Frame - The Skeleton

The skeleton provides an animal's structure. It is made up of two components: **Cartilage and Bones**.

- **Cartilage** is very firm tissue, similar to bone, but not as hard. It is gristly and flexible. Cartilage is associated with the joint surfaces of the bones.
- **Bones** are made of compact and spongy layers of living tissue. The compact layer contains nerves and blood vessels and provides strength and rigidity to the outside of the bone. The spongy layer allows the bone to be flexible and resilient, lessening the danger of fractures. Bones are designed to provide structure and to protect vital organs including the stomach, lungs, and heart. However, a bone may die if it is severely injured. There are four types of bones:
 - o Long
 - o Flat
 - o Short
 - o Irregular

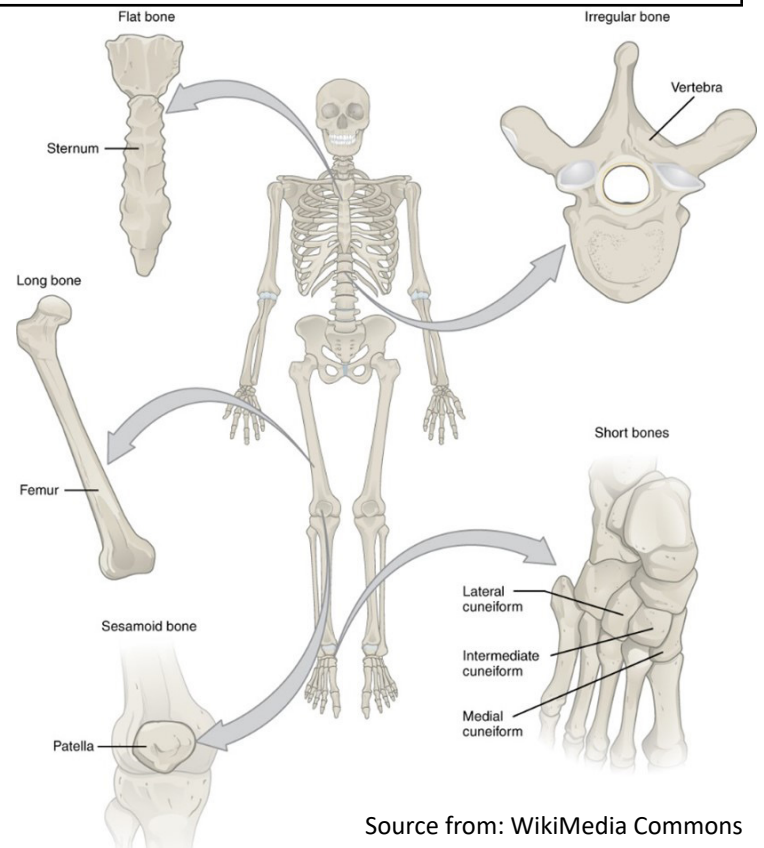


Type of Bones	Description																
Long	<ul style="list-style-type: none"> Contains central cavity filled with red and white blood cell-producing marrow. At the end of each bone, before maturity, is a growth plate made of cartilage from which the bones form. At maturity the plate's function ends and it turns into bone. Some cartilage does not turn into bone; it functions as the discs of bone joints throughout the animal's life. (eg. Discs in the back of human). 																
	<table border="1"> <thead> <tr> <th>Part of Bone</th> <th>Function</th> </tr> </thead> <tbody> <tr> <td>Epiphysis</td> <td>End of a long bone</td> </tr> <tr> <td>Diaphysis</td> <td>Middle or shaft of long bone</td> </tr> <tr> <td>Articular Cartilage</td> <td>Surface of joints where bones meet. Degenerates in joint diseases</td> </tr> <tr> <td>Compact</td> <td>Hard Layer</td> </tr> <tr> <td>Marrow Cavity</td> <td>Contains soft cell producing marrow</td> </tr> <tr> <td>Periosteum</td> <td>Cell membrane lining on the surface of the bone; very sensitive</td> </tr> <tr> <td>Endosteum</td> <td>Lining between hard and spongy bone, very sensitive</td> </tr> </tbody> </table>	Part of Bone	Function	Epiphysis	End of a long bone	Diaphysis	Middle or shaft of long bone	Articular Cartilage	Surface of joints where bones meet. Degenerates in joint diseases	Compact	Hard Layer	Marrow Cavity	Contains soft cell producing marrow	Periosteum	Cell membrane lining on the surface of the bone; very sensitive	Endosteum	Lining between hard and spongy bone, very sensitive
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Endosteum	Lining between hard and spongy bone, very sensitive																
Flat	Found in the ribs, sternum, and scapula.																
Short	<ul style="list-style-type: none"> Also known as Sesamoid bones. Small and rounded in shape. Found at points of friction, such as the patella in front of the knee or the stifle. Also found in the back of the hand, in the wrist and ankle. 																
Irregular	Found in the vertebrae, clavicle and skull																

DID YOU KNOW?



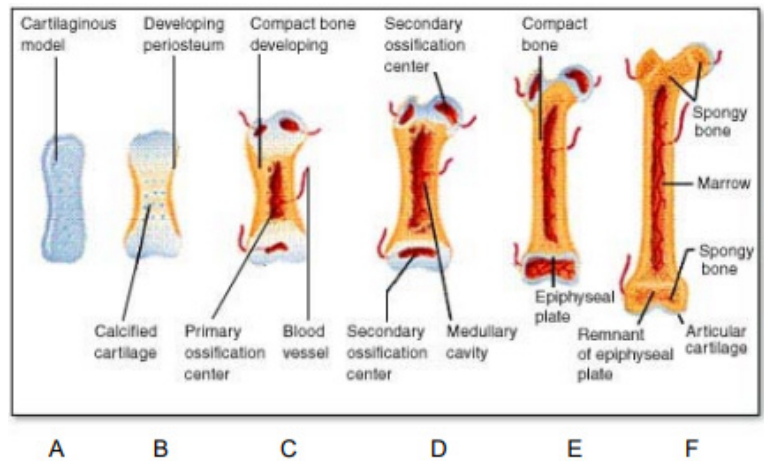
The study of bones is termed Osteology, from the Latin, "oste" meaning bones and "ology" meaning the study of.



Source from: WikiMedia Commons

How Do Bones Grow?

- The cartilage stage of bone formation
- Spongy bone begins to emerge
- An epiphysis appears at each end of the bone
- Marrow cavity appears
- Articular cartilage forms at ends of the bone
- Bone at birth compared to adult size



This chart compares the medical names for bones to the more common names that you are familiar with:

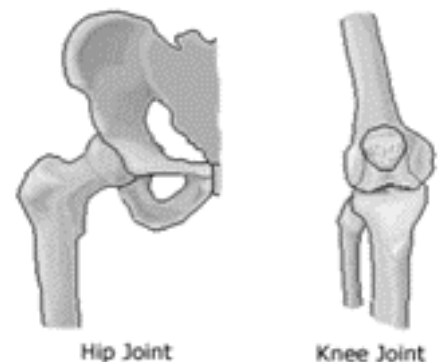
Medical	Common
Digit	Toe/Finger
Metacarpal/Metatarsal	Hand/Foot
Carpal/Tarsal	Wrist/Ankle
Radius/Ulna	Forearm
Tibia/Fibula	Lower leg
Patella	Kneecap
Scapula	Shoulder blade
Cervical bones	Neck
Vertebrae	Backbone
Humerus	Upper arm
Femur	Upper leg

Joints

Joints are the meeting places between the bones and can be fibrous, elastic, or cartilage tissue. They are separated into three classes:

- Immovable joints, such as those in the skull;
- Movable joints, for example the elbow and knee joints; and
- Partially movable joints, such as those in the vertebrae.

The majority of joints are movable. They allow free movement between the bone ends. Smooth cartilage covers both bone ends providing a slippery surface and easy movements. Inside the joint there is synovial fluid that greases the joint.



This is produced by the synovial membrane of the joint capsule. Ligaments connect bone to bone and are made of strong tissue, providing support to the movable joint.

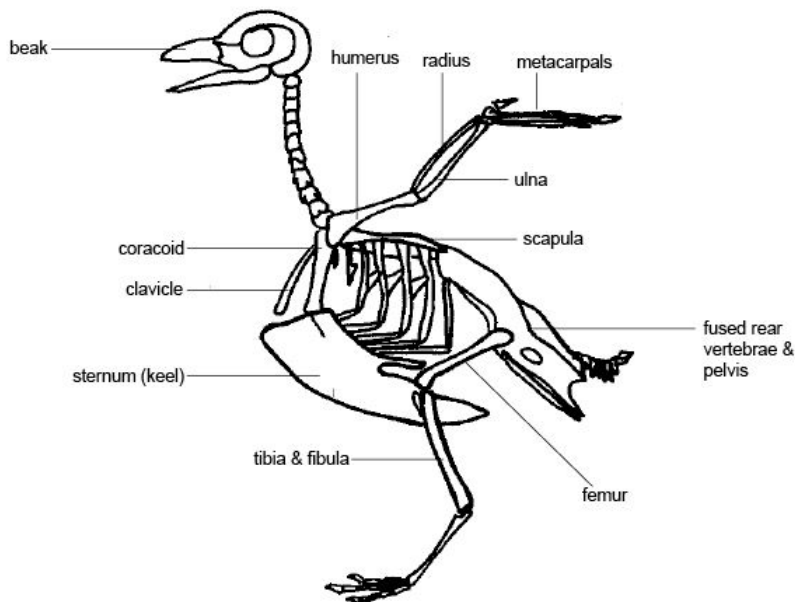
Birds' Skeletons Are Different!

The bird's skeleton is different from that of mammals for one very important reason: It can fly. In order to do so, the forelimbs become wings powered by strong breast muscles. Mammals however have strong muscles in their arms and forelegs.

Bird's bones are very light. Air sacs replace bone marrow in many limb bones and also in parts of the skull, spine, and pelvis.

Strength and rigidity in a bird's skeleton are made possible by the joining of bones. With mammals, it is in the mineral or hard part of the bones. This joined or fusion occurs in the skull, pelvis, wings and leg bones.

- The carpals and metacarpals are joined together in wings called carpometacarpus
- The joining of the tibia and tarsals in the legs is called tibiotarsus
- Joining of the tarsal bone and metatarsals is tarsometatarsus
- Chickens have many fused vertebrae to give rigidity to the body in flight and to allow the bird to walk upright on two legs. The strength of a mammal's back is due to a jointed backbone and its attached muscles.
- Birds have a cloaca, almost like a soft pelvic opening, to ease the passage of eggs.



Source from: https://en.wikibooks.org/wiki/Anatomy_and_Physiology_of_Animals/The_Skeleton

DID YOU KNOW?



The dog skeleton is made up of about 250 bones plus cartilage. A cat skeleton is made up of about 230 bones plus cartilage.

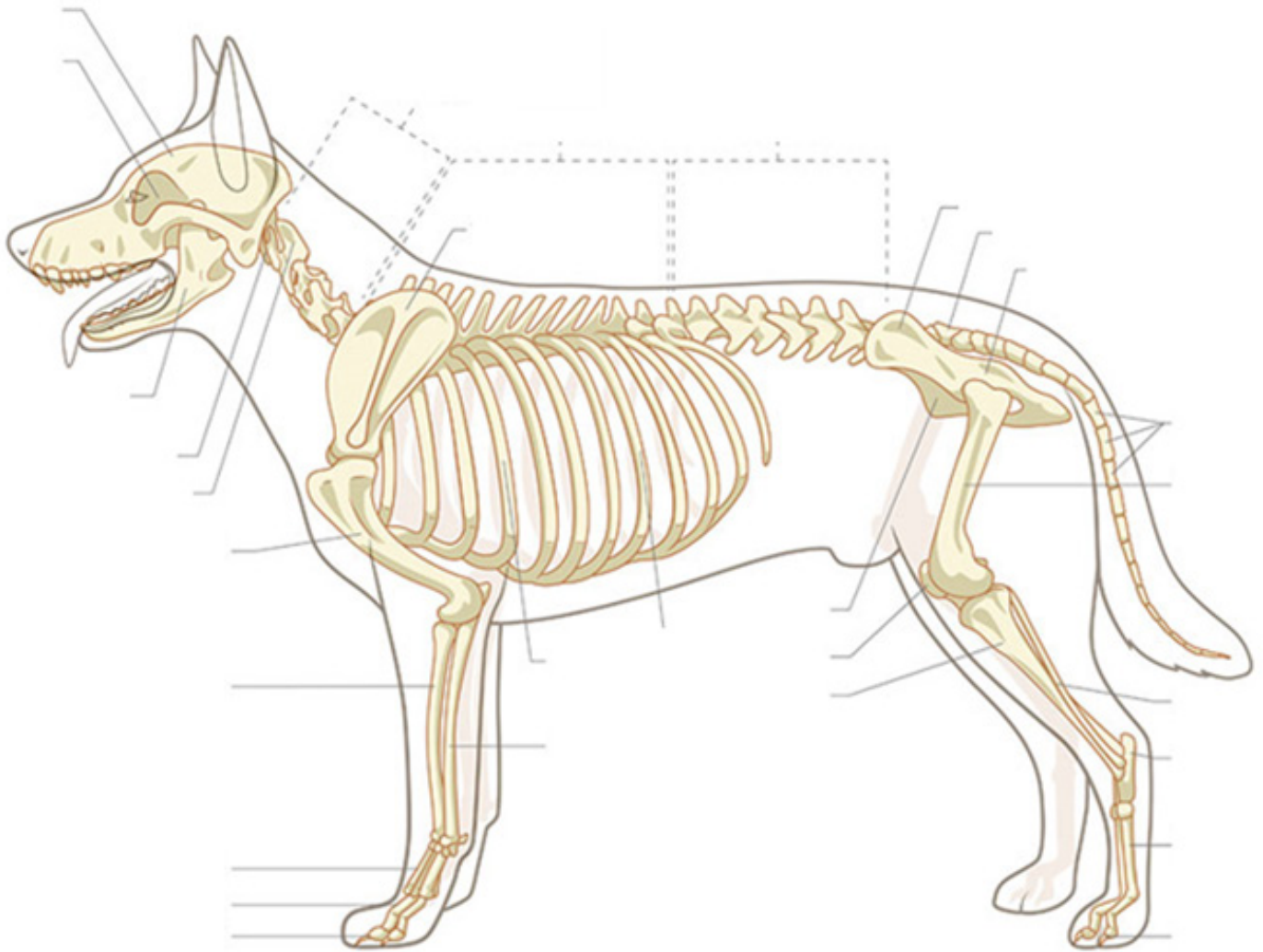
Activity #1 - Hollow Strength

Do	<p>Time: 20 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Paper• Tape• Scissors• Paper plates• Measuring cups• Weights (blocks – small) <p>Instructions:</p> <ol style="list-style-type: none">1. Provide members with a sheet of paper (8.5' x 11') and ask them to cut it horizontally into three equal pieces.2. Roll each sheet into a cylinder (1 inch or 2.5 centimeters in diameter) and fasten it with tape.3. Stand the rolls on their ends, placing a paper plate on top of the bones.4. Begin to add weights (wooden blocks) to the plate.5. Count how many blocks the plate can hold before it collapses.6. Roll 3 more sheets of paper as tightly as they can (no hollow space in the centre)7. Stand these “bones” on their ends as before placing the same plate on top of them.8. Load bricks onto the plate until the bones collapse.
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to show members that the hollow bones are able to support more weight before collapsing. This emphasizes that the large bones in animals are hollow, thereby allowing them to be strong and carry a lot of weight. Hollow bones are also lighter than solid bones, therefore requiring less energy to move them.</p>
Apply	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• What worked well in this activity?• What did you notice about the hollow bones?• What is one disadvantage about hollow bones?

Activity #2 - Guess That Bone!

Do	<p>Time: 20 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Bones of the Dog Worksheet (blank) printed for every member• One copy of Bones of the Dog Worksheet (Answer Key) <p>Instructions:</p> <ol style="list-style-type: none">1. Give each member a copy of the Bones of the Dog worksheet. Encourage members to work together on completing it.2. Use the Answer Key if any member becomes stuck.
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is go over the basic anatomy and nomenclature of the bones in a canine skeleton.</p>
Apply	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• What was the most difficult bone to identify?• Can you identify a pattern in naming some of the bones?

Bones of the Dog



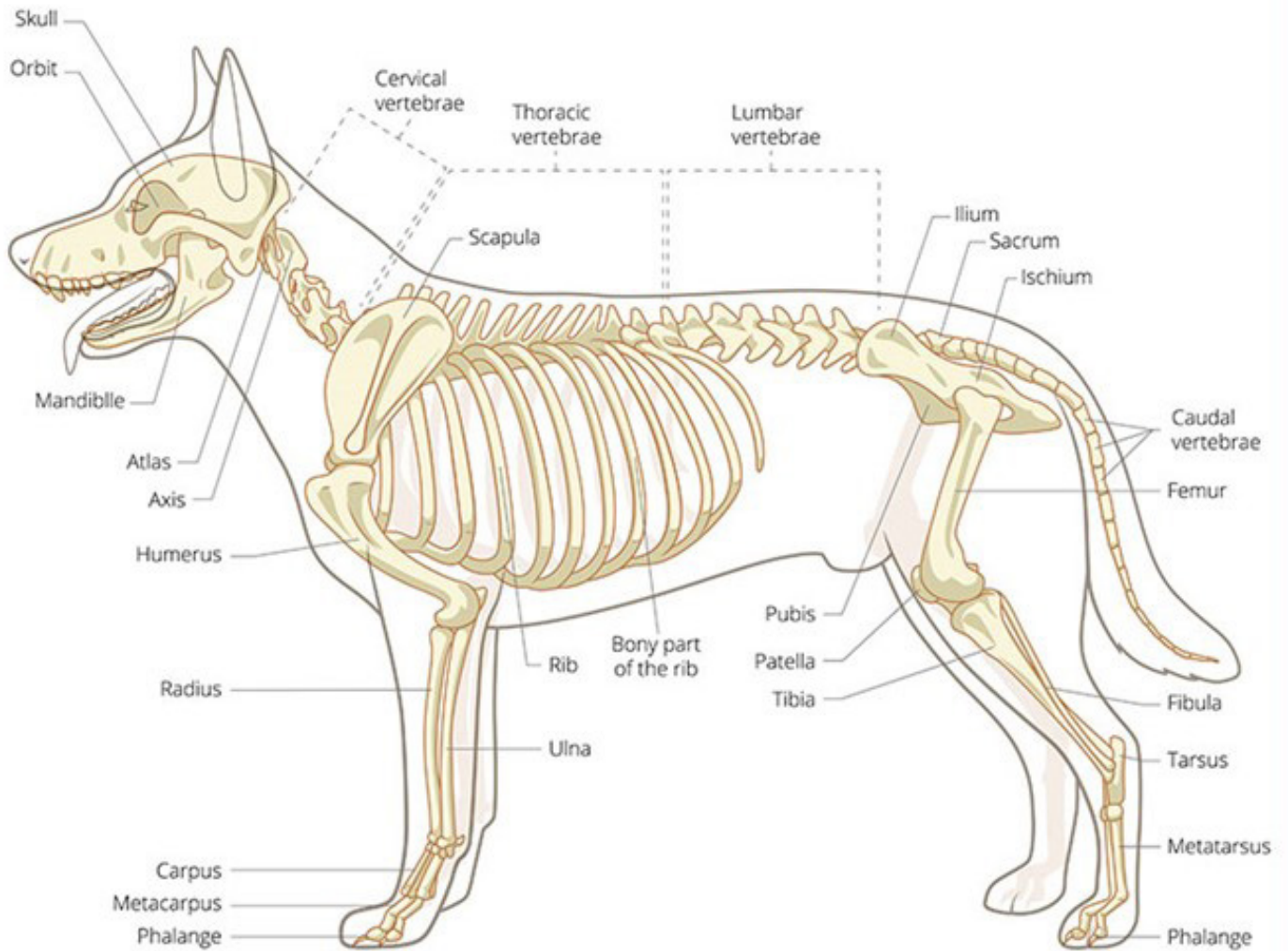
Phalange
 Carpus
 Tarsus
 Skull
 Skull
 Orbit
 Mandible
 Atlas

Axis
 Humerus Radius
 Metacarpus
 Ulna
 Radius
 Rib
 Bony part of rib
 Scapula

Cervical vertebrae
 Thoracic
 vertebrae
 Lumbar
 vertebrae
 Ilium
 Sacrum
 Ischium
 Caudal vertebrae

Femur
 Pubis
 Metatarsus
 Tarsus
 Tibia
 Patella
 Fibula

Bones of the Dog



Introduction To Bone Injury And Radiography

The Bones “Disease Guide”

A bone injury may result in two types of fractures:

1. A **CLOSED** fracture occurs when the skin is not broken. The bone may or may not be broken all the way through
2. An **OPEN** fracture occurs when the bone is broken off and punctures the skin. This is the most serious type of fracture.

There are four common methods of treating fractures:

1. **Casting.** The veterinarian places the bones where they belong. A stocking is placed over the limb. Then Plaster of Paris is applied in layers. As this dries it becomes very hard. The use of fibreglass in animal medicine instead of Plaster of Paris is increasing because it is water-resistant and lightweight. It is commonly used on lower legs and on all types of animals.
2. **Splinting.** The veterinarian places the bones where they should be, then places metal or wood beside the bone on each side for support. Everything is wrapped tightly enough to prevent slipping of the supports. It is commonly used on hand, wrist, ankle and foot injuries.
3. **Pinning.** This method requires surgery. A pin is placed through the long bone lengthways and secured in place. This can be removed after the bone has healed or can be left. It is commonly used for hip and upper leg fractures.
4. **Plating.** This also requires surgery. A metal plate resembling a hinge is attached to both broken ends of the bone, pressure is applied to make ends meet, and the plates are screwed in place. It is commonly used on small animals for hip and upper leg fractures.

Long or leg bone fractures on animals over 270 kg (600 lbs):

- Generally not treated
- Weight of the animal puts too much pressure on the leg bones
- Cattle -cannot ship animals with a broken leg based on regulatory and welfare requirements.
- Treated gently and moved as little as possible
- Check with your veterinarian to make sure the animal can be shipped humanely
- Expensive race horses –surgery -no guarantee that the animal will be able to race again
- Arthroscopic surgery is now more commonly used

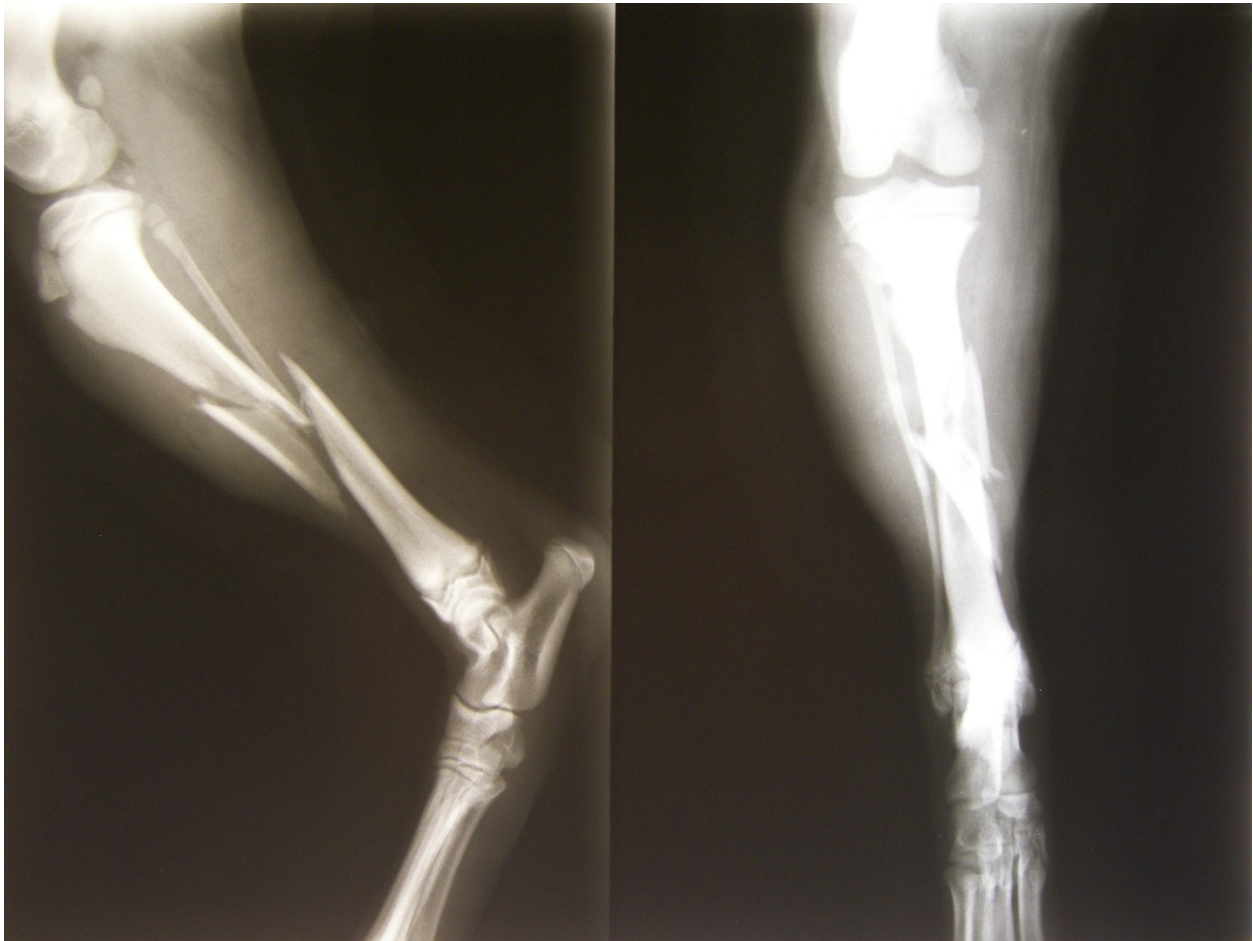
Skeletal Diseases

Disorder	Cause	Effect	Treatment	Recovery
Osteomyelitis (os-teo-my-elitis)	Bacterial infection of bone and bone marrow. Often occurs after a fracture with bone penetrating the skin.	Often the animal may be lame. Can lead to infectious arthritis or septicemia (blood poisoning)	Antibiotics - very difficult to treat.	Incomplete in most cases.
Atrophic Rhinitis (A-tro-fic Rinitis)	At least two bacteria together. A disease of swine.	Nasal turbinate bones become damaged - visible twisting of snout. Sneezing and coughing.	Vaccine for prevention - use non-infected breeding stock, use strict management and sanitation practices. Good ventilation is an asset. No treatment.	Cannot reverse the damage - not fatal but reduces animals' rate of gain.
Lumpy Jaw [One type of osteomyelitis (#1)]	Caused by a bacteria - Actinomycesbovis - affects cattle and is infectious.	Jaw bone swells and may ooze a yellow discharge.	Antibiotic treatment can be effective if the lump is not too large. Intravenous iodine is another treatment. A vaccine is available.	If Antibiotic treatment is not successful, the animal is sent to market for salvage.
Cartilage or Bone Tumours	Not known.	May be enlarged joints or tumour right on the bone - very painful.	Hard to treat - not practical in farm livestock.	No recovery - euthanasia.
Splints	A weakening of the front leg bone - usually in young horses. Caused by hard training, poor conformation or malnutrition.	Lameness, heat, pain and swelling.	Hot and cold treatments, cortisone and rest. Surgery for horses.	Full recovery usually expected if adequate rest is given.
Sprains	Torn ligaments in the joint.	Painful movement	Rest to repair the ligaments. Casts sometimes applied.	Variable - can be full.
Degenerative Arthritis	Wear and tear on the cartilage.	Inflamed joint - painful to walk.	Antibiotics. Vaccine may be used depending on cause.	Nil - euthanasia in severe cases.
Infectious Arthritis	Can be caused by a penetrating wound, infected navel - where bacteria, fungi, mycoplasma or virus enters the bloodstream. i.e. Caprine Arthritis Encephelitis Virus (in goats).	Joint is very swollen - destroys the joint by making the surfaces rough.	Antibiotics. Vaccine may be used depending on cause.	Usually, full recovery or can lead to osteomyelitis.
Ringbone	Excessive wear and tear - usually in horses.	Increase of calcium deposits in the leg - painful.	No treatment - corrective shoeing may help.	Variable.

Radiographs

Radiographs are an image that is created by use of x-rays. X-rays were first discovered in the late 18th century by Wilhelm Roentgen and have been used as a way to visualize the bones and other structures of humans and animals ever since. X-rays are essentially created by passing waves of electrons between a positive and negative electrode.

When the waves bounce off the animal (based on the density of the structure we are looking at), that is how the radiograph is created. Essentially, when more waves of electrons bounce off (e.g. bones), this creates a white colour. When electrons pass right through with less dense structures (e.g. air), this creates a black colour. In combination, veterinarians are able to visual internal structures of animals (e.g., broken bones, foreign bodies, etc.) with minimal impact to the patient.



Tibia and Fibula fracture in a dog.

Source from: Wikimedia Commons https://commons.wikimedia.org/wiki/File:Fracture_tibia%2Bfibula_r%C3%A9duite.jpg

Activity #3 - Broken Bones

Do	<p>Time: 25 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• None <p>Instructions:</p> <ol style="list-style-type: none">1. Ideally, this activity would be done with the help of a veterinarian or during a visit to a veterinary clinic.2. The veterinarian can discuss ways to read and interpret radiographs.3. The vet can also discuss options and if it is an older age group, the costs associated with each option.
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to discuss what can be done to cast broken bones.</p>
Apply	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• What are some of the challenges with broken bones?• Are any difficult to deal with?

Meeting 2 - Providing Strength And Coverage

Setting Objectives:

To identify the role of muscles in different animals.

Suggested Learning Outcomes:

- To identify the various types and structural components of muscles.
- To introduce the names of common muscle groups.
- To identify common ailments effecting muscles.

Suggested Roll Call Questions:

- Name a muscle disease or disorder and describe its effect on the animal.
- Name your favourite meat and identify which animal it comes from.
- Name a fact you know about muscles.

SAMPLE MEETING AGENDA

Time: 2 hours 15 minutes

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	10-15 minutes
Topic Information, Discussion	Form, Structure And Function Of Muscles	15 minutes
Topic Information, Discussion	Muscle Groups	10 minutes
Activities Related To Topic	Activity #1 - Pin The Group On The...	20 minutes
Topic Information, Discussion	Integument And Suturing	15 minutes
Activities Related To Topic	Activity #2 - Give It A Go!	20 minutes
Topic Information, Discussion	Myopathies Of Muscles	15 minutes
Wrap Up, Social Time And Adjournment		10 minutes

Form And Function Of Muscles

The muscular system is the prominent and extensive feature of an animal's anatomy. Muscles are responsible for allowing the body to experience movement. Muscles are also valuable economically because they are the major element of meat.

There are three muscle groups:

1. Striated or skeletal muscles, the largest group of muscles, are found along long bones, joints and the skull. They are attached to the bones by tendons. Tendons are strong and flexible. They can concentrate the muscle's action onto a small area. Striated muscles in the mouth and esophagus are not attached to bones. Striated muscles allow the body to move and they protect the organs (i.e. stomach and liver).
2. Smooth muscles are found in the lining of the intestines, blood vessels, organs and reproductive tract.
3. Cardiac muscle is found only in the heart.

DID YOU KNOW?



The study of muscles is called mycology, from the Latin "my" meaning muscles and "ology" meaning study of.

Striated Muscle

There are two types of striated muscle fibre:

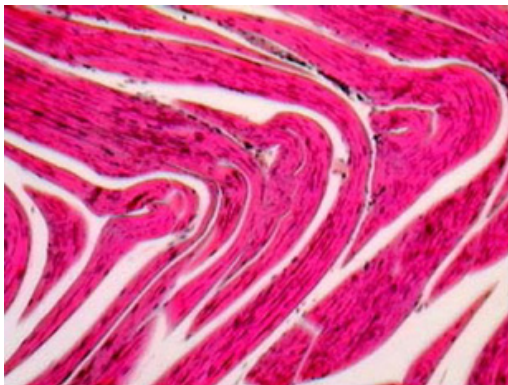
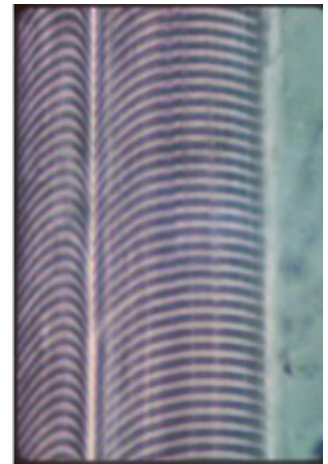
- Red and white.

Both types are found in each muscle. The red muscle fibres perform continuous work and are more resistant to fatigue. The white muscle fibres are used for quick spurts of movement.

The ratio of red to white fibres varies with each type and species of animal and is different in each muscle within the same species. It has been found however, that quarter horses tend to have a high percentage of white fibres than thoroughbreds. This is because their training (short runs, quick turns) demands a greater number of "quick" fibres.

Skeletal muscles are voluntary. This means that they are controlled by conscious thought such that you need to "think" before you move your arm.

The limb muscles are arranged in matching pairs; each muscle has its opposite. The extensor and flexor muscles are examples. These muscles help stabilize the joint as well as create movement.



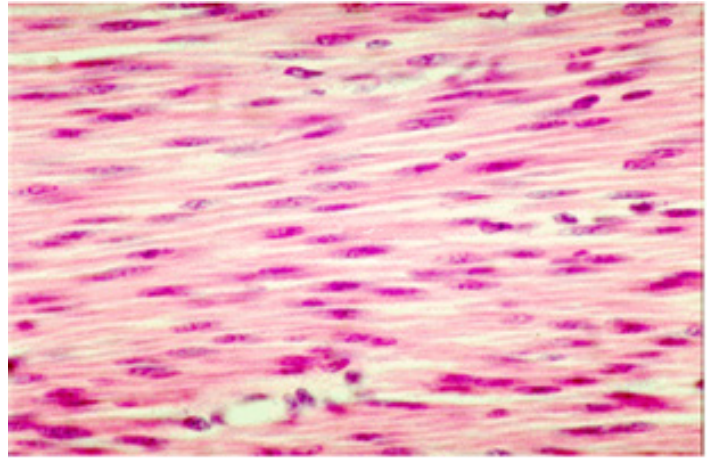
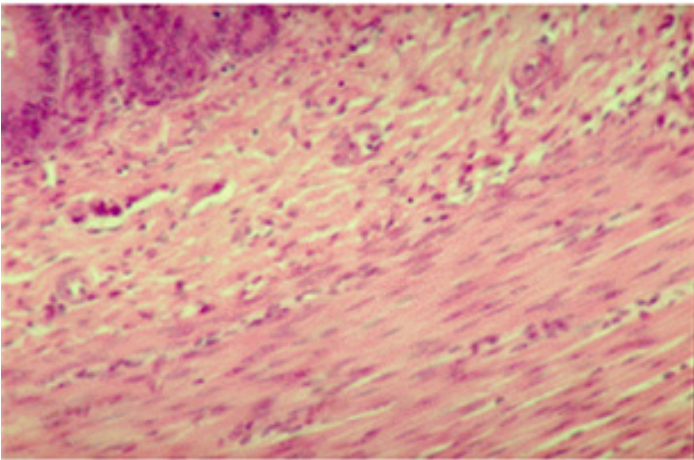
Seen from the side under the microscope, skeletal muscle fibers show a pattern of cross banding, which gives rise to the other name: striated muscle.

Striated muscle in a frog's leg showing the red and white fibers

Smooth Muscles

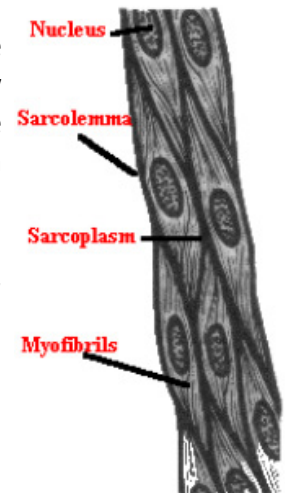
Smooth muscles are white to pinkish in colour. They are involuntary muscles, which mean that they are controlled by the brain independently of conscious thought. Therefore you do not need to "think" before using these muscles. There are two types of smooth muscles:

1. **Visceral** - found in the stomach, intestine, urinary tract, and genital systems. These usually perform a generalized function on an entire organ.
2. **Multi-unit** - found in eye muscles, walls of blood vessels and around the alveoli of the lungs. These perform more specific functions than visceral muscle.



The slide shown on the left is a section of the small intestine showing smooth muscle in the lower right and dense irregular connective tissue in the upper left. Note how the smooth muscle forms neat, parallel lines, whereas the dense irregular connective tissue is more wavy and less organized. The slide on the right is a close up the smooth muscle seen on the left.

Smooth muscle features long, narrow "spindle" shaped cells with a single central, somewhat elongated, nucleus. These cells are arranged parallel to one another in situ and do not show any striations microscopically.



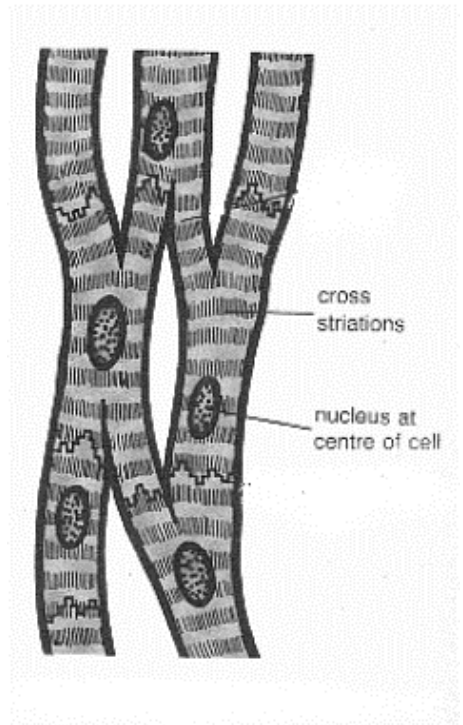
Cardiac Muscles

Cardiac muscle is involuntary striated muscle. The heart has two sides, right and left. Each side has an atrium, a thin-walled area which collects returning blood from large veins, and a ventricle, which pumps blood from the heart by a large artery. Between the atrium and the ventricle of each side is the atrioventricular valve (A-V valve). This has cusps (flaps) which are attached to the ventricle by chordae tendineae. These resemble strings on a parachute. The cusps prevent the blood from flowing back to the atria instead of into the ventricle. There are also two semilunar valves, pulmonary and aortic, which prevent the blood from flowing back to the ventricles which is going to the lungs or the rest of the body. It is only the action of the muscles of the heart which force the blood to all parts of the body.

The cardiac muscle has some qualities of both striated and smooth muscles. The heart is capable of functioning independently because the heart has its own nerve supply and starts its own beat. It is the only muscle that can do this. The heart can be removed from an animal and continue to beat if kept in a solution that supplies nourishment.

Smaller animals have faster heart rates than larger animals. A young animal will have a faster heart rate than a mature animal because in general the heart rate increases as the size of the animal decreases.

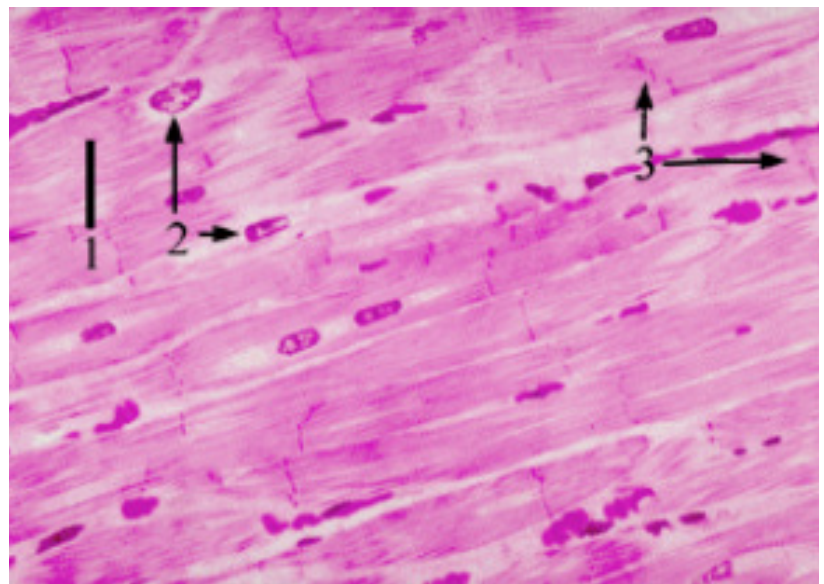
Cardiac muscle is unique in that it shows some features of skeletal muscle and some features of smooth muscle. As the name implies, cardiac muscle is the muscle that makes up the wall of the heart. Cardiac muscle is similar to skeletal muscle in that it is striated and multinucleate, and similar to smooth muscle in that the nuclei are centrally located and many cells are required to span the length of the muscle. It differs from both skeletal muscle and smooth muscle in that its cells branch and are joined to one another via intercalated discs. Intercalated discs allow communication between the cells such that there is a sequential contraction of the cells from the bottom of the ventricle to the top, facilitating maximal ejection of blood from the ventricle during contraction. This occurs without nervous innervation to each cell or group of cells. Cardiac muscle also differs from the other two muscle types in that contraction can occur even without an initial nervous input. The cells that produce the stimulation for contraction without nervous input are called the pacemaker cells.



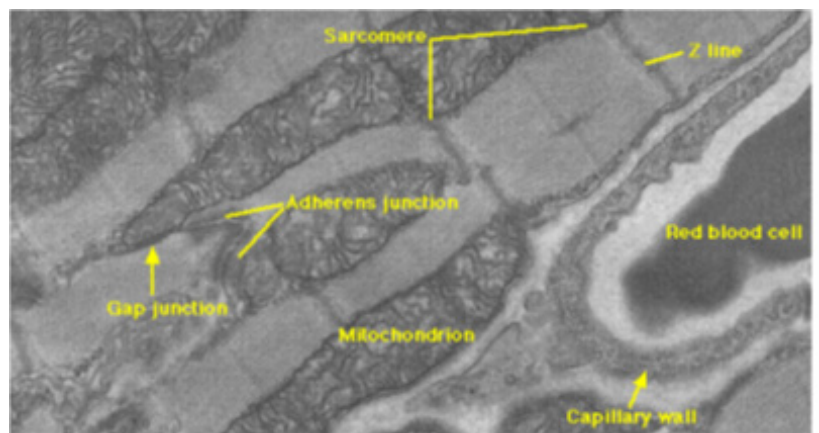
Cardiac or heart muscle resembles skeletal muscle in some ways: it is striated and each cell contains sarcomeres with sliding filaments of actin and myosin.

However, cardiac muscle has a number of unique features that reflect its function of pumping blood.

- The myofibrils of each cell (and cardiac muscle is made of single cells — each with a single nucleus) are branched.
- The branches interlock with those of adjacent fibers by adherens junctions. These strong junctions enable the heart to contract forcefully without ripping the fibers apart.



1. Cardiac Muscle Cell 2. Nuclei 3. Intercalated Discs



The following chart compares heart weights and heart rates for different species.

Animal	Heart Rate (beats/min)	Mature Heart Weight
Cow	60 - 70	2-4 kg
Sheep	60 - 120	220 - 240 g
Horse	23 - 70	3-5 kg
Pig	55 - 86	450 g
Dog (30 Kg)	100-130	200 - 400 g
Dog (10 Kg)	100-130	60 - 130 g
Cat (5 Kg)	110 - 140	20 - 40 g
Budgie	250 - 450	2 - 5 g
Owl	600 - 700	50 g
Mouse	324 - 858	2 - 5 g
Human (70 Kg)	58 - 104	1 kg

Link It!

The skeletal muscle is the major source of meat, making up 35-65% of carcass weight. The tenderness of meat depends upon the amount and type of connective tissue it contains (cartilage, bone & tendon), and is a reflection of the fat content. As a muscle is exercised, extensive connective tissue develops around the muscle, causing the meat to become firmer. As an animal ages, its muscles naturally become tougher, simply through prolonged use. Substantial muscle toughening in beef animals becomes more evident at about 30 months of age.

Muscle Groups

When investigating the anatomy of an animal, the muscles can be broadly grouped into categories:

1. Head and neck
2. Forelimb
3. Thorax
4. Abdomen
5. Pelvis and Perineum
6. Hindlimbs

Activity #1 - Pin The Group On The...

Do	<p>Time: 25 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Muscles of the Dog worksheet <p>Instructions:</p> <ol style="list-style-type: none">1. This activity is meant to identify the different muscle groups. Divide the members into smaller groups, preferable with a senior member in each group to be able to assist younger members. Have the groups label the worksheet with the labels. Then have the members label 3 muscles within the broad groups. Encourage members to try this first without any resources. If they are struggling, they may use the internet or other resources.
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to begin to explore the muscle anatomy of canines (which can broadly be applied across veterinary species).</p>
Apply	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• What are some of the easy muscles you were able to identify? Show where these muscles may be located on yourself.• What is the name of the strangest muscle you encountered?

Muscles Of The Dog Worksheet



Muscles Of The Dog - ANSWER KEY

Head and Neck

- Brachiocephalicus
- Omotransversarius
- Sternocephalicus
- Serratus ventralis
- Splenius
- Longissimus capitis
- Longissimus atlantis
- Longus colli
- Masseter
- Temporalis
- Digastric
- Platysma
- Caninus
- Buccinator
- Etc.

Thorax

- Diaphragm
- Cutaneous trunci
- Trapezius
- Rhomboideus
- Latissimus dorsi
- Serratus ventralis
- Pectoralis
- Intercostal (external and internal)
- Transversus thoracis
- Etc.

Pelvis and Perineum

- Middle gluteal
- Superficial gluteal
- Levator ani
- Coccygeus
- Iliopsoas
- Etc.

Abdomen

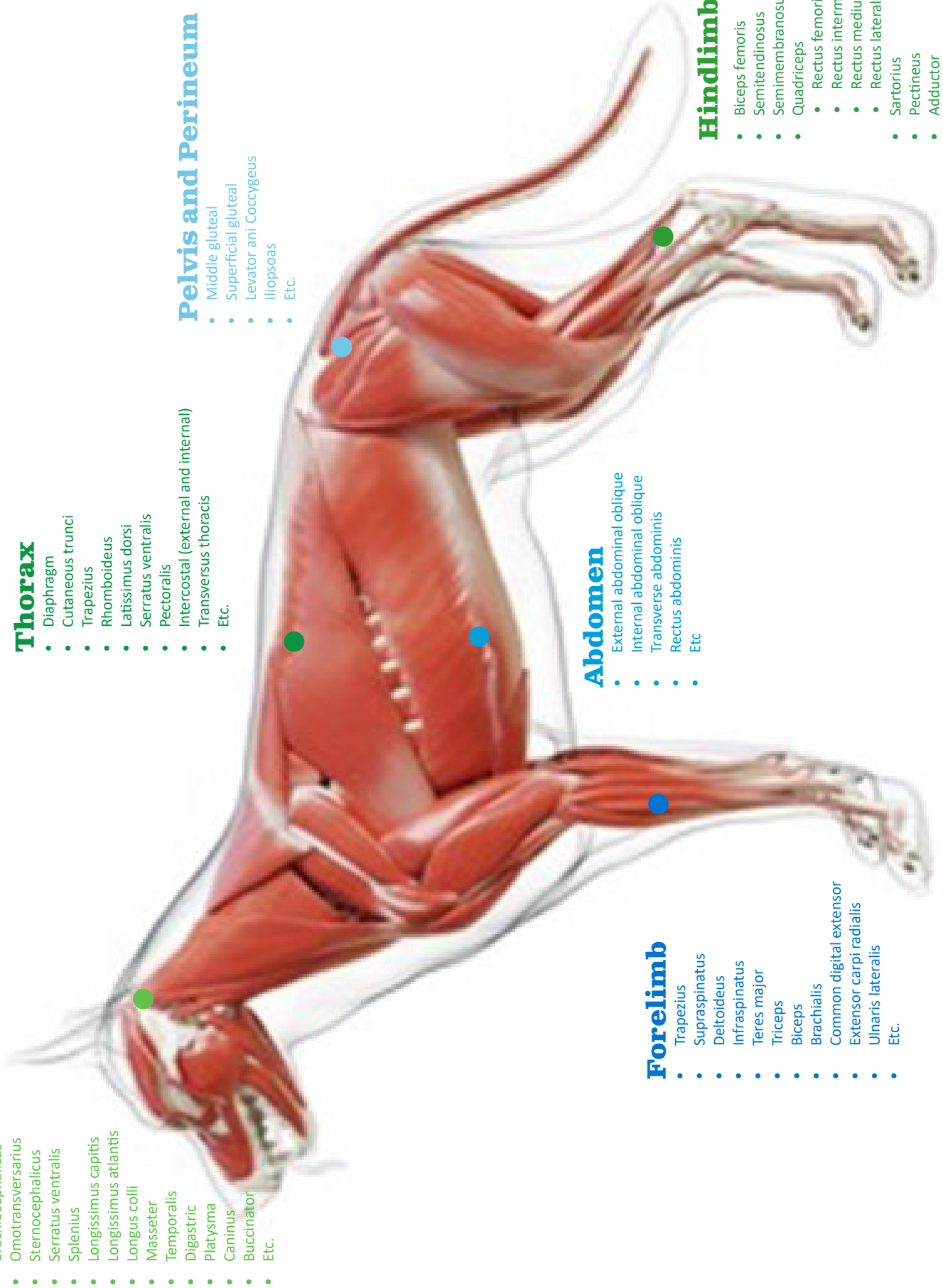
- External abdominal oblique
- Internal abdominal oblique
- Transverse abdominis
- Rectus abdominis
- Etc.

Forelimb

- Trapezius
- Supraspinatus
- Deltoideus
- Infraspinatus
- Teres major
- Triceps
- Biceps
- Brachialis
- Common digital extensor
- Extensor carpi radialis
- Ulnaris lateralis
- Etc.

Hindlimb

- Biceps femoris
- Semitendinosus
- Semimembranosus
- Quadriceps
- Rectus femoris
- Rectus intermedius
- Rectus medius
- Rectus lateralis
- Sartorius
- Pectineus
- Adductor
- Gracilis
- Gastrocnemius
- Etc.



Integument And Suturing

The skin is the body's largest organ. While in animals, most of the skin is covered in fur, feathers, scales or other structures, it is vital to the survival of the animal. The integument is the skin and the accessory structures responsible for protecting the body's internal organs. It is composed of several layers:

Epidermis

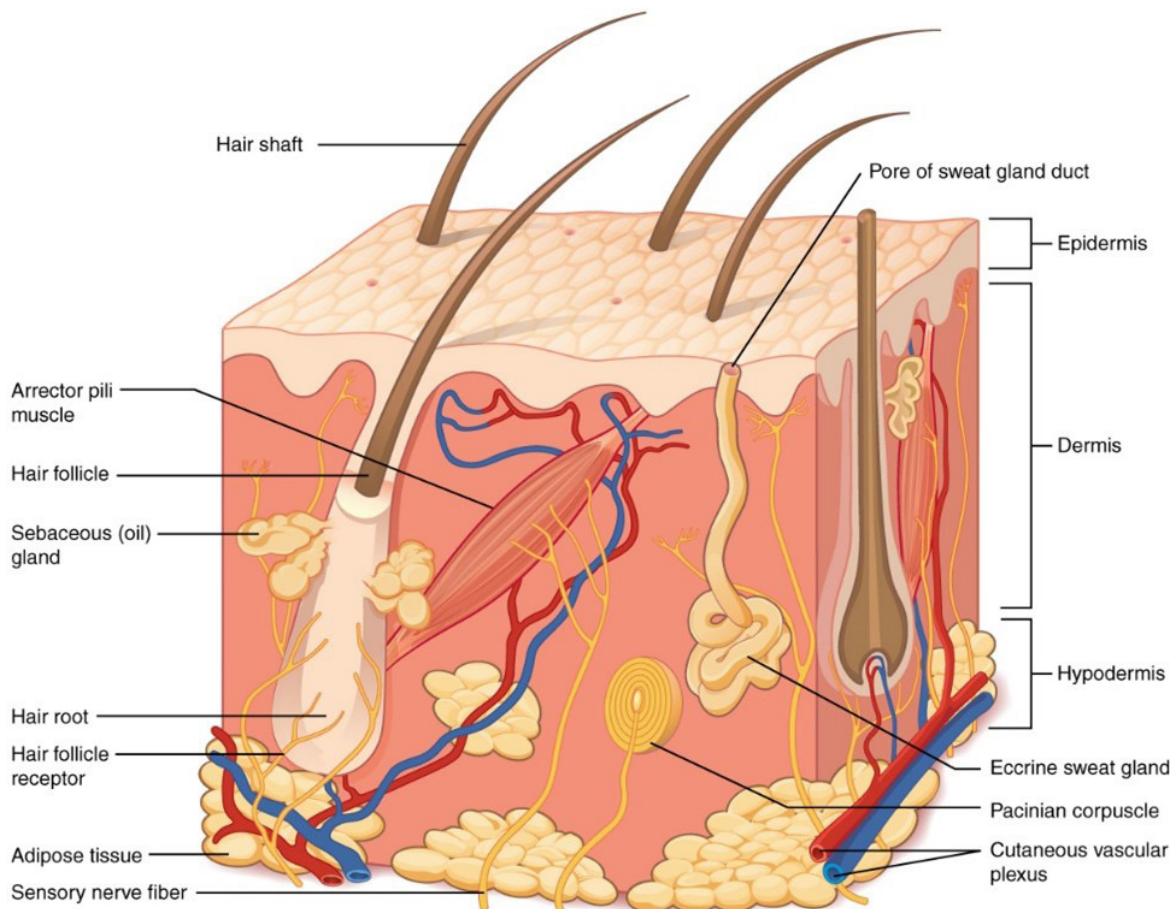
The epidermis is keratinized stratified squamous epithelium. It lacks blood vessels. It acts as an immediate barrier to abrasion and pathogens. It has many layers of cells and sloughs off regularly, being replaced continuously. It is the layer that is closest to the outside world. The epidermis has many layers within it including (from deepest to superficial): stratum basale, stratum spinosum, stratum granulosum, stratum lucidum, and stratum corneum.

Dermis

This layer is composed of blood vessels, nerves, lymphatic vessels, sweat glands and hair follicles. It has 2 primary layers: Papillary and reticular.

Hypodermis

The hypodermis is also well vascularized and is the place where most of the fat is stored in the skin layers. This fat serves as an energy reservoir and as a protection pad against trauma.



Source from: Wikimedia Commons https://commons.wikimedia.org/wiki/File:501_Structure_of_the_skin.jpg

Suturing

When there is a deep fresh cut or laceration through the layers of the skin (either traumatic or purposefully during surgery), the skin must be sutured back together. One consideration when suturing is the type of suture material that will be used. The choice is between non-absorbable and absorbable suture. Non-absorbable suture material is a material that retains its full strength for longer than 60 days. Absorbable material is material that loses most of its integrity within that 60-day period. Depending on what body structure is being sutured (e.g. internal organ versus outer layer of skin), different suture material will be used. This ensures that the closed wound stays closed and that the bodily structure has adequate time to heal.

Suture material is also different sizes. This again will be selected on the basis of the bodily structure being sutured. Generally, the size of the suture material is directly related to the strength. However, the body of the animal will also react more adversely to these suture materials.

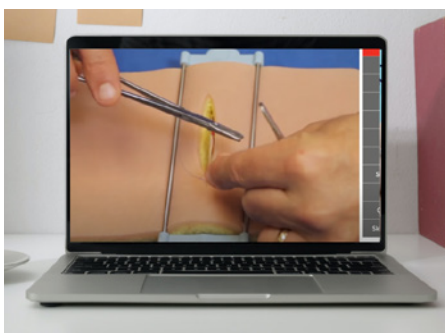
There are many suture patterns that can be used. This is again dependant on the structure that is being sutured. Generally, an apposing (or direct place next to each other) pattern is used for structures such as intestine or on the skin. Everting or inverting patterns may also be used less frequently.

The different suture patterns are often best learned by watch and then try techniques. Below are a few YouTube links that show suture patterns in detail. Give these a try!



Simple interrupted suture (wound suturing) - OSCE Guide

<https://www.youtube.com/watch?v=z8oWv-nVO6g>



Suture Techniques Course Video

<https://www.youtube.com/watch?v=Akyr4zIBS9E>



How To Suture: Intro To Suturing Like a Surgeon

<https://www.youtube.com/watch?v=NnKdmjX5pWU>

Activity #2 - Give It A Go!

Do	<p>Time: 20 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Suturing Materials (needles, suture, subjects or objects) or YouTube Videos <p>Instructions:</p> <ol style="list-style-type: none">1. Ideally this activity would be done with the help of a veterinarian or during a visit to a veterinary clinic. Otherwise, activities involving cardboard boxes or bananas can be done to go over this activity.2. The veterinarian can discuss ways to suture which are also outlined in the topic information. Reasons for each type of suture can also be explored.
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to discuss what can be done to cast broken bones.</p>
Apply	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• What are some key aspects to remember when suturing?• Why is a sterile environment important when suturing?• How can veterinarians promote healing?

Myopathies Of Muscles

Injuries to bones, joints, ligaments, tendons, and nerves may all cause atrophy and impaired function of the muscles. Injury to muscle may cause inflammation, degeneration, atrophy or muscle death. The following table outlines a few of those problems (myopathies) that occur with muscles:

PROBLEM	CAUSE	TREATMENT	RECOVERY
Disuse Atrophy	Because of pain or injury, the muscle is not used and deteriorates.	Exercise.	May be slow but full recovery possible.
Loss of Nerve Conduction	A severed or damaged nerve blocks messages from the brain. It becomes impossible to command a muscle to move.	If minimal damage - rest. If severe - no treatment.	None to full recovery depending on severity.
Destruction of Muscle Structure	Crushing, bruising or tearing of the muscle causes deterioration.	Rest.	Full.
Ischemia	Loss of blood supply to the muscle because flow is cut off. A foot "going to sleep" is an example.	None.	None to full recovery depending on the damage.
Excessive Exercise	Too much exercise can rob muscles of fuel (starch, glucose), causing muscle tissue to break down.	Rest and drink fluids.	Full.
Strains	Over- stretched or overexerted part of musculature.	Pain and painful to move.	Rest - prevent by avoiding over-exertion.
"Classical Azoturia" or "Tying Up" or "Monday Morning" Disease - usually in horses	Animal is fed too much then exercised too much, especially after a prolonged rest period.	Severe pain - muscle breakdown - can lead to kidney failure. Urine is dark red.	Provide lots of fluids, light, exercise, electrolytes, intramuscular treatments.
Myositis i.e. Blackleg in cattle	Inflamed muscles - bacterial, viral or trauma, etc.	A bacteria in the soil produces a toxic gas that becomes trapped in the muscles, resulting in pain, swelling and loss of function.	None. Blackleg - prevention is vaccine. Not all myositis have a vaccine available.
Vitamin E and Selenium Deficiency	Nutritional deficiency found most often in well-muscled, fast-growing cattle, pigs, sheep, and horses.	Muscles degenerate. May also affect heart.	Injections with Vitamin E and Selenium.
Porcine Stress Syndrome (PSS)	Stress-induced condition - hereditary, halothane test used on live animals to see if carrier.	The muscles very rapidly degenerate until the animal dies. Muscle breakdown in the carcass - makes it unfit for human consumption. Happens to swine - carcass is condemned.	No treatment - prevent by using PSS free breeding stock.
Monensin Toxicity	Additive at low levels to sheep, cattle and poultry feed. Is toxic to horses and dogs if ingested.	Muscles degenerate. May cause lameness or sudden death.	None - use extreme care in handling and mixing feeds.

There are also a few terms that are used almost exclusively with dogs which are outlined below:

Hydrocephalus (Hydro-sef-a-lus)	Occurs in short-nosed dogs. An enlarged skull. Condition is rare but tends to occur in Pugs and Pekinese.
Brachycephalic (Brack-sef-a-lick)	Short face, bulging forehead - causes restricted breathing in short-nosed dogs such as the Pug and Bulldog.
Tumours (localized swelling) (specific types)	Tend to be hereditary. High incidence in Boxers and Boston Terriers.
Osteochondrosis (Ost-ee-o-chond-o-sis)	Occurs in fast-growing dogs such as the Irish Wolfhound, resulting in very sore joints.
Hip dysplasia (dis-place-ee-ah)	Abnormal bones in the hip. Found in St. Bernards, Newfoundlands, and German Shepherds. Animal tends to drag hind legs and it is painful to walk. Unsteady walk.
Dystocia (Dies-tok-ia) (Pelvis is too small or fetus is too large)	Difficulty giving birth. Occurs in small dogs with large heads such as Bulldog, Yorkshire and Boston Terriers.
Heart Ailments	Abnormal valve development in the heart. Newfoundlands, Golden Retriever and Rottweiler are susceptible.

Meeting 3 - Chompin' At The Bit!

Setting Objectives:

To identify the role of teeth in digestion and structure.

Suggested Learning Outcomes:

- To identify the importance of teeth for animals.
- To identify the difference in teeth structure for different species.
- To identify the need for teeth surgery by veterinarians.

Suggested Roll Call Questions:

- Have you ever had a cavity? How was it treated?
- Why is it important to visit the dentist regularly?
- List one thing you do to take care of your teeth or your animal(s)'s teeth.

SAMPLE MEETING AGENDA

Time: 2 hours 10 minutes

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	10-15 minutes
Topic Information, Discussion	Introduction To Teeth!	20 minutes
Activities Related To Topic	Activity #1 - Abattoir Investigation	1 hour
	OR	
Activities Related To Topic	Activity #2 - Importance Of Dental Care	1 hour
	OR	
Activities Related To Topic	Activity #3 - Form And Purpose	1 hour
Topic Information, Discussion	Problems with Teeth!	10 minutes
Wrap Up, Social Time And Adjournment		10 minutes

Introduction To Teeth!

As with humans, animals have two sets of teeth. The first ones are temporary “baby” or “milk” teeth. They are softer and fewer in number than the permanent teeth.

There are three classes of teeth and their purposes are:

1. Incisors – cutting
2. Canine – tearing or seizing
3. Molars and premolars – grinding or shearing

Different animals have different sizes and number of these teeth which are useful for their specific diet. This topic will be covered later but different species also have different teeth come in at different times and replaced by others at certain times:

Dog	<ul style="list-style-type: none">• No teeth at birth• From 3-6 months permanent incisors appear• From 6-7 months all permanent teeth are in
Bovine (Cow)	<ul style="list-style-type: none">• Central incisors are in at birth or by 2 weeks• At 2 weeks all temporary teeth are in• The permanent teeth appear slowly, starting at 6 months and ending at 4 years
Horse	<ul style="list-style-type: none">• Baby teeth appear between birth and 9 months• Permanent teeth appear between 6 months and 5 years
Goat/Sheep	<ul style="list-style-type: none">• First temporary incisors appear at 1-7 days• By 6 weeks all temporary teeth are in• Permanent teeth appear at 4 years of age
Pig	<ul style="list-style-type: none">• Canine teeth are present at birth• These “needles” teeth are removed to prevent injury to the sow• By 4 weeks almost all temporary teeth are in. At 20 months

Estimating Age From Teeth!

You can often estimate the age of the animal by the number and type of teeth present. For example, in the sheep, one pair of permanent front teeth should come in each year from one to four years. Therefore, you can estimate the age of the animal by the number of permanent teeth that it has. From then on only an estimate of the age is possible from the mouth.

Veterinary Dentists???

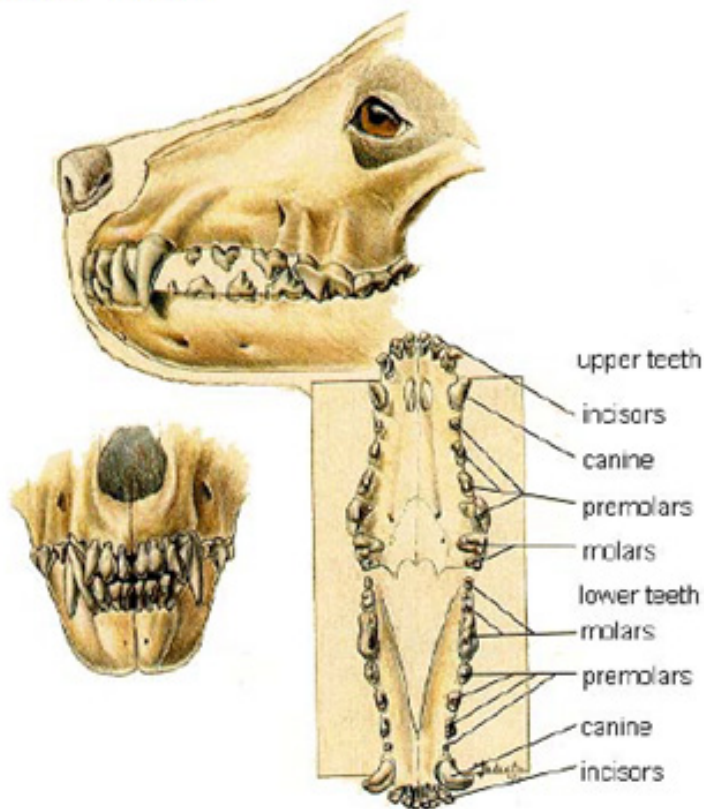
Teeth are necessary for animals to eat, and an animal must eat properly to maintain good health. Like humans, animals can develop plaque build-ups, cavities, periodontitis and gingivitis. Plaque is the major cause of periodontitis and gingivitis and if left untreated both can lead to systemic infection (i.e. infection that travels through the bloodstream). Dental care is available through a veterinarian.

Bad breath, medically known as “halitosis”, results from the bacterial infection of the gums causing periodontal disease. In rare cases, some diseases or situations can cause bad breath in the absence of, or in addition to, tooth/gum disease. Conditions such as kidney failure, diabetes, nasal or facial skin infections, cancers, or situations where the animal is ingesting feces or other materials, can cause bad breath with or without periodontal disease.

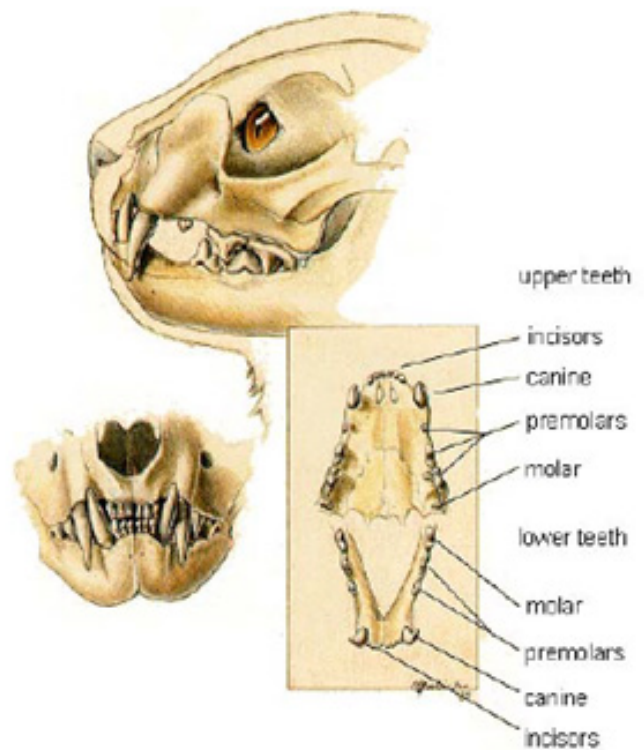
Both plaque and tartar can damage the teeth and gums. Disease starts with the gums –they become inflamed (red, swollen, and sore). The gums finally separate from the teeth, creating pockets where more bacteria, plaque and tartar build up. This in turn causes more damage, and finally it causes tooth and bone loss.

This affects the whole body too. Bacteria from these inflamed oral areas can enter the bloodstream and affect major body organs. The liver, kidneys, heart and lungs are most commonly affected. Antibiotics are used prior to and after dental cleaning to prevent bacterial spread through the blood stream

DOG TEETH

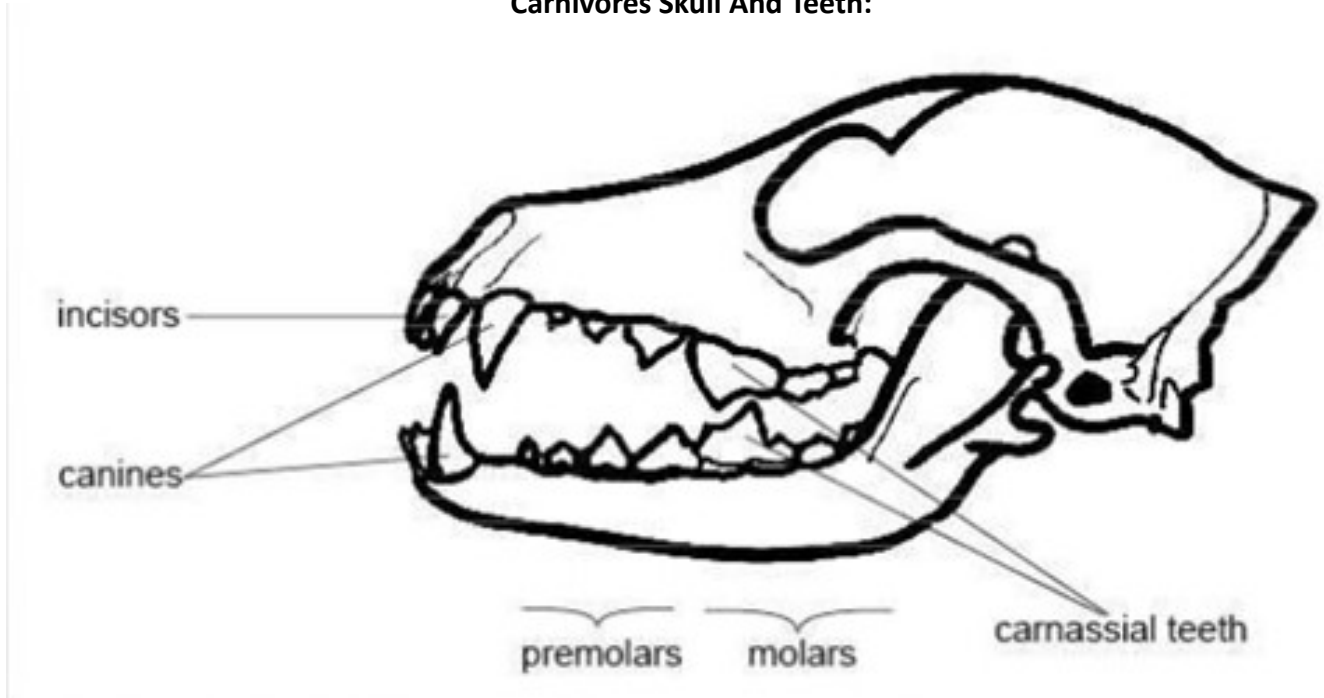


CAT TEETH

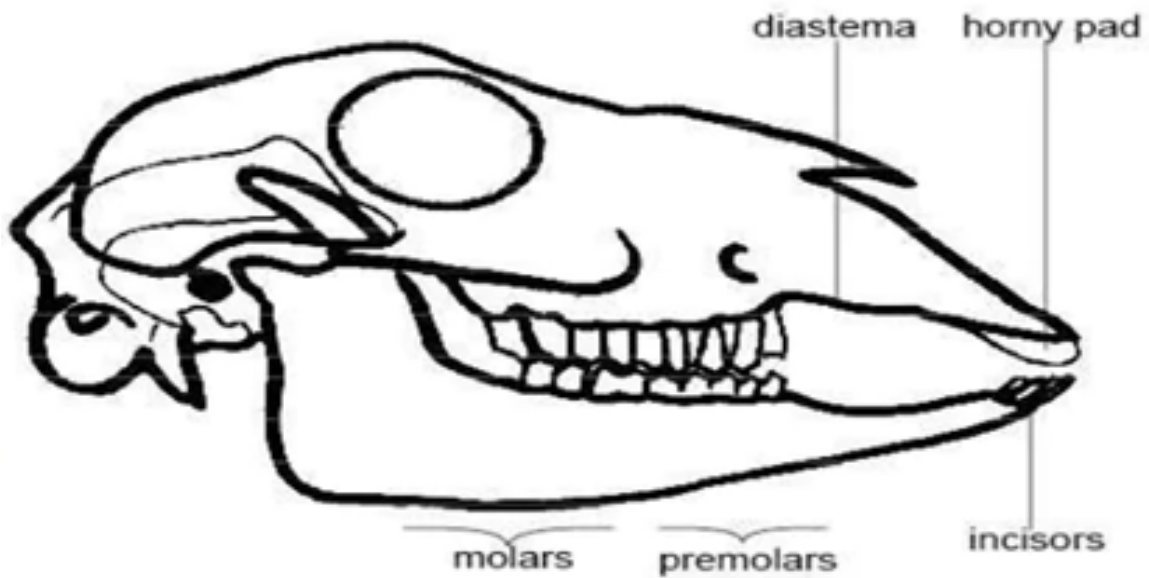


The following is some of the morphological differences between species:

Carnivores Skull And Teeth:



Herbivores Skull And Teeth:



Omnivores are like yourself; they are a mix between both herbivores and omnivores and have similar features to both above.

Activity #1 - Abattoir Investigation

Do	<p>Time: 1 hour</p> <p>Materials:</p> <ul style="list-style-type: none">• None <p>Instructions:</p> <ol style="list-style-type: none">1. Go to an abattoir and see if they can show you the difference between the ages of different animals. For example a lot of meat packaging plants tell the age of an animal by looking at the teeth and the workers or managers may be able to show the group how the process is done.2. A full tour of the plant can also be a part of this meeting.
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to identify how age of animals can be identified through specimens.</p>
Apply	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• What are some key aspects to look for when assessing age?• Based on the information provided in the previous topic information section, how else might you assess age?

Activity #2 - Importance Of Dental Care

Do	<p>Time: 1 hour</p> <p>Materials:</p> <ul style="list-style-type: none">• None <p>Instructions:</p> <ol style="list-style-type: none">1. Have a video chat or go to a vet that specializes in veterinary dentistry.2. Get the vet to explain how important proper dental care is to your animals well being.3. Ideally, get the vet to go over the tools that they use to treat dental problems in pets and how these relate to human dentistry.
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to identify the importance of veterinary dentistry.</p>
Apply	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• How similar is human and animal dentistry?• Why is veterinary dentistry one of the most common procedures (most popular surgeries)?• What can we do to promote good dental health?

Activity #3 - Form And Purpose

Do	<p>Time: 1 hour</p> <p>Materials:</p> <ul style="list-style-type: none">• Teeth and potentially jaws from various species. <p>Instructions:</p> <ol style="list-style-type: none">1. Find different teeth of various species (a vet might have some teeth that they could lend you) and compare them. Pay attention to the size, the shape and how they wear.2. Identify the differences between form and structure and hypothesize why these teeth might be structured the way that they are.3. Get youth to hypothesize why this might be.
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to identify the importance of different jaw sizes, teeth structures and overall composition for the purpose of that specific species.</p>
Apply	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• What is the structure you hypothesized for herbivores?• For carnivores?• For omnivores?• Did any structures surprise you? Might they be important for ripping or tearing or grinding?

Problems With Teeth

The following is a list of some of the common problems associated with teeth.

Problem	Cause	Effect	Treatment	Recovery
Losing several teeth, often sheep and goats "broken mouth"	Old age.	Difficulty eating and subsequent weight loss likely.	None.	None.
Abscessed tooth	Trauma. Usually found in older animals. Bacteria enters the tooth.	The centre of tooth is open - should be closed, foreign material i.e. feed gets stuck, and infected.	Pull tooth, drain abscess, flush with antibiotics.	Full.
Periodontis Gingivitis	Usually bacterial following trauma (i.e. animal in a vehicle accident).	Inflammation around base of tooth. Gingivitis - inflammation of gums.	Scrape plaque from teeth, antibiotics, special mouthwash.	Full.

Meeting 4 - Hooves, Paws And Claws!

Setting Objectives:

To identify the differences between the different structures and functions of hooves paws and claws.

Suggested Learning Outcomes:

- To identify the structure and parts of hoofs, paws and claws.
- To identify the role of these structures.

Suggested Roll Call Questions:

- Research a component of a hoof, claw or paw and state the name and purpose for the club?

SAMPLE MEETING AGENDA

Time: 1 hour 40 minutes

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	10-15 minutes
Topic Information, Discussion	Hooves, Paws And Claws	15 minutes
Activities Related To Topic	Activity #1 - Trimming Those Nails	30 minutes
	OR	
Activities Related To Topic	Activity #2 - Increasing The Scale	30 minutes
	AND	
Topic Information, Discussion	Problems, Problems, Problems!	15 minutes
Wrap Up, Social Time And Adjournment		10 minutes

Hooves, Paws And Claws

Hooves are like toenails. The hoof is insensitive, but it has nerves and blood vessels immediately below it. If you drop a book on your toenail, it is not the nail that senses the pain but the tissue underneath.

Movement is essential to the natural wearing down of hooves. For example, cattle should have their hooves trimmed 1 - 2 times per year. Cattle will naturally wear down their hooves if on rough hard ground or concrete. Cattle on a soft manure pack will need hoof trimming more often. Dogs should have their toenails trimmed about once every month or two.

Keeping hooves clean is important to prevent diseases. Providing a clean and safe environment helps to protect the hooves. These measures and good management help to prevent foot rot, osteomyelitis, laminitis and splints.

The horse has a single hoof; the cow has a cloven hoof; the pig has a cloven hoof with large dew claws; and the dog has a padded foot with nails. The following are diagrams of different hooves.



Cow Hoof



Pig Hoof



Horse Hoof

These differences exist because animals have had to adapt to their environment. The horse evolved to have a single hoof as it changed from living in the forest to living on grasslands. Cattle and pigs with cloven hooves have a greater ability to withstand rugged terrain. Dogs and cats, being predators, developed pads for quiet movement and nails for better traction.

Controversial Conversations

Although scratching is a common and normal behaviour in cats, some owners might feel the need to prevent this behaviour through other means. One of these methods is through declawing (or onychectomy).

The Canadian Veterinary Medical Association (CVMA) opposes this procedure, but it still happens in veterinary practices across Canada. The surgery involves the amputation (removal) of the digits of primarily the front paws, but the back claws might also be removed. The surgery provides no advantage to the feline and the long term behavioural and physical changes are not well known.

Think About It!

Do you think there is ever a need to perform this surgery? Where do you stand?

Activity #1 - Trimming Those Nails

Do	<p>Time: 30 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Nail clippers• Dog or cat <p>Instructions:</p> <ol style="list-style-type: none">1. Have a veterinarian or registered veterinary technician outline the importance of keeping toe nails trimmed.2. Have them explain the parts of the nails and the ways to avoid pain and discomfort.3. Explain what can happen if the toes get too long and explain the importance of not nicking the quick.4. You can also explain ways to promote a low stress experience for your pet.
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to demonstrate the process of trimming nails and the importance of this practices regularity.</p>
Apply	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• How often do you do this procedure?• What are things you are looking for?

Activity #2 - Increasing The Scale

Do	<p>Time: 30 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Hoof Trimming• Shoeing Equipment <p>Instructions:</p> <ol style="list-style-type: none">1. Have a veterinarian or hoof trimmer outline the ways that they trim cows or horses' feet.2. For horses, get a ferrier to outline the extra steps of shoeing and the importance of this practice.
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to demonstrate the process of trimming hooves and potentially shoeing animals.</p>
Apply	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• Are there any things you look for while trimming?• How do you make decisions about what to trim and what to leave?

Problems, Problems, Problems!

These problems are commonly associated with large animals (with hooves) but it is important to be able to recognize these as a veterinary professional (lameness will be covered in the next meeting for all species):

Disorder	Cause	Effect	Treatment/ Recovery
Foot Rot (Strawberry Foot)	Bacteria-Fusiformis Necrophorus - by small stones, frozen ground, mud, urine, and manure.	Lameness, swelling, and inflammation of the skin of the coronary band and the skin between the claws	Keep cattle on paved surfaces; keep them as dry as possible. Have cattle walk through copper sulphate foot baths. Treat with injectable antibiotics and local treatment of the foot lesions. If treated right away a full recovery is possible.
Club Foot	Can be hereditary. Can be a result of foot rot.	The toe forms an angle of more than sixty degrees to the ground. Soon the wall of the toe is about twice as high as that of the heels.	If it is hereditary you may want to consider culling that bloodline. Otherwise do not overwork the animal, and get a hoof specialist to look at the animal.
Spongy Hoof	Animals that have large, flat, and spreading feet are more likely to have this disorder.	The soft, non-resistant horn becomes hot and tender after a long journey on a hard road. Lameness may result.	Allow the animal to rest on a soft bed. Make sure the hoof is free from debris that may harm the horn. Ensure that the animal is well cared for. To prevent another case do not push the animal
Ringed or Ribbed Hoof (Grass Rings)	Anything tending to an alternate increase and decrease in the secretion of horn from the coronet. (i.e. Alternating between wet and dry pastures)	The wall becomes marked with a series of well-defined ridges in the horn, each ridge running parallel with the coronary margin.	This disorder is regarded as normal because it occurs so often. However, when it affects the quality or the quantity of blood flow directed to any part of the animal,
Brittle Hoof (Cracked Hoof)	The condition is most often hereditary. It happens in smaller animals like ponies. Animals that have their hooves in wet areas for a long time and then are transferred to constant dryness of stable bedding. Also caused by excessive wound dressing.	The horn of the animal suffers from an abnormally dry state. May appear as being baked hard and stony. The hoof may start cracking.	Have a balance if wet and dry areas. Make sure that the animals feet are tended to regularly

Meeting 5 - Mooovement!

Setting Objectives:

To identify how animals move and how anomalies can be detected.

Suggested Learning Outcomes:

- To identify movement and normal gait importance.
- To assess gait in large animals (specifically dairy)
- To learn about treatment for small animals?

Suggested Roll Call Questions:

- Have you ever hurt yourself playing sports? What happened?
- How much do you move in a day?

SAMPLE MEETING AGENDA

Time: 1 hour 50 minutes

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	10-15 minutes
Topic Information, Discussion	Movement And Potential Problems	10 minutes
Activities Related To Topic	Activity #1 - Small Animal Lameness	1 hour
	OR	
Activities Related To Topic	Activity #2 - Large Animal Lameness	1 hour
Wrap Up, Social Time And Adjournment		10 minutes

Movement And Potential Problems

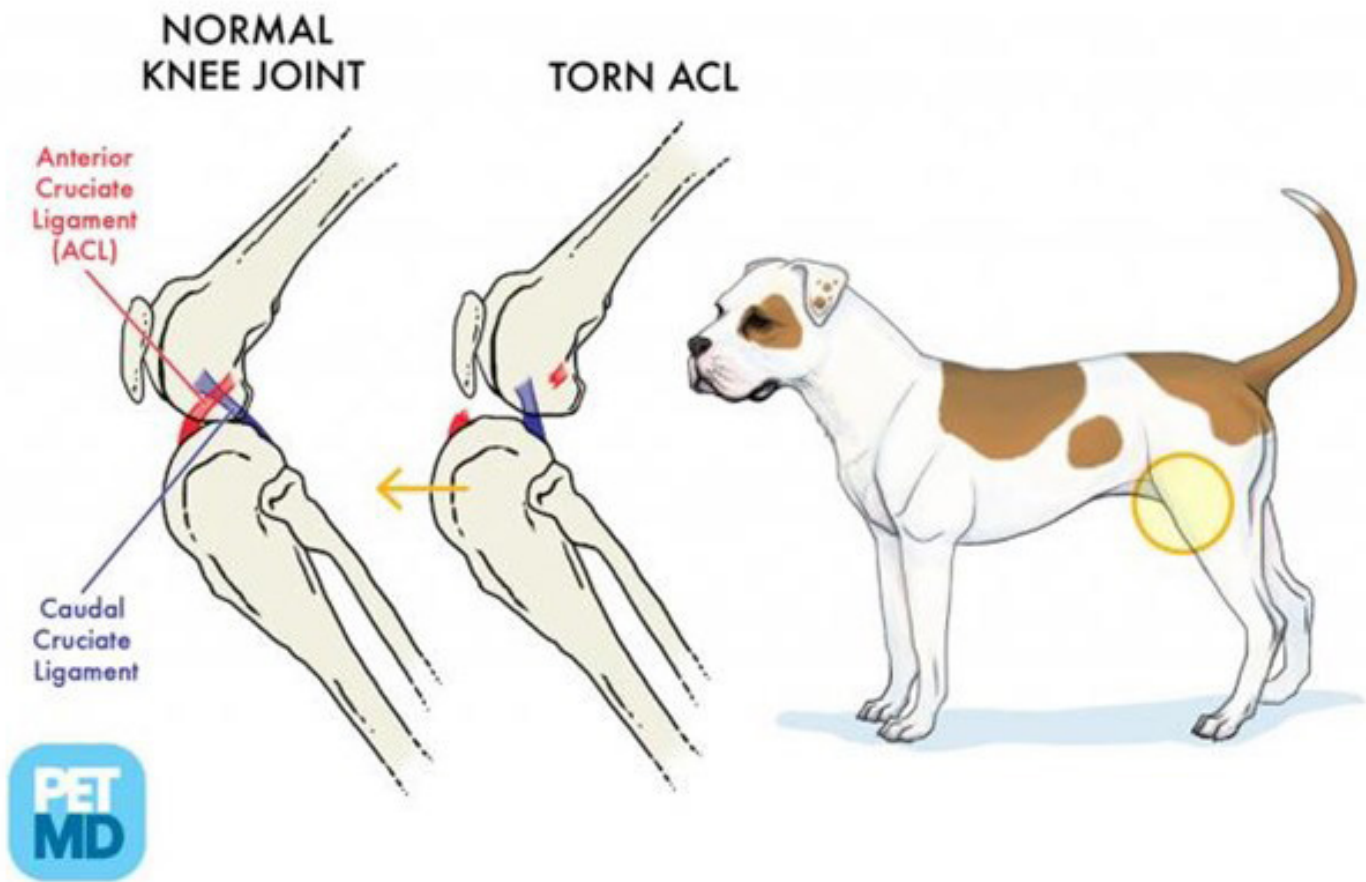
Animal movement occurs in a variety of ways, but every animal has normal mechanics that govern their movements. A frog, for example will use its large back feet and spring forward, while using their front feet for support.

This is a normal movement for this animal which may not be normal for other animals. Mechanics are how an animal moves and what muscles, bones and other organs are used for movement. Therefore, different species look very different from one another (different muscle and bone structure).

These normal mechanics or gaits can be assessed in great detail to determine health status of animals. The next two activities will explore this in detail for both small and large animals.

Small Animal Lameness

A very common cause of lameness in small animal veterinary species is a crucial ligament rupture. This is a particularly common presentation in dogs. The cruciate ligaments (cranial and caudal) are located in the knee joint, “crossing over” to connect the femur and the tibia. This hinge joint is not very stable, as there are no interlocking bones which makes it very prone to injury. Typically, injury to the cruciate ligaments occur either by degeneration or through trauma. Once injury to one or both of the ligaments has occurred, the knee joint will be extremely painful, usually causing the animal to display overt signs of lameness.



Source from: PetMed at <https://www.petmd.com/dog/infographic/cranial-cruciate-ligament-in-dogs-medical-diagram>

Activity #1 - The Bee's Knees

Do	<p>Time: 1 hour</p> <p>Materials:</p> <ul style="list-style-type: none">• Pipe cleaners• Wooden dowels• Tape• Stapler• Scissors• Elastic bands <p>Instructions:</p> <ol style="list-style-type: none">1. Depending on numbers in the club, have members divide into manageable groups sizes. Ask the members to create a model of the knee joint. Give them lots of creative freedom surrounding this (feel free to also get creative with the materials offered to create these models). Encourage the members to include the cruciate ligaments in their models and try to make them as realistic as possible. If there is a particularly good model, use it as a demonstration as to what would happen if one of the cruciate ligaments were to rupture. Show the group a video of the “Drawer test” on YouTube, which is one of the tests used to diagnose cruciate ruptures.
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to demonstrate the complexity of the knee joint and the impact of a cruciate ligament tear.</p>
Apply	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• What surprised you about the knee joint?• How might an animal change the way in which it moves if it had a cruciate ligament tear?

Activity #2 - Gait Score

Do	<p>Time: 1 hour</p> <p>Materials:</p> <ul style="list-style-type: none">• ProAction Lameness Scoring Guide• Pen/pencil• Scrap piece of paper <p>Instructions:</p> <ol style="list-style-type: none">1. Have a producer, validator (classifier), or veterinarian run through the importance of lameness scoring dairy cattle.2. Outline the importance of this practice and then get people to score some cows.3. The following videos break down scoring for dairy cows (you can use these and others online): https://www.youtube.com/watch?v=OswNnRT-q3k&t=15s https://www.youtube.com/watch?v=FxHTcPb0_r8&t=2s https://www.youtube.com/watch?v=O9TOvnC4vF4&t=1s4. Next, have youth review the two guides attached and compare and contrast the two guides. You can use the guide that is appropriate to the housing type.5. You can also judge a class for lameness as a part of this activity.
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to demonstrate the steps needed to score dairy cattle and the process to assess lameness.</p>
Apply	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• Why is it important to assess lameness in dairy cattle?• Can you think about ways that a cow might become lame (environmental, cow behaviour, predisposition, diet)?• How can we use a scoring system to assess lameness on farm?• How might this bolster consumer support for dairy products if validation is done?• Freestall or loose housing scoring is preferred. Why do you think that is the case?

Animal Care



Quick Guide to Mobility Scoring - Gait Scoring

- ❖ Preferred method for detecting lameness in dairy cattle
- ❖ Use with free-stall or other loose-housing systems
- ❖ Use with tie-stall systems where cattle are routinely exercised, if practical

1. Establish a suitable location:

Often the easiest location is the transfer alley between the parlour and the pen (particularly after a footbath as this will slow the animals down).

Criteria for choosing a location:

- Distance allows observation of cattle walking for **four strides**
- Surface is smooth/flat
- Avoid slatted concrete surfaces if possible
- Avoid sloped flooring (downward or upward) or alleys with steps

2. Gait score sample cattle:

- Record the identification number of the animal.
- If cattle have been released from tie-stalls, habituate them to walking by walking up and down a passageway in a calm manner until the cattle walk in a straight line at a steady pace.
- Observe at least four strides for each animal and record the degree of limping on the Cattle Assessment Record. The gait scoring categories are based on the Gait Scoring System referenced in Appendix F of the Code of Practice, developed by Flower and Weary (2006) (see Table 1).
 - Score 'A' for acceptable for no limp present (equivalent to Scores of 1 and 2)
 - Score 'M' for monitor for mild or moderate limp present (equivalent to Score 3)
 - Score 'R' for requires corrective action for an obvious or severe limp present (equivalent to Scores of 4 and 5)
- The **gait behaviours associated with limping are:**
 - Favouring one or more limbs
 - Uneven weight bearing with weight transfer at walk: an animal free from injury should bear weight evenly over the four limbs
 - Reluctance to bear weight on a limb: an animal with an injury may not place all her weight on an affected limb and may walk with an uneven, irregular, jerky or awkward step, as if favouring one leg

Table 1: Gait Scoring System for Dairy Cows (from Appendix F of the Code of Practice for the Care and Handling of Dairy Cattle, 2009)

Score	Description	Behavioural Criteria
1 Sound	Smooth and fluid movement	<ul style="list-style-type: none"> • Flat back when standing and walking • All legs bear weight equally • Joints flex freely • Head carriage remains steady as the animal moves
2	Ability to move freely not diminished	<ul style="list-style-type: none"> • Flat or mildly arched back when standing and walking • All legs bear weight equally • Joints slightly stiff • Head carriage remains steady
3	Capable of locomotion but ability to move freely is compromised	<ul style="list-style-type: none"> • Flat or mildly arched back when standing, but obviously arched when walking • Slight limp can be discerned in one limb • Joints show signs of stiffness but do not impede freedom of movement • Head carriage remains steady
4	Ability to move freely is obviously diminished	<ul style="list-style-type: none"> • Obvious arched back when standing and walking • Reluctant to bear weight on at least one limb but still uses that limb in locomotion • Strides are hesitant and deliberate and joints are stiff • Head bobs slightly as animal moves in accordance with the sore hoof making contact with the ground
5 Severely Lame	Ability to move is severely restricted Must be vigorously encouraged to stand and/or move	<ul style="list-style-type: none"> • Extreme arched back when standing and walking • Inability to bear weight on one or more limbs • Obvious joint stiffness characterized by lack of joint flexion with very hesitant and deliberate strides • One or more strides obviously shortened • Head obviously bobs as sore hoof makes contact with the ground
source: University of British Columbia Animal Welfare Program		

Taken from Alberta's Humane Handling of Dairy Cattle - Standards for the Transportation of Cull Animals, original source: University of British Columbia Animal Welfare Program.

Animal Care



Quick Guide to Mobility Scoring - In-stall Scoring

Use only with tie-stall systems where walking and observation of cattle is not practical, and where cattle are tied in and used to the stalls that they are in.

1. Encourage the animal to be assessed to stand.
 - Each animal must be standing undisturbed for at least 3 minutes before their assessment begins (allows for urination/defecation).
 - If the sample size means that you need to score adjacent animals, do not score them immediately after each other, as the scoring of the first animal may affect the second one. Move to the next animal to be scored and then return to the skipped animal once she has had at least 3 minutes of standing undisturbed.
 - Encourage the animal to stand up by standing behind her while saying ‘up up’. If she does not respond to this, a gentle tap on the spine may be required. If she does not respond, tap her on the flank to encourage her. If she still does not respond, move on to the next few animals and then return to the original animal to try again or ask the farmer or farm worker to help.
2. Observe the animal. If the animal urinates or defecates during the assessment, stop scoring and return to assess her later, or ignore the behaviours just before and during urination or defecation, and continue scoring once the animal has returned to normal resting posture.

The assessment consists of two parts:

a) Animal standing in stall

- Stand about one meter behind the animal slightly to one side for a good view of both front and hind feet.
- Observe the animal’s feet for a full 60 seconds.
- Record the presence of EDGE, WEIGHT SHIFT, and REST (UNEVEN WEIGHT) indicators for each position (see Table 1) for all four feet, except for EDGE which can only be assessed on the hind feet.

b) Animal moved from side to side

- Stand behind the animal with a view of both hind feet.
- Shift the animal from side to side by walking from one side to the other behind the animal and then back. If she does not respond, gently tap her hipbone with your hand to encourage her to move over.

Note: if an animal refuses to move because she obviously does not want to bear weight on one foot or limb, do not force her to move and double-tick this element and score her as ‘R’ for Requires corrective action.

- Observe how the animal shifts weight from hind foot to hind foot. Observe if the UNEVEN MOVEMENT indicator is present (see Table 1).
- Record presence of UNEVEN MOVEMENT indicator.

3. Score an animal ‘A’ for acceptable if less than 2 indicators are recorded, and score an animal as ‘R’ for Requires corrective action if 2 or more indicators are recorded (i.e. obviously / severely lame).

Table 1: Behavioural indicators of lameness

Behaviour Indicator	Description
Animal standing in stall (voluntary movements)	
EDGE	Placement of one or more hooves on the edge of the stall while standing stationary. Standing on the edge of a step when stationary, typically to relieve pressure on one part of the claw (Figure 1). This does not refer to when both hind hooves are in the gutter or when cow briefly places her hoof on the edge during a movement/step.
WEIGHT SHIFT	Regular, repeated shifting of weight from one hoof to another. Repeated shifting is defined as lifting each hind hoof at least twice off the ground (L-R-L-R or vice versa). The hoof must be lifted and returned to the same location and does not include stepping forward or backward
REST (UNEVEN WEIGHT)	Repeated resting of one foot more than the other as indicated by the cow raising a part or the entire hoof off the ground. This does NOT include raising of the hoof to lick or during kicking.
Animal moved from side to side	
UNEVEN MOVEMENT	Uneven weight bearing between hooves when the cow was encouraged to move from side to side. This is demonstrated by greater rapid movement of one hoof relative to the other, or by an evident reluctance to bear weight on a particular foot.



Figure 1: Example of EDGE

Meeting 6 - Battle Ready!

Setting Objectives:

To discuss horns and antlers and how those impact an animal.

Suggested Learning Outcomes:

- To identify the difference between horns and antlers and their purpose.
- To discuss dehorning methods for domestic animals.

Suggested Roll Call Questions:

- Name an animal that grows antlers or horns.
- Have you ever seen an animal being dehorned? How was it done?

SAMPLE MEETING AGENDA

Time: 1 hour 50 minutes

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	10-15 minutes
Topic Information, Discussion	Horns Vs. Antlers	10 minutes
Activities Related To Topic	Activity #1 - Principles Of Horn Removal	40 minutes
Wrap Up, Social Time And Adjournment		30 minutes

Horns Vs. Antlers

Antlers

Animals with antlers include deer, elk, caribou, moose and reindeer. Found only on males, antlers are used for self-defence and for aggressive encounters with other males for herd dominance. Distinguished from horns by their many points, antlers drop off in early winter to re-grow larger in the spring.

Horns

Some cattle, goats and sheep have horns. As with antlers, horns are used for self-defence and struggles for dominance. Unlike antlers, horns are found both on male and female animals. They have only one point and are continuously growing.

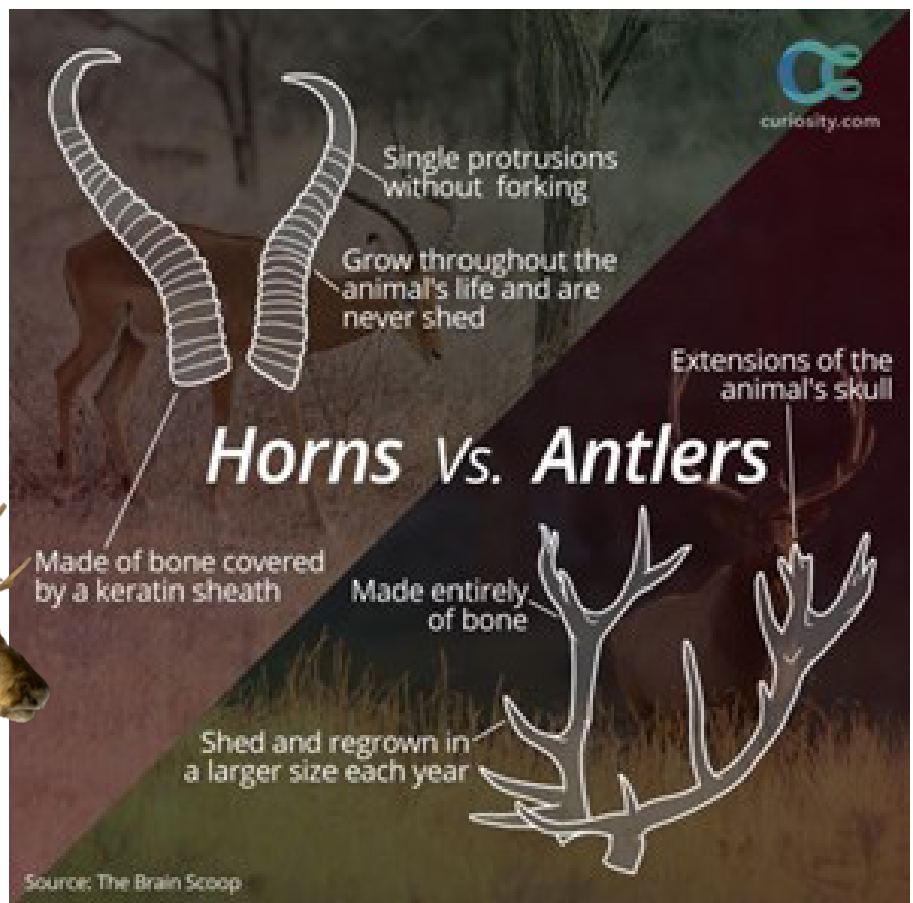
The interior of a horn is hard and coral-like, with many cavities.

Cattle are de-horned primarily to ensure the safety of the rest of the herd. Less aggressive herd mates can be severely injured by cattle who use their horns in the struggle to be dominant. Humans can also be injured by horned animals.

DID YOU KNOW?



Some breeds/strains of cattle do not have the genetics for horns - Aberdeen Angus and Polled Herefords are two examples. Some producers prefer polled strains as it eliminates the labour and expense of de-horning the animals.



Source: <https://twitter.com/curiositydotcom/status/531619759184281602>

Activity #1 - Principles Of Horn Removal

<h1>Do</h1>	<p>Time: 1 hour</p> <p>Materials:</p> <ul style="list-style-type: none">• Pipe cleaners• Wooden dowels• Tape• Stapler• Scissors• Elastic bands <p>Instructions:</p> <ol style="list-style-type: none">1. The following are three methods that may be used for disbudding or dehorning (a veterinarian can outline these, demonstrate one or more, and then compare and contrast them):2. De-horning Paste. This is a chemical paste used to burn the horn buds on young animals. It is similar to a wart remover, though much stronger. Paste is used on calves up to one month of age and sometimes on young goats. The burning however may cause itchiness. When done properly, this is a humane and effective method of de-horning. A local anesthetic and analgesic is required.3. Horn Cutters. This instrument looks like a giant nail clipper. It is used most often on mature cattle. It is not recommended that horns be left to this stage before removal. The horns should first be tied off with string to decrease the blood flow, and the animal's head firmly restrained. The cutters are used to clip the horns close to the head. This method is generally used in cold weather to decrease the chances of flies infecting the exposed horn stumps. The strings are usually left in place for a week until the horn stumps heal. A local anesthetic and analgesic is required.4. Electric De-horner. Usually used on a calf just after weaning, it is applied, red-hot, to the horn buds. The heat burns the horns, much like a wart being burned off. A local anesthetic and analgesic is required.
<h1>Reflect</h1>	<p>Learning Outcomes:</p> <p>The objective of this activity is to demonstrate the complexity of the knee. The objective of this activity is to demonstrate the process of dehorning and the importance of pain mitigation.</p>
<h1>Apply</h1>	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• What were some of the key steps you took?• What is a way you can mitigate pain?• Brainstorm some pros and cons of each method!



Circulatory and Respiratory Systems

Meeting 1 - A Breath Of Fresh Air!

Setting Objectives:

To identify the role, structure and function of the airway and the role of the airway's connection to the outside world.

Suggested Learning Outcomes:

- To outline the role and parts of the airway.
- To outline the role of the first structures of the airway.
- To discuss obstructions to the airway and how these can be handled in pets.

Suggested Roll Call Questions:

- Name one part or function of the respiratory system.
- Name one problem of the respiratory system that you or a family member has had.
- Name one thing in the air that you or your animal(s) should not breathe.

SAMPLE MEETING AGENDA

Time: 2 hours 55 minutes

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	10-15 minutes
Topic Information, Discussion	Structure Of The Airway	10 minutes
Activities Related To Topic	Activity #1 - Crosswords	15 minutes
Topic Information, Discussion	A Little Bit Of Inspiration	15 minutes
Activities Related To Topic	Activity #2 - How Is Your Breathing?	10 minutes
Topic Information, Discussion	A Little Bit Of Expiration...	15 minutes
Activities Related To Topic	Activity #3 - Dealing With Obstructions!	10 minutes
Wrap Up, Social Time And Adjournment		10 minutes

Structure Of The Airway

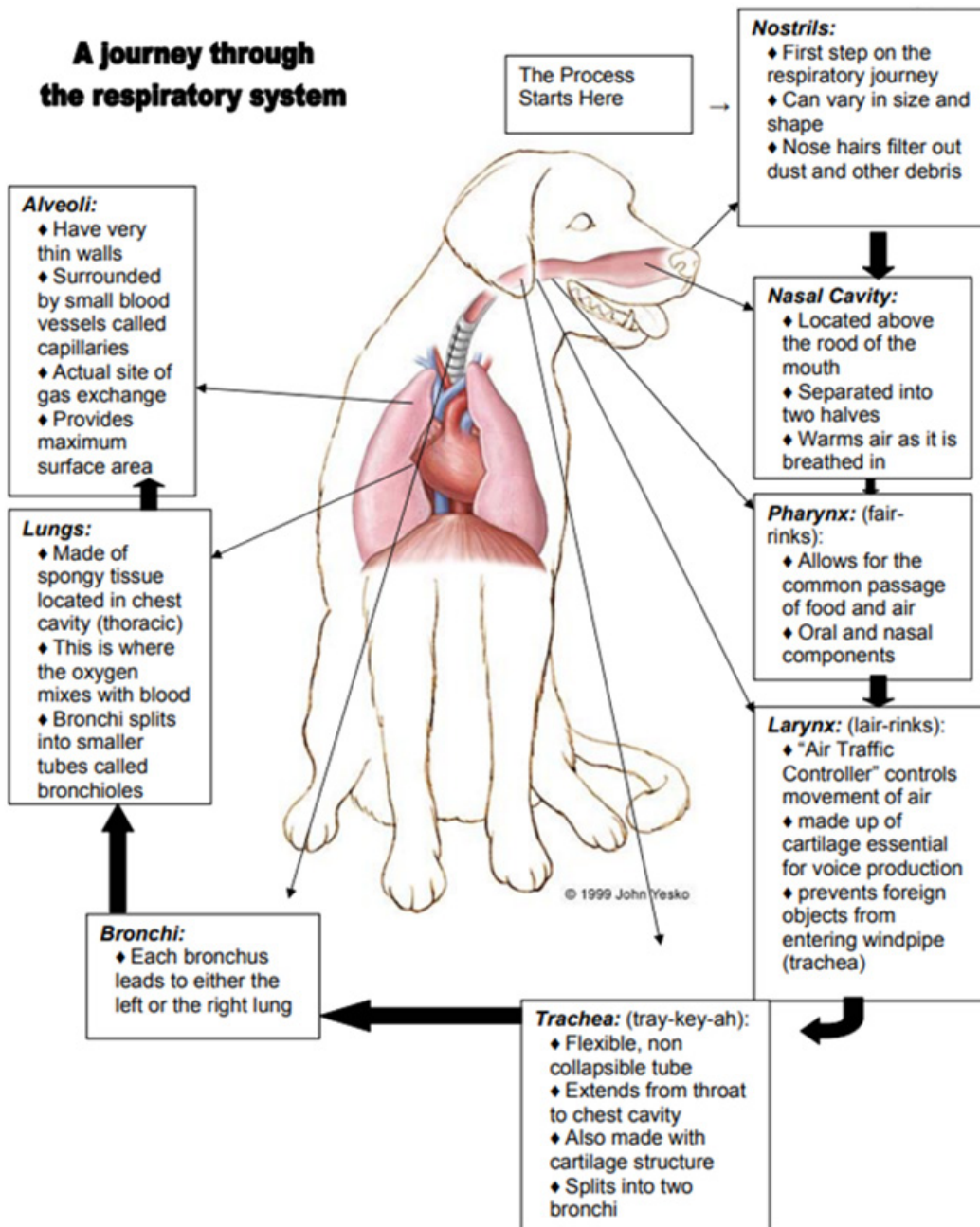
As Vital As The Air We Breath

The respiratory system provides every animal, including you, with oxygen and helps remove harmful waste products like carbon dioxide. In addition to gas exchange, the respiratory system has many other vital functions.

Many parts of the body work together to form the respiratory system. Together they allow for gas exchange by creating a pathway for air to move from the environment (outside) into your body, and then out again.

The respiratory system is a common route for administering anesthetics to people and pets for surgery – the gases used are quickly absorbed from the alveoli into the blood, which carries them to the brain. They cause a person or animal to “sleep.”

The diagram on the next page shows the respiratory system of a dog (which is similar to other specie, including humans):

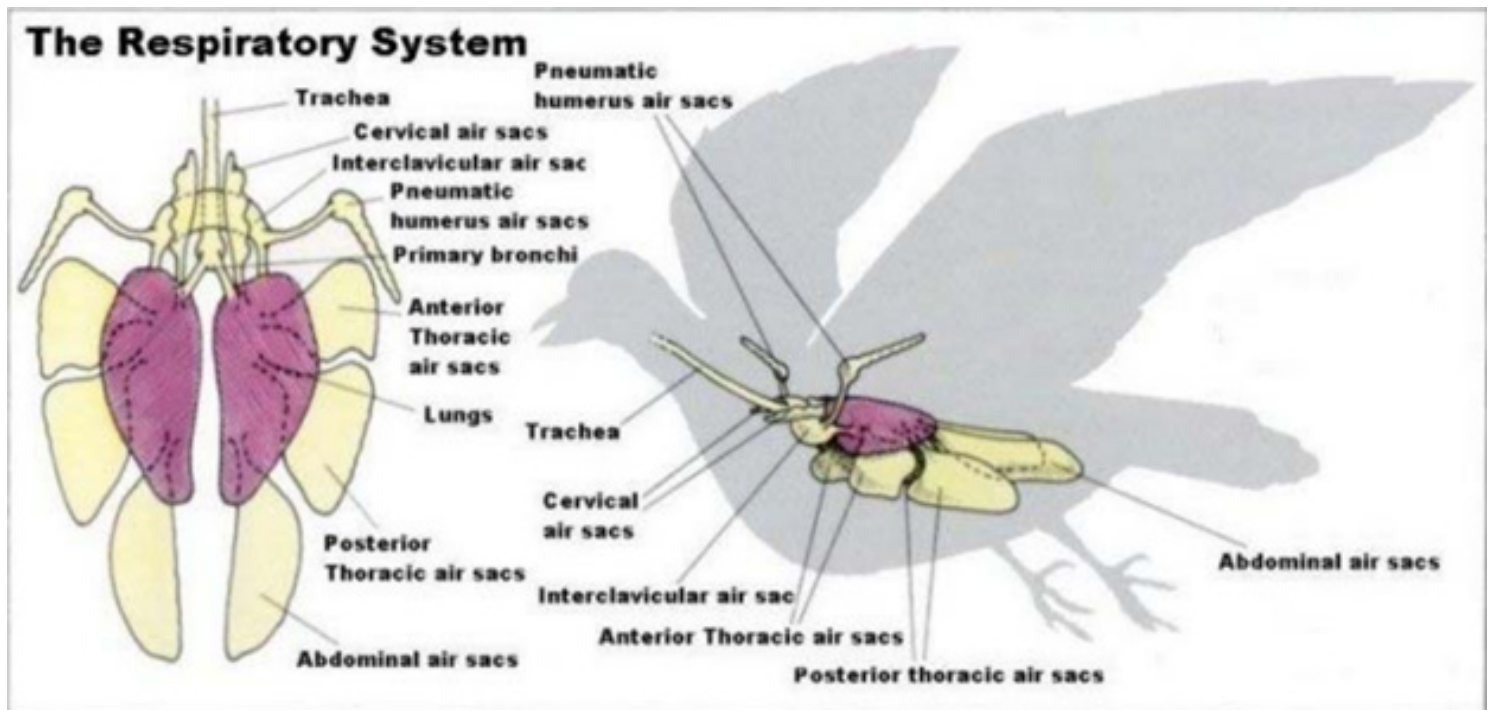


Birds Are A Little Different

Flying is more than walking or running, it is a very demanding activity. As a result, birds need a very efficient way of drawing oxygen into their bodies expelling carbon dioxide. The lungs of birds are much smaller and more efficient than those of other animals.

Birds draw air through their lungs into air sacs outside the lungs. These air sacs help lighten the bird to make flight easier. Air sacs also:

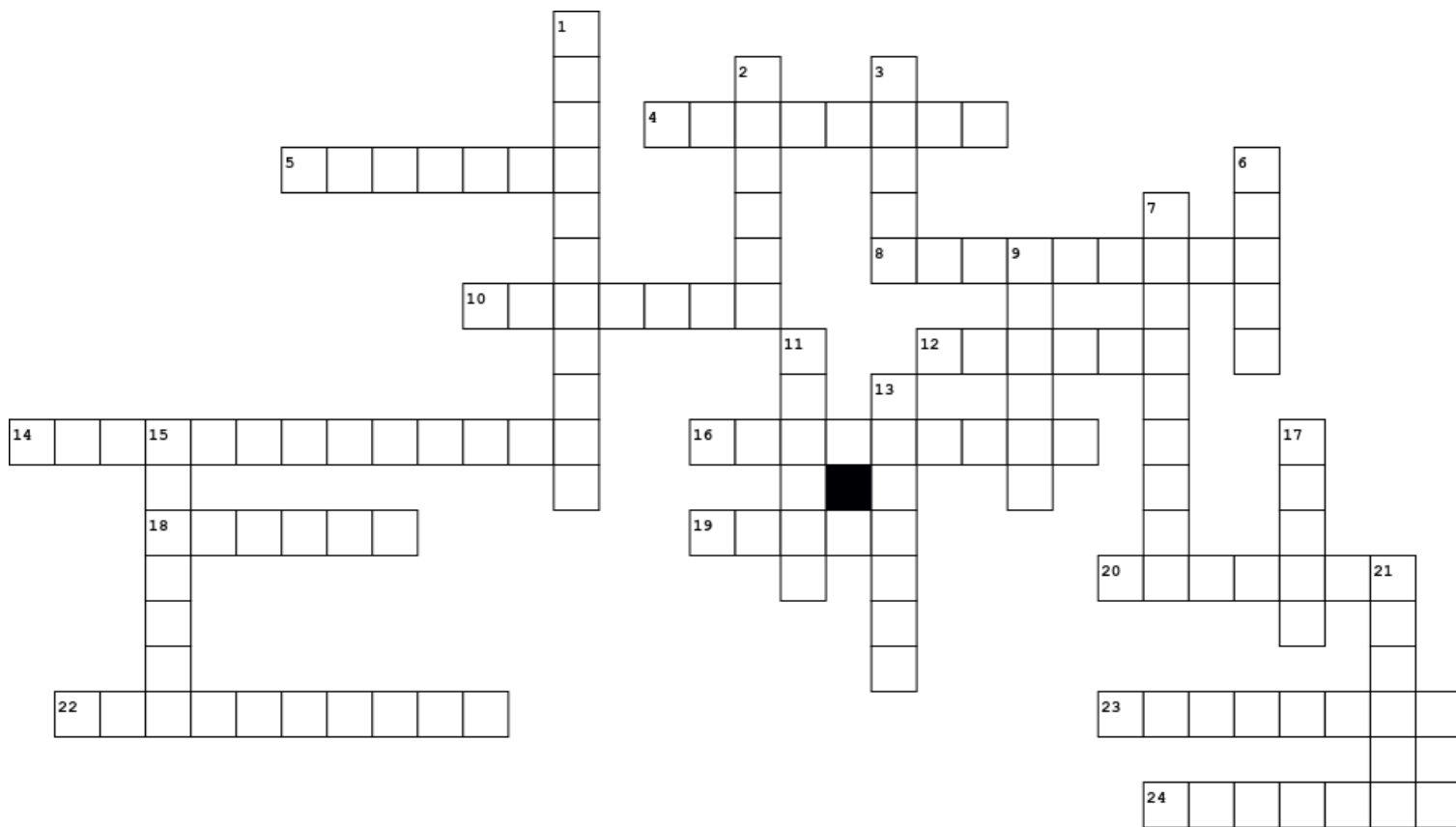
- Lessen friction between muscles
- Help regulate body temperature
- Act as reserve air tanks in fast-flying birds
- Help with voice production



Activity #1 - Introduction To Respiratory And Circulatory

Do	<p>Time: 15 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Introduction to Respiratory and Circulatory Crossword Worksheet• Pen/pencil <p>Instructions:</p> <ol style="list-style-type: none">1. You will need to print out enough of the worksheets so that each member has one.2. Get them to read over the clues and try and figure out the term. At the last 5 minutes, take up the crossword together.
Reflect	<p>Learning Outcomes:</p> <p>The goal of this activity is to discuss the role of the different parts of the respiratory system and how those parts relate to their function.</p>
Apply	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• Were there any parts that surprised you?• Were there any tricky clues?

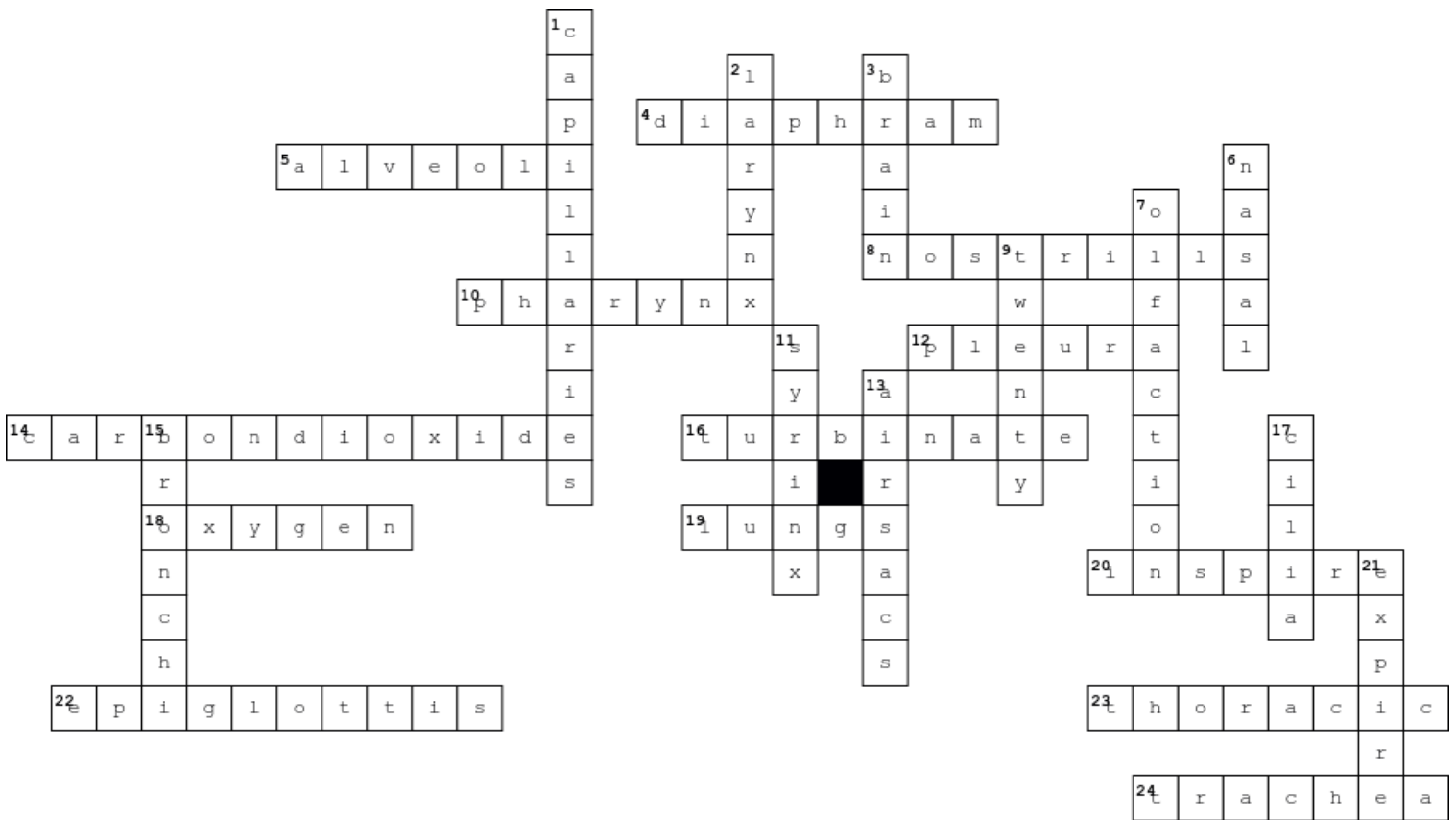
Introduction To Respiratory And Circulatory Crossword



Across	
4.	Muscular wall between chest and abdomen.
5.	Thin-walled sacs in the lung.
8.	Two in number (not the lungs).
10.	Shared between respiratory and digestive systems.
12.	Thin membranes covering the
14.	Waste product produced in the body (2 words).
16.	Bones in the nose.
18.	Exchanged in the lungs for the answer to 15 down.
19.	Soft and spongy.
20.	Air in.
22.	Protects the entrance to larynx.
23.	Cavity.
24.	Flexible tube.

Across	
1.	Tiny blood vessels in the lungs.
2.	Cartilages and muscles.
3.	Controls the breathing.
6.	_____ cavity - contains hairs and special bones
7.	Sense of smell.
9.	Average respiratory rate in a cow.
11.	Voice production.
13.	In a bird (only in birds; 2 words).
15.	Trachea divides into these structures.
17.	Tiny hairs on cells which wave back and forth.
21.	Air out.

Introduction to Respiratory and Circulatory Crossword - ANSWER KEY



Across	
4.	Muscular wall between chest and abdomen.
5.	Thin-walled sacs in the lung.
8.	Two in number (not the lungs).
10.	Shared between respiratory and digestive systems.
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21.	Air out.

A Little Bit Of Inspiration

As Vital As The Air We Breath

Breathing consists of both inspirations (breathing in) and expirations (breathing out). These processes allow air to move in and out of your body.

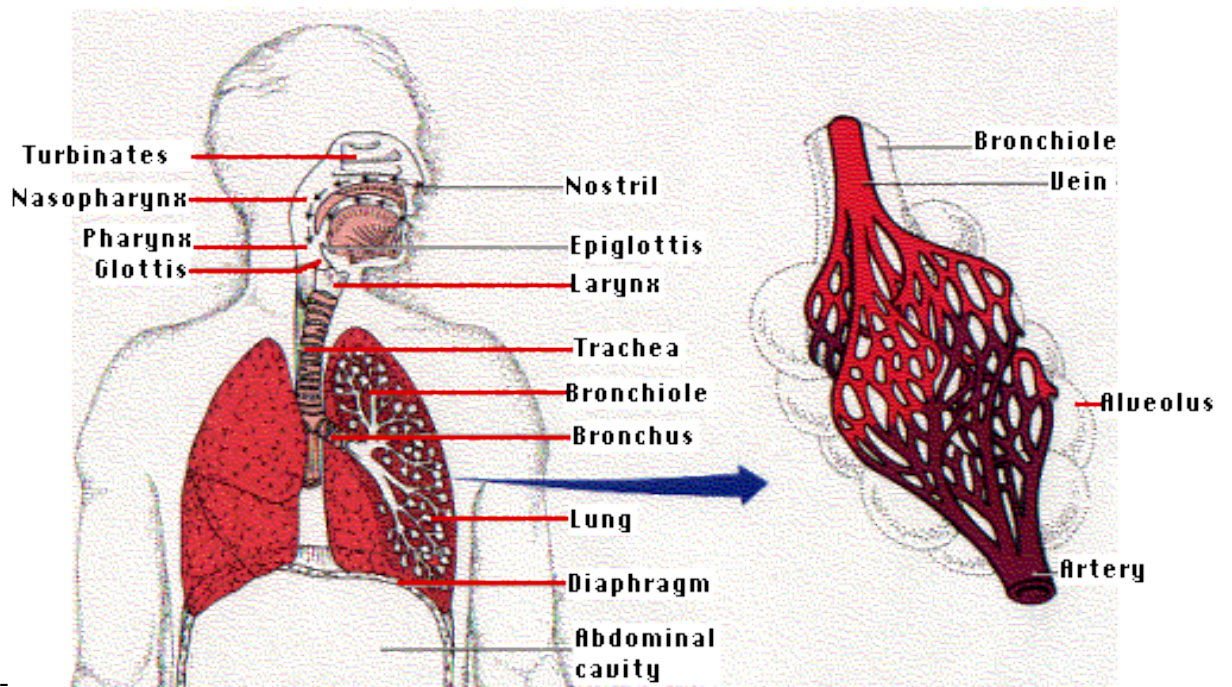
INSPIRATION is done by your muscles. The muscles used include the diaphragm, the intercostal muscles (between the ribs), and the abdominal muscles.



Once air reaches the lungs, oxygen must find its way into the blood stream. The process, by which this happens, GAS EXCHANGE, takes place in the lower respiratory system. How does this work?

The Pathway Of Oxygen

With each breath, oxygen-rich air moves through the trachea, the bronchi, and the bronchioles into the alveoli. Once oxygen reaches the alveoli, it passes into the surrounding capillaries. The oxygen attaches to the hemoglobin in the blood flowing through the capillaries. The blood enters the pulmonary vein and the oxygen is carried to the heart, where it is distributed to the rest of the body



<https://socratic.org/questions/does-anyone-know-the-major-organs-of-the-respiratory-system-human>

Activity #2 - How Is Your Breathing?

Do	<p>Time: 10 minutes</p> <p>Materials: None</p> <p>Instructions:</p> <ol style="list-style-type: none">1. Try and hold their breath for as long as possible. Get members to count the seconds that they can hold it.2. Next, get members to breath more deeply to fill their lungs up with as much oxygen as possible.3. Next get members to try and hold their breath again.
Reflect	<p>Learning Outcomes:</p> <p>The purpose of this activity is to demonstrate a natural adaptation to the need for oxygen and to look at the need for oxygen.</p>
Apply	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• Did you find that you can increase the length of time that you can hold your breath by breathing more deeply before?

A Little Bit Of Expiration...

EXPIRATION is the reverse action of inspiration; it forces air out of the lungs.

The Pathway Of Carbon Dioxide

The process of cellular respiration requires the use of oxygen and results in the production of carbon dioxide, a waste product. Carbon dioxide is a harmful toxin and must be removed from the body. Carbon dioxide moves through the bloodstream, where it is pumped into the pulmonary artery. As oxygen moves out of the alveoli into the capillaries, carbon dioxide takes its place in the alveoli. When the animal expires, carbon dioxide follows the same pathway that oxygen took to enter the lungs.

Secondary Functions:

The respiratory system also has several secondary functions. These include:

- Temperature control (a dog achieves this by panting – heat is expelled, and then cooler air is inhaled)
- Olfaction (smell), through special nerve endings in the nasal cavity
- Voice production, by the vocal cords in the larynx
- Air is moistened by the mucous membrane, which helps lubricate the system
- Several structures trap foreign airborne particles
 - o Nasal hairs, mucous membranes, and the cough reflex

Think About It!

Breathing is an involuntary action... that means that you do not have to tell yourself to take a breath. How does your body know to breathe faster when you are physically active, or to breathe at a slower rate when you are sleeping?

Breathing is controlled by the medulla oblongata, located at the base of the brain. This control center responds to the rise in carbon dioxide levels forcing the respiration rate to increase to bring in more oxygen. As the carbon dioxide level drops, so does the respiratory rate.

The rate of respiration varies between species of animals. It is important to note that younger animals (neonates) often have a higher respiration rate. The normal ranges of respiratory rates for common animals are: (expressed in breaths per minute).

Cow 10-30

Pig 10-20

Horse 8-12

Sheep 10-20

Dog 15-25

Cat 20-30

Activity #3 - Dealing With Obstructions!

Do	<p>Time: 10 minutes</p> <p>Materials: None - DO NOT PERFORM THIS MANEUVER ON A LIVE ANIMAL THAT IS NOT CHOKING</p> <p>Instructions: This activity is meant to be a more informal discussion on the topic of blockages to the airway.</p> <p>An animal needs to be able to breath. If it cannot then the exchange of oxygen and carbon dioxide cannot take place and will result in a quick death of the animal.</p> <p>Think of a way that you could distinguish between a full and partial blockage. If you can see the object, remove it with care.</p> <p>Otherwise, you can conduct a style of the Heimlich maneuver to dislodge the object.</p> <ol style="list-style-type: none">1. Straddle the dog while standing so his back legs are between your own.2. Make a first and quickly thrust up in the space between the chest and belly on the underside of the dog.3. Check to see if the item is dislodged
Reflect	<p>Learning Outcomes: The goal of this activity is to demonstrate how to dislodge and save a choking dog.</p>
Apply	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• Read out the following: Even after you successfully remove the object, a significant number of dogs may get fluid in their lungs after a choking episode (this is called non-cardiogenic pulmonary edema), so they need to be hospitalized and given oxygen.

Meeting 2 - Lungs O' Fun!

Setting Objectives:

To identify the role, structure, and function of the lungs.

Suggested Learning Outcomes:

- To identify the role of the lungs through a fun activity.
- To outline the gas exchange mechanism of the lungs.

Suggested Roll Call Questions:

- How do often do you breathe in a minute?
- What do you think is the role of surface area and pressure?

SAMPLE MEETING AGENDA

Time: 2 hours

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	15-20 minutes
Activities Related To Topic	Activity #1 - Lung Fun!	15 minutes
Topic Information, Discussion	Pressure And Surface Area	10 minutes
Activities Related To Topic	Activity #2 - Breathe In A Bag!	10 minutes
Topic Information, Discussion	Diseases Affecting The Respiratory System...	20 minutes
Activities Related To Topic	Activity #3 - Case Studies	15 minutes
Wrap Up, Social Time And Adjournment		10 minutes

Activity #1 - Lung Fun!

Do	<p>Time: 15 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Balloons of different sizes <p>Instructions:</p> <p>Get a variety of balloons and get members to try blowing them up in a variety of ways:</p> <ul style="list-style-type: none">• Start by just inflating the balloon with a regular steady breath• Next, try and exhale quickly before blowing the balloon at a regular rate.• Then exhale completely and try and blow up the balloon with the remaining air <p>If you have balloon animal balloons (longer), try and get members to blow these balloons up.</p>
Reflect	<p>Learning Outcomes:</p> <p>The purpose of this activity is to explore the nature of pressure and the lung.</p>
Apply	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• When the balloon starts out there is air on the outside but none on the inside. The pressure that gets exerted from the outside makes putting the initial air into the balloon difficult. What did you notice about the initial fill of the balloon? Was it hard? What made it easier?• How difficult was it to inflate the balloon after you got past the initial air needed?• If you had a longer balloon, were you able to blow it up at all? Think about why the pressure on the outside might be greater for this type of balloon?• How might this activity mimic a lung? Do lungs tend to deflate?

Pressure And Surface Area

As was demonstrated in the last activity, the air pressure on the outside of an object exerts enough of a force until the amount of force applied on the inside, can counteract the force on the outside. This is what causes the inflation of the object.

In short, air forced into the lungs, causes the lungs to inflate as the pressure on the inside is greater than the pressure on the outside. However, this greater pressure also aids in the exchange of gasses to allow oxygen to come in and carbon dioxide to leave.

Additionally, you may have noticed a trend in the previous meeting where, in general, the bigger the animal the lower the respiration rate. That is due to the size of lungs and therefore the surface area will be a lot larger than smaller animals. This makes the gas exchange work!

Think About It!

Have you ever heard of someone who might not have two fully functioning lungs or a lung that was deflated? This happens and often requires medical intervention to correct. How might the respiration rate be affected by these situations? Higher or lower?

Activity #2 - Breathe In A Bag!

Do	<p>Time: 10 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• 1 paper bag <p>Instructions:</p> <p>One leader will breathe into a bag, they will notice as they breathe into the bag that their breathing rate will eventually increase.</p> <p>Why? (Carbon Dioxide- Which is why the leader is doing the demonstration).</p> <p>Help them to understand that as the bag fills with exhaled carbon dioxide, the amount of oxygen in the air decreases. Their breathing rate increases, as it tries to supply the body with enough oxygen.</p> <p>A practical use of the paper bag rebreathing is for individuals who experience panic attacks. These individuals begin to hyperventilate, causing their CO₂ levels to drop. By rebreathing their own air into and out of the paper bag, they can bring up their CO₂ levels to normal.</p>
Reflect	<p>Learning Outcomes:</p> <p>The goal of this activity is to explain how carbon dioxide and oxygen concentrations affect breathing rates.</p>
Apply	

Diseases Affecting The Respiratory System

These are a way of controlling or preventing the diseases.

Vaccinations

What Is A Vaccine?

A substance used to stimulate the production of antibodies and provide immunity against one or several diseases, prepared from the causative agent of a disease, its products, or a synthetic substitute, treated to act as an antigen without inducing the disease.

A vaccine is made up of the virus or bacterium that causes the disease (usually it is weakened or inactivated in some way). When given to an animal, it causes the animal's body to produce ANTIBODIES against the disease without causing the actual disease. These antibodies protect the animal when it encounters the disease in the future.

Pet vaccinations can protect against the following: rabies, distemper, hepatitis, parvovirus infection and tetanus. These are diseases with routine vaccines. Fortunately, the continuing development of many different vaccines, for all types of diseases, has given us strong protection against many serious illnesses.

Respiratory Diseases

Lead to the following effects:

1. Decreased production (less milk, fewer eggs...)
2. Slower growth rate among meat producing animals. This means that more days are required to reach market weight, and this in turn means that more feed will be required.
3. Increased labour load for the farmer/owner, who must now nurse the sick animal(s).
4. Death of animals.
5. Higher cost for medication.
6. Poor athletic performance- especially in horses and dogs.

Respiratory Diseases

Disease	Symptoms and Effects
Enzootic Pneumonia of Calves (en-zu-aht-ik nu-mo-nee-ah) Affects Cattle	<ul style="list-style-type: none">• The most common type of infectious pneumonia, occurring in calves up to 6 months of age.• Occurs when calves are housed in a damp, wet or, an environment with inadequate air exchange.• Characterized by a harsh dry cough, increased respiratory rate and fever. Though calves often continue to eat and drink.• Damages the lungs, which allows bacteria to get in. The calf becomes much sicker, goes off feed, coughs more and grows very poorly.• The best prevention is to provide a clean dry environment that is well ventilated.• This disease is carried by adult cattle, and so moving calves to a calf barn or outdoor hutches immediately after birth offers added protection.

Disease	Symptoms and Effects
<p>Infectious Bovine Rhinotracheitis (I.B.R.) (ry-no-tray-kee-eye-tis)</p> <p>Affects Cattle</p>	<ul style="list-style-type: none"> • A viral disease of beef and dairy cattle. • Occurs most often during the fall and early winter when cattle are moved indoors or assembled in feedlots. • Usually spread by cattle that appear healthy but carry the virus. • Shows up in several ways: by attacking the nasal passages and trachea, leading to a red and crusty nose and a harsh, dry cough. It also causes diarrhea in young calves and abortion in pregnant cows. • Cattle usually recover in 10-14 days if there are no complications. If the cattle are stressed and a bacterial infection sets in, pneumonia may result which makes the animal much sicker. • Vaccines are available. They are injected either into the muscle or more commonly, up the nose.
<p>Shipping Fever Pneumonia</p> <p>Affects Cattle</p>	<ul style="list-style-type: none"> • A respiratory infection that usually occurs in young cattle as the result of both a bacterial infection and stress. Weaning, transporting calves over long distances without proper rest or food, rapid weather changes, castration, dehorning, transferred to a feedlot, etc. are all forms of stress. • Causes severe damage to the lungs. Calves have difficulty breathing, do not eat and may die if not treated. • Treatment with antibiotics is successful only if started early. Therefore, recognizing the symptoms is crucial. • Prevention lies in keeping stresses to a minimum. • A vaccine is available to reduce the occurrence of shipping fever.
<p>Atrophic Rhinitis (ah-tro-fik ri-ny-tis)</p> <p>Affects Swine</p>	<ul style="list-style-type: none"> • A disease of pigs that attacks the turbinates and changes the shape of the nose. (Atrophic rhinitis is sometimes called "bullnose".) • Caused by at least two types of bacteria and the toxic substances one of them produces. • Often passed down from mother to piglet, causing very young pigs to sneeze and snuffle. • When the turbinates are attacked, they do not grow normally. • If only one side is infected, the nose twists sideways. If both sides are attacked, the nose is shortened and wrinkled. • Does not greatly affect the pig's growth on its own, but the conditions that favour atrophic rhinitis (cold, damp...) also encourage other diseases, and together they can slow the animal's growth. • Prevention measures include: keeping the barn clean, dry, warm, free of drafts, not overcrowding the herd and adopting a proper vaccination schedule.
<p>Enzootic Pneumonia of Pigs</p> <p>Affects Swine</p>	<ul style="list-style-type: none"> • A common disease of pigs that results in significant economic loss. • Caused by a mycoplasma — a particular type of infectious agent — which damages the respiratory tract and allows bacteria to set up a more severe pneumonia. The disease is sometimes called mycoplasma pneumonia. • Symptoms include a dry cough, unthrifty appearance and poor growth, especially after weaning and during the growing and finishing stages. • The disease is aggravated by poor ventilation, dust, high humidity, manure gases, overcrowding and temperature fluctuations. • The situation can be severe enough that a high percent of pigs become chronic and grow poorly or must be euthanized. In this situation, the farmer may consider depopulating the site to manage the challenge. • Good barn management practices are the key to keeping this disease under control.

Disease	Symptoms and Effects
<p>Porcine Reproductive and Respiratory Syndrome (PRRS)</p> <p>Affects Swine</p>	<ul style="list-style-type: none"> • A viral disease characterized by both reproductive impairment or failure in breeding animals and respiratory disease in pigs. • The most economically significant disease that affects swine production in North America at the time of writing this manual. • Occurs in all age groups and the best way to prevent it is to prevent the disease from entering the herd. • Often it can be difficult to diagnose the disease so by limiting entry of animals into a herd and to stabilize those animals that already have it. • The situation can be severe enough that a high percent of pigs become chronic and that economic and welfare factors are affected. In this situation, the farmer may consider depopulating the site to manage the challenge.
<p>Actinobacillus (Ak-tino-bah-sil-us) Pleuropneumonia (Ploor-o-nu-mo-nee-ah)</p> <p>Affects Swine</p>	<ul style="list-style-type: none"> • Caused by a bacterium which may live in the nose and lungs of apparently healthy pigs. (This is often how the disease is introduced to new herds.) • A poor environment aggravates the illness. • Causes infections in both the lung tissue and the membrane covering the lung and lining of the chest cavity - thus the name: pleuro- (for pleura) and pneumonia (for lung). • The acute form of the disease is characterized by high body temperature, laboured breathing and a bloody frothy discharge coming from the nostrils. Many of these pigs die. • The chronic form slows down the growth rate of pigs and makes them poor keepers (they need more feed than normal to put on weight). • Keeping a closed herd (not allowing any new animals in) is the best prevention. Buying weaner pigs from a single clean source will help keep the disease out of a finishing barn. • As with other respiratory diseases, prevention also lies in keeping environmental stresses to a minimum. • Vaccines are available to help reduce death losses during an outbreak but they are not as effective in preventing chronic pleuropneumonia.
<p>Kennel Cough (Infectious tracheobronchitis) (tra-ke-o-brongki-tis)</p> <p>Affects solely dogs.</p>	<ul style="list-style-type: none"> • Caused by a virus with bacterial complications. • Affects trachea and bronchi of dogs of all ages. • Usually a self-limiting disease (dog usually recovers on its own after a period of illness) but may progress to fatal pneumonia in puppies and old dogs. • Spreads rapidly among dogs that are closely confined (kennel). 5-10 days after exposure to virus, infected dogs experience bouts of harsh dry coughing which may be followed by gagging. • Dog may be depressed and off feed. • Most severe signs occur in first 5 days but disease may persist for 10-20 days. • Isolation of sick dogs from those that are healthy. • Cough depressants and possible antibiotics (if disease is complicated by a bacterial infection). • Prevented by vaccination of healthy puppies and dogs.

Disease	Symptoms and Effects
<p>Feline Rhinotracheitis ("cold") (ri-no-tra-ke-i-tis)</p> <p>Feline (cat) Specific</p>	<ul style="list-style-type: none"> • Caused by a virus, often part of a complex of respiratory diseases. • Incubation period of 2-6 days • Onset marked by fever, frequent sneezing, inflammation of eyes and nose, and often salivation. • Clear discharge from eyes and nose initially - soon becomes thick and contains pus, indicating bacterial complications. • Cat becomes depressed and does not eat - ulcers may develop in mouth of weakened cat. • Signs persist for 5-10 days in milder cases - may last up to 6 weeks in severe cases with severe weight loss. • Kittens and aged cats most susceptible to severe signs and may die • Frequent cleaning of discharges from eyes and nose to make cat comfortable • Antibiotics (if bacterial infections complicate the disease). • Prevented by vaccination of healthy kittens and cats.
<p>Equine Viral Rhinopneumonitis (EVR) (ri-no-nu-mo-ni-tis)</p> <p>Also known as equine herpes virus</p> <p>Horse Specifics</p>	<ul style="list-style-type: none"> • Caused by a virus • Can affect horses of all ages • Degree of sickness partially determined by the horse's immunity level. • 2-10 days after infection a fully susceptible horse will develop a fever, reddening of the nose and eyes with a clear discharge, pharyngitis (sore throat), a cough and a poor appetite. • Nervous signs may develop - horse has poor muscle coordination to point of being paralyzed in hind limbs. However, this is less common in comparison to the respiratory form. • Disease may cause pregnant mares to abort - particularly in 8th to 11th month. None if virus infection alone. • Antibiotics if bacterial complications occur. Vaccines used to help lessen the clinical signs of the disease.
<p>Heaves (Chronic Alveolar Emphysema)</p> <p>Now known as equine asthma</p> <p>Horse Specific</p>	<ul style="list-style-type: none"> • Unknown, but exposure to inhaled allergens in mouldy hay, bedding or stable dust, can lead to an allergic reaction. This is thought to play a part in the development of the disease. • A chronic (long-lasting) non-infectious respiratory disease. • Affected horse has difficulty breathing; inspirations are quicker, expirations are prolonged with forced contractions of the muscles of the abdomen (leading to a ridge along the ribs of the animal called the "heave line"). • Medications may be used under direction of veterinarian. • Chronic cough, unthrifty, lacks stamina. • Keep horse in dust free surroundings (dampen feed and bedding). • Signs are worse in hot, dry weather with dusty conditions. • Do not expose to inhaled allergens (feed good quality hay)

There are also a few diseases that affect humans as well (occupational exposure):

Disease	Symptoms and Effects
Farmer's Lung	<ul style="list-style-type: none"> • An acute allergic response to a variety of organic dusts, particularly those from mouldy hay, straw, grains or other decayed plant material. • Most frequent among cattle farmers, but may also occur in swine producers. • An inflammatory reaction to the inhaled debris. • Symptoms include defective gas exchange by the lungs, cough, or fever. Often resembles flu or a nagging winter cold. • Prevention lies in maintaining well-ventilated barns and work areas, and wearing protective gear such as dust masks or mechanical filter respirators when working closely with hazardous dusts. Mouldy compost, wood chips, mouldy cheese, feathers or droppings can cause a similar reaction.
Bronchitis	<ul style="list-style-type: none"> • An inflammation primarily of the lining of the bronchial air passages, resulting in thickening of the lining. • Primary causes are from exposure to dust, fumes and irritating gases. Infections may play a secondary role. • Results in increased coughing and sputum production. (Mucus and other secretions coughed up from the air passages make up the sputum.) • Breathing is difficult due to obstruction of the airways. • Once again, prevention lies in proper ventilation and the correct use of masks and respirators.
Silo Filler's Disease	<ul style="list-style-type: none"> • Results from exposure to the nitrogen oxides ("silo gas") present mostly in non-airtight vertical silos within weeks of filling. • One of the deadliest situations encountered in primary agriculture. Usually causes sudden death in exposed persons, due to fluid accumulation in the lungs. If person survives, extensive and permanent lung damage results. • Prevention lies in staying out of the silo for the first three weeks after filling; in completely ventilating the attached feed room; in wearing self contained breathing apparatus if you must go into the silo after filling; and having someone outside the silo if entering is absolutely necessary (buddy system).

Activity #3 - Case Studies

Do	<p>Time: 20 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• None <p>Instructions:</p> <p>These cases are best discussed with the help of a veterinarian who can walk members through the steps in the diagnosis! Alternatively, a veterinarian can walk through some other common respiratory cases they get in their clinic.</p> <p>It is always best to go through the diseases first and then to discuss the prompts in the apply section to determine next steps.</p> <p>Case 1</p> <p>A group of young cattle are displaying respiratory systems after travelling from Red Deere, AB to Wellington, ON. What might be the cause? Cause: Shipping Fever</p> <p>Case 2</p> <p>Your horse has been having trouble breathing lately, particularly when it tries to breath out. Cause: Heaves</p> <p>Case 3</p> <p>A farmer has trouble breathing when they are around sawdust shavings and older hay. Additionally, the farmer has a calf with a fever. The animals within the barn are also displaying similar symptoms. Cause: Farmer’s Lung</p>
Reflect	<p>Learning Outcomes:</p> <p>The goal of this activity is to discuss the signs and symptoms of common diseases affecting the respiratory system.</p>
Apply	<p>Discuss The Following Prompts As a Group:</p> <p>The cases above are just recommendations and others can be substituted in their place.</p> <p>For each case, ask:</p> <ol style="list-style-type: none">1. How can the disease be prevented?2. What are the symptom(s)3. What is the underlying disease name?4. Are there any other diseases this could be?

Meeting 3 - Overview Of The Circulatory System

Setting Objectives:

To identify the role and function of the vessels and overall structure of the circulatory system.

Suggested Learning Outcomes:

- To discuss the different components of the circulatory system.
- To differentiate between veins, arteries, and capillaries.
- To go over how to take a pulse on yourself and animals in your care and the importance.

Suggested Roll Call Questions:

- What does the term circulation mean to you?
- Name a component of the circulatory system. What does it do?
- Name a fact you know about the circulatory system.
- Do you know anyone who has suffered from heart disease? How was it treated?
- Suggest a tip for keeping a healthy heart.

SAMPLE MEETING AGENDA

Time: 2 hours 10 minutes

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	10-15 minutes
Topic Information, Discussion	Overview Of The Circulatory System	20 minutes
Activities Related To Topic	Activity #1 - Colour The Oxygen Status!	15 minutes
Activities Related To Topic	Activity #2 - Dissect It!	20 minutes
Topic Information, Discussion	Taking The Vitals	15 minutes
Activities Related To Topic	Activity #3 - Apply It!	20 minutes
Wrap Up, Social Time And Adjournment		10 minutes

Overview Of The Circulatory System

Your body's circulatory system is made up of three distinct parts:

- Pulmonary circulation (lungs)
- Coronary circulation (the heart)
- Systemic circulations (the rest of the body)

This system cycles blood throughout your entire body. Similarly, animals rely on an extensive system of organs and blood vessels to cycle blood throughout their bodies. Blood vessels are hollow pipes designed for carrying blood. All animals, including humans, rely on the hollow tubes found throughout their bodies to circulate blood. There are three different types of blood vessels: arteries, veins, and capillaries. During blood circulation, the arteries carry blood away from the heart and to the tissues where oxygen is used. The capillaries connect the arteries to veins. Finally, the veins carry the blood back to the heart.

Arteries

- Blood is pumped from the heart through the aorta, the main artery
- The aorta divides and branches out into many smaller arteries, reaching each region of an animal's body
- An artery is made up of three layers: an outer layer of tissue, a muscular middle and an inner layer of epithelial cells.
 - o The muscle in the middle is elastic and very strong.
 - o The inner layer is very smooth so that the blood can flow easily with no obstacles in its path.
 - o The muscular wall of the artery helps the heart pump the blood.

With each heartbeat, the artery expands as it fills with blood. When the heart relaxes, the artery contracts, exerting a force that is strong enough to push the blood along. This rhythm between the heart and the artery results in an efficient circulation system. The arteries deliver the oxygen-rich blood to the capillaries where the actual exchange of oxygen and carbon dioxide occurs. The capillaries then deliver the waste-rich blood to the veins for transport back to the lungs and heart.

Capillaries

- Unlike arteries and veins, the structure of capillaries is designed for gas exchange; they are only one epithelial (thin cells) cell thick and are very fragile.
 - The exchange of oxygen and carbon dioxide takes place through the thin capillary wall:
 - The red blood cells inside the capillary release their oxygen, which passes through the wall and into the surrounding tissue.
 - The tissue releases its waste products, like carbon dioxide, which passes through the wall and into the red blood cells.
 - Capillaries are also involved in the body's release of excess heat.
 - During exercise, an animal's body and blood temperature rises.
 - To help release this excess heat, the blood delivers the heat to the capillaries so it can be released into the tissue.

Veins

- Although they are thinner and contain less tissue than arteries, veins also have three layers: an outer layer of tissue, muscle in the middle, and a smooth inner layer of epithelial cells.
- Veins receive waste-rich blood from the capillaries after the exchange of oxygen and carbon dioxide has taken place.
- Gate-like valves located inside the veins ensure that blood keeps moving in the proper direction and is not allowed to flow backwards (important, considering that blood must flow against the force of gravity!)
- Waste-rich blood has been depleted of oxygen; as a result the blood has a deep purplish colour. The relatively thin walls of veins on your body allows for the blood to be seen through your skin.

What is a PULSE?

A pulse is a measure of the heart rate. It can be measured by counting the number of contractions felt when touching an artery near the surface of the skin. Since the rhythmic contractions keeps pace with the beat of the heart, we can easily get an accurate measure of the heart's pulse.

How is BLOOD PRESSURE measured?

The pressure of blood flowing through the arteries is measured using two numbers. The first number, which is higher, is taken when the heart beats during the systole phase. This is called the Systolic Pressure. The second number, which is lower, is taken when the heart relaxes during the diastole phase. This is called the **Diastolic Pressure**.

The Heart

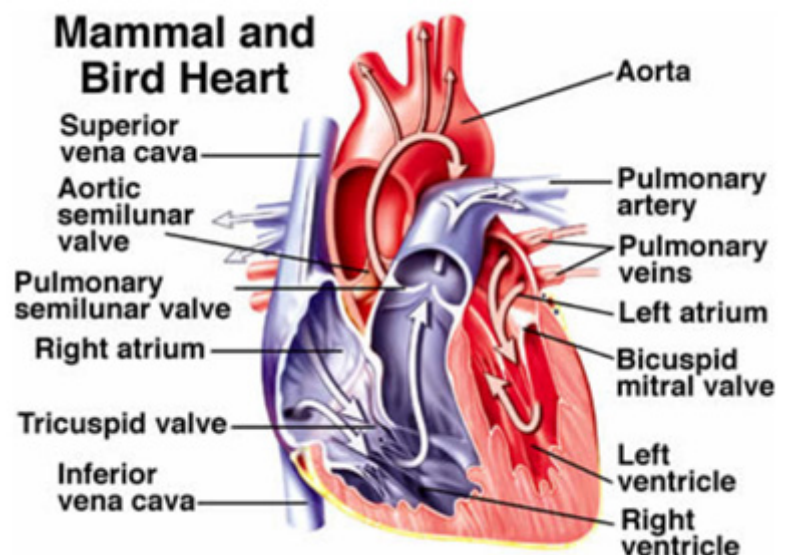
The heart works hard pumping blood to the rest of the body. Coronary circulation refers to the movement of blood through the tissues of the heart. As it was mentioned earlier, the circulation of blood through the heart is just on part of the circulatory system. Serious heart damage may occur if the heart tissue does not receive a normal supply of food and oxygen. The heart tissue receives nourishment through the capillaries located in the heart.

Systemic Circulation

Systemic circulation is a major part of the circulatory system, supplying blood to the rest of the body, except for the heart and the lungs. The blood vessels (arteries, veins, and capillaries) are responsible for the delivery of oxygen and nutrients to the tissue. Blood is forced into the aorta, which then branches into many smaller arteries, which run throughout the body. Deoxygenated blood returns to the heart through the veins.

Apply It?

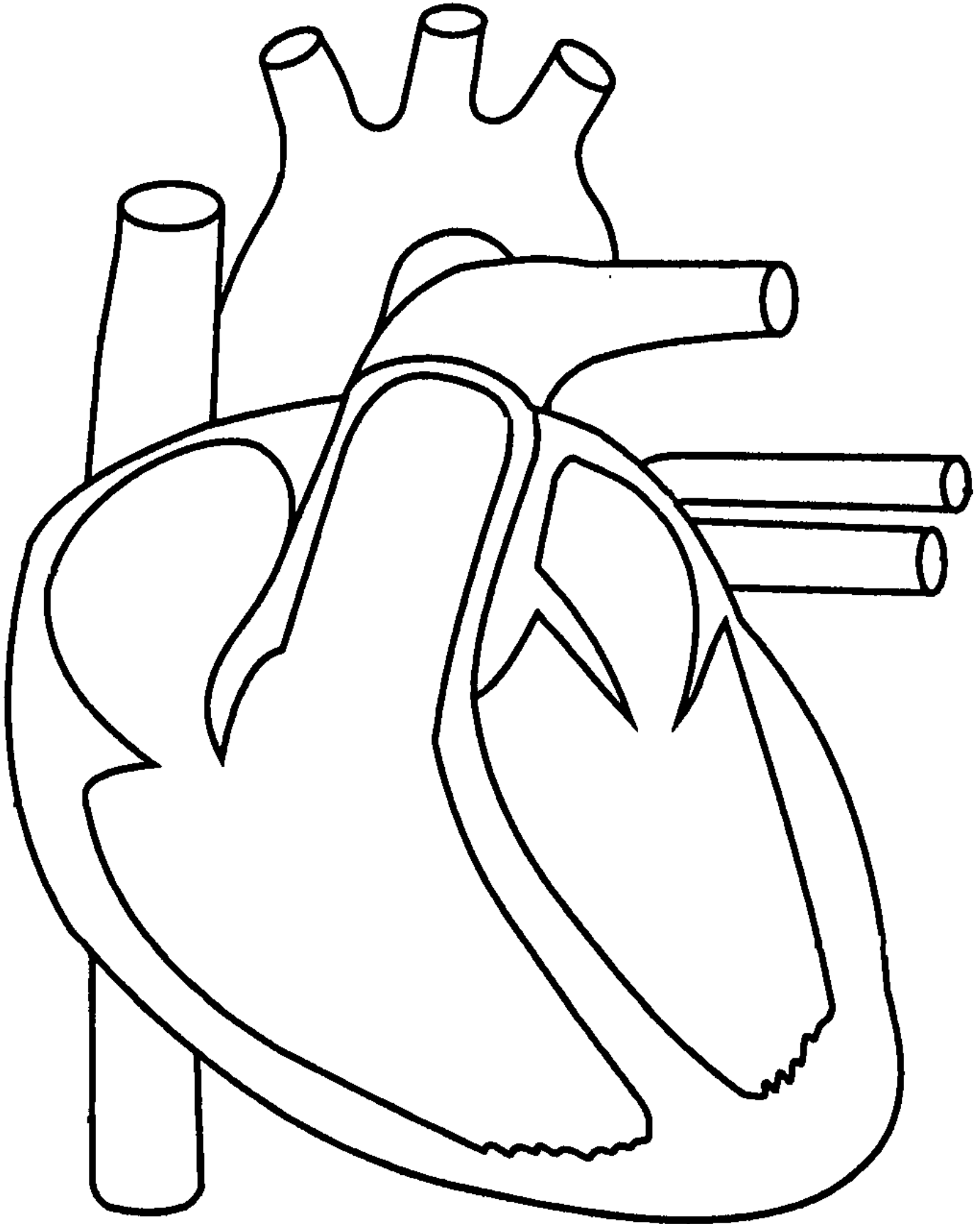
Blood that flows up to the brain must flow against the force of gravity. If the blood in your body is having a hard time climbing up, you will feel lightheaded and possibly even faint! Fainting is your brain's natural request for more oxygen-rich blood. When you faint, your head comes down to the same level as your heart, making it easy for the blood to quickly reach the brain.



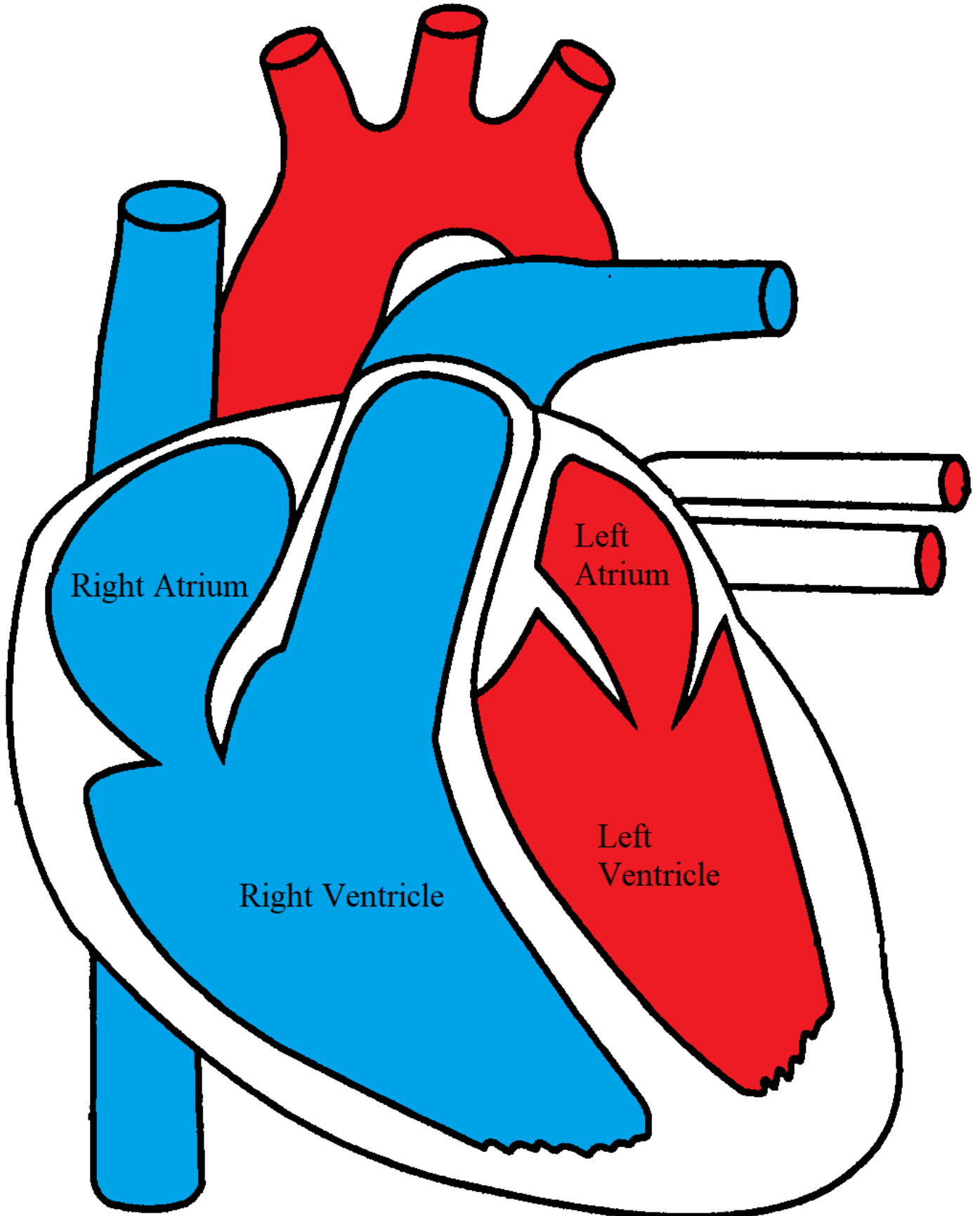
Activity #1 - Colour The Oxygen Status

Do	<p>Time: 15 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Blue and Red (or other colours) and the colouring page <p>Instructions:</p> <p>The activity will get you to colour in the heart with its oxygen status.</p> <ol style="list-style-type: none">1. You can use whatever colours you would like but please include a legend. Alternatively, you can use different patterns to note the different statuses.2. Next label all parts of the heart that you can (at least the ventricles and the atrium).
Reflect	<p>Learning Outcomes:</p> <p>The purpose of this activity is to go over the parts of the heart and to discuss the way that the oxygenated blood travels around the body.</p>
Apply	<p>Processing Prompts:</p> <ul style="list-style-type: none">• What is the purpose of the heart? Think of it like a pump.• What is the role of the aorta? Pulmonary artery? And vena cava?

Colour The Oxygen Status



Colour The Oxygen Status - ANSWER KEY



Activity #2 - Dissect It!

Do	<p>Time: 20 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Pig or Cow Heart(s)• Scalpel• Knife• Latex gloves <p>Instructions:</p> <p>Get a heart from a local abattoir or grocery store. Next open the heart up to show the chambers. Talk about the heart as you did in the last activity and look at the structure and the amount of muscle. Members can all open their own heart if they wish. Discuss why the heart needs to have its structure to ensure it does its job.</p> <p>Focus on safety: If members are opening the heart with the scalpel or knife, special attention should be paid to safe sharps handling.</p>
Reflect	<p>Learning Outcomes:</p> <p>The purpose of this activity is to go over the parts of the heart and to give members a hands-on activity (not on paper) to discuss the structure and function of the heart.</p>
Apply	

Taking The Vitals (Amended From The Ontario 4-H Goat Manual)

Normal Vital Signs

A good way to identify signs of abnormal goat health is the physical condition of a goat. This can be in the form of body condition score or in the vital signs of the goat.

For Senior members: If you have ever taken a first aid course, this is like the airway, breathing, and circulation (ABC) check that you would use to determine human vital signs. We pair these ABC checks with the animal's temperature as this will help us determine if the goat might be running a fever or might have some other ailment.

In general, it is important to recognize the normal ranges of the animal you are examining. For those values that fall outside of the range (either higher or lower), this can indicate a problem with your goat.

Biosecurity Break!

Make sure that you wash your hands before and after you take an animal's vital signs. You can spread diseases from one animal to the next on your hands (consider gloves or other PPE).

DID YOU KNOW?



TPR is a term that means temperature, pulse and respiration rate and is often used in an animal and human health context.

Diagnostic Techniques To Determine Vital Signs

1. If glass, shake the thermometer down to ensure an accurate reading.
2. Apply a lubricant to the end of the thermometer with petroleum jelly or a water-based lubricant.
3. Ensure the goat/kid is restrained (at the most minimal level) and lift the tail to gently insert the thermometer partway into the rectum and hold it there for at least 20-30 seconds.
4. Remove the thermometer and read the results and verify the temperature falls within the appropriate range.
5. The animal mustn't be stressed or hot when taking the temperature as this can change the reading to read outside of the normal range.

To Check The Respiration Rate:

1. Ensure the animal is calm and place a hand on its side (especially if there is a lot of hair). Count each breath that the animal takes (movement outward of the chest; or expansion of the chest wall) for 1 minute.
2. Check the normal range for that animal.

To Check The Heart Rate Or Pulse:

1. Ensure the animal is as calm as possible.
2. Find the animal's artery below and slightly inside the jaw with your fingers
3. Watch a clock (preferably a watch with hands) and count the number of heartbeats observed in 15 seconds (older members can use a stopwatch on their phone to count the time and a calculator for subsequent calculations).
4. Multiply that number by 4 to get the number of beats per minute.
5. Remember that the rate can be up to 2x higher for kid goats.

Discuss It!

What does normal look like? Does the animal look uncomfortable? Do the vital signs point to abnormal physical signs which might explain an underlying condition or disease?

Activity #3 - Apply It!

Do	<p>Time: 20 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Some form of animal (large or small) <p>Instructions:</p> <p>Using the information from the last topic information section, check the vitals on one animal with the help of a trained veterinarian or veterinary technician.</p>
Reflect	<p>Learning Outcomes:</p> <p>To apply knowledge gained from this meeting.</p>
Apply	<p>Discuss The Following Prompts As A Group:</p> <ul style="list-style-type: none">• What is the importance of taking vitals and understanding normal ranges?

Meeting 4 - Transport Vessels

Setting Objectives:

To identify the role, structure, and function of blood.

Suggested Learning Outcomes:

- To identify the parts of blood and their role.
- To identify techniques veterinarians, use to diagnose problems relating to blood.

Suggested Roll Call Questions:

- Give one component of blood and its purpose.
- What do you use blood for?

SAMPLE MEETING AGENDA

Time: 2 hours

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	15-20 minutes
Topic Information, Discussion	What Is Blood?	20 minutes
Activities Related To Topic	Activity #1 - Tour A Lab	50 minutes
Wrap Up, Social Time And Adjournment		10 minutes

What Is Blood?

Blood is the fluid consisting of plasma, blood cells, and platelets, which is circulated by the heart through the cardiopulmonary (both heart and lungs) system, carrying oxygen and nutrients to and waste materials from all body tissues.

Blood is what keeps us and our animals alive!

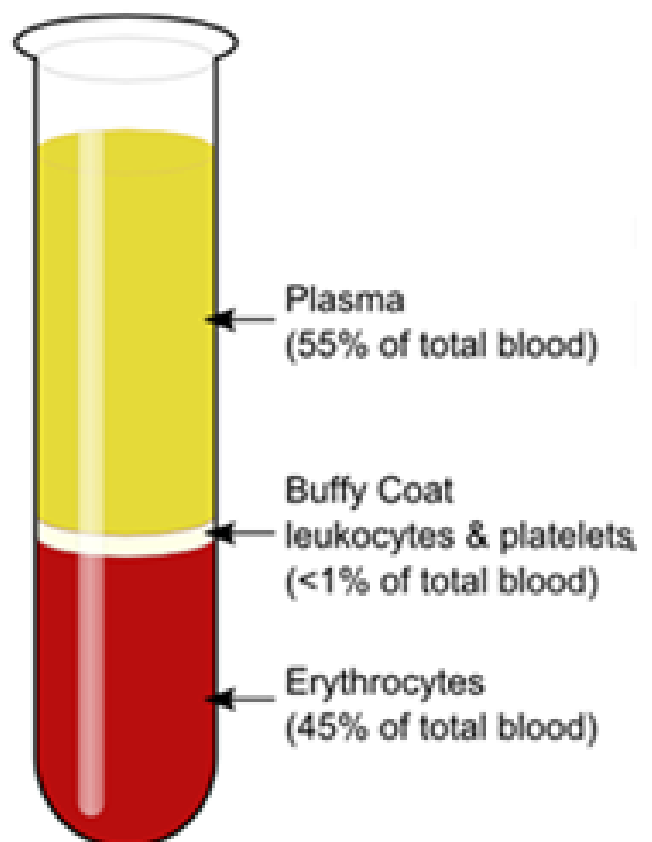
But let us break down the parts:

1. Plasma: A yellowish fluid that contains nutrients, proteins, hormones and other non-functional components.
2. Red Blood Cells (RBCs): These are also called erythrocytes and are shaped like flattened disks (like hockey pucks) that are slightly indented. RBCs contain hemoglobin which binds oxygen and carries it around the body. RBCs stay in the body for up to 4 months but each day, discarded RBCs are replaced by newly created RBCs from the bone marrow.
3. White Blood Cells (WBCs): These are also called leukocytes and are a key part of the immune system of animals. The immune system protects the body's organs from invading pathogens and other stressors. The level of WBCs in infected individuals are often higher than unaffected individuals as the body creates more WBCs when the body is under attack.
4. Platelets: The fourth and final component of blood are also called thrombocytes. These are cells that aid in the process of clotting. When you get a cut, platelets gather and try and close the area to prevent more blood loss and to prevent infection.

Using a tool called a centrifuge, blood can be spun down into its components which is the basis of our tests and understanding of blood. A centrifuge spins tubes in a circle fast so that a sample can be separated by their mass (with the heaviest components at the bottom of the tube). There are three components when spinning blood which can be analysed by tests:

- Plasma
- Buffy Coat (which includes both the leukocytes (WBCs) and the thrombocytes (platelets)).
- Erythrocytes (RBCs).

Relative percentages in each fraction are also given on the image.



Activity #1 - Tour A Lab!

Do	<p>Time: 50 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• None <p>Instructions:</p> <p>The activity is for members to tour a lab that analyzes blood or tissue. These are present at most universities and potentially in private practices or at private companies.</p> <p>See if you can get a tour or if facility manager or other personnel will give members a virtual tour!</p> <p>Get the person to go over some of the equipment that they use everyday!</p>
Reflect	<p>Learning Outcomes:</p> <p>The purpose of this activity is for members to see a facility that handles blood and other samples.</p>
Apply	<p>Discuss The Following Prompts As A Group:</p> <ul style="list-style-type: none">• How many people work at this lab?• What are the different jobs?• What kind of tests do they do in the lab?

Meeting 5 - Diagnostics And Complications

Setting Objectives:

To identify tools and techniques for diagnosing issues with the pulmonary and respiratory issues.

Suggested Learning Outcomes:

- To identify the parts and function of a stethoscope.
- To identify diseases affected the vasculature.

Suggested Roll Call Questions:

- What tools does your doctor use to diagnose an illness?

SAMPLE MEETING AGENDA

Time: 1 hour 40 minutes

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	15-20 minutes
Topic Information, Discussion	Let's Talk Diagnostics!	10 minutes
Activities Related To Topic	Activity #1 - Using A Stethoscope	30 minutes
Wrap Up, Social Time And Adjournment		20 minutes

Let's Talk Diagnostics!

A veterinarian team has several tools that they can use in assessing the key vital organ systems including the respiratory, circulatory and the digestive. This section breaks down those tools for members to delve a little deeper into the world of veterinary medicine:

Thermometer: This tool is straightforward and is something that all members should be familiar with. It is used for taking temperatures and can be quite useful for determining if an animal is fighting an infection or disease if too high or low.

Surgical Instruments: These are the tools used for surgery and may include scalpels, tweezers, pliers, and sutures. These tools can be used by trained professionals to perform surgery and conduct other procedures. One of the most important aspects is that these materials need to be kept sterile so that infection does not result from any surgeries.

Blood Tests: This diagnostic test uses principles of blood that we discussed earlier in this section. Essentially, components in the blood can be separated based on which level they are on and protein and enzymes which can be quantified and identified. These tests can be quite complicated, but the purpose of this section is to bring some of the tests available to your attention.

Stethoscope: A stethoscope is an instrument used for something called "auscultation". This term refers to listening to internal sounds of an animal. There are a few parts of this medical instrument. One end, also known as the bell, is a small disk that resonates into the tubes that go into the ears. As a part of the next activity, members will have the chance to use this type of instrument to hear and conduct part of a physical exam on a species that is available for this meeting.

Activity #1 - Using A Stethoscope

Do	<p>Time: 30 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Stethoscope, trained professional (if possible) <p>Instructions:</p> <p>In this activity, members will explore the use of a stethoscope through hands on instruction from a veterinarian, veterinary technician, human doctor, or student.</p> <p>Members can be told what they are hearing and what it might mean</p>
Reflect	<p>Learning Outcomes:</p> <p>The purpose of this activity is for members to use a key diagnostic tool for veterinary medicine.</p>
Apply	

Meeting 6 - Putting It All Together!

Setting Objectives:

To identify tools and techniques for diagnosing issues with the pulmonary and respiratory issues.

Suggested Learning Outcomes:

- To identify the parts of both the circulatory system and respiratory system through dissection.

Suggested Roll Call Questions:

- What is the number one thing you will take with you from this club?
- What else are you still questioning about these systems?

SAMPLE MEETING AGENDA

Time: 2 hour 10 minutes

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	15-20 minutes
Activities Related To Topic	Activity #1 - Dissection Time	80 minutes
Wrap Up, Social Time And Adjournment		10 minutes

Activity #1 - Dissection Time

Do	<p>Time: 80 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Dissection Guide• Specimen or online dissection game <p>Instructions:</p> <p>If it is possible to do this activity in person, it will have the most impact. Dissection guides can be found online for the species that you are able to dissect (it is best if the vessels are coloured).</p> <p>Otherwise you can use open source online dissection guides: https://froggy.lbl.gov/virtual/ https://www.pbslearningmedia.org/collection/dissection-videos-for-classroom-use/</p> <p>There is a chance that these links may become broken. If so, you can search updated resources online. There are also paid options for guides but these are likely not necessary.</p>
Reflect	<p>Learning Outcomes:</p> <p>The purpose of this activity is for members to put it all together through a hands-on activity.</p>
Apply	<p>Discuss The Following Prompts As A Group:</p> <ul style="list-style-type: none">• Can you trace the path of oxygen and carbon dioxide throughout the animal?



Digestive System

Meeting 1 - A Great Opening

Setting Objectives:

To identify the structure and role of the oral cavity and how that relates to the types of diets that an animal consumes.

Suggested Learning Outcomes:

- To discuss an overview.
- To outline the role of dentition (teeth structure).
- To compare the different types of diets that animals consume.

Suggested Roll Call Questions:

- Name something that an animal eats.
- Can you name a type of diet that an animal eats?
- What did you eat today?

SAMPLE MEETING AGENDA

Time: 2 hours 30 minutes

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	20-25 minutes
Topic Information, Discussion	Parts Of The Digestive System	15 minutes
Activities Related To Topic	Activity #1 - Digestion Jeopardy	15 minutes
Topic Information, Discussion	Types Of Diets	10 minutes
Activities Related To Topic	Activity #2 - Place The Foods!	15 minutes
Topic Information, Discussion	Introduction To Teeth	15 minutes
Activities Related To Topic	Activity #3 - Form And Purpose	20 minutes
Topic Information, Discussion	Diseases Affecting The Oral Cavity	10 minutes
Wrap up, Social time And Adjournment		10 minutes

Parts Of The Digestive System

Structure	Components	Function	What happens to the food?
Mouth	<ul style="list-style-type: none"> Contains lips, teeth, a tongue, and salivary glands 	<ul style="list-style-type: none"> Lips help bring food into mouth. Teeth begin mechanical digestion. The tongue helps mix and move food towards the esophagus. Salivary glands provide juices containing enzymes that help in the chemical digestion of food. The epiglottis, a muscular flap, closes off the trachea and opens the esophagus so that food can pass smoothly to the stomach. 	<ul style="list-style-type: none"> The teeth crush the food. Saliva wets it and turns it into a soft mash; saliva contains enzymes which begin digestion of starch (a complex carbohydrate) Tongue turns the mash into a bolus.
Esophagus	<ul style="list-style-type: none"> Tube connecting mouth and stomach The cardiac sphincter, a special ring of muscles, is located where the esophagus joins the stomach 	<ul style="list-style-type: none"> The passage of chewed food from the mouth to the stomach The cardiac sphincter is normally closed preventing food and acid in the stomach from moving back up. A peristaltic contraction triggers to open 	<ul style="list-style-type: none"> No digestion occurs here
Stomach	<ul style="list-style-type: none"> The simple stomach is divided into several regions: the cardia, the body, and the pylorus The walls of the stomach have three layers: <ol style="list-style-type: none"> an inner MUCUS MEMBRANE, or lining with glands that secrete important digestive juices A thick middle MUSCLE LAYER that makes movement possible An outer layer of CONNECTIVE TISSUE 	<ul style="list-style-type: none"> First major digestive organ within the gut The lining of the stomach secretes gastric juice, a mixture of mucus the enzyme pepsin and hydrochloric acid (HCl) The mucus acts as a gel to provide a flexible protective coating to the stomach Pepsin helps in the digestion of protein HCl is what gives the stomach the acidic environment needed by the enzymes that work there Separating the stomach from the intestine is the PYLORIC SPHINCTER. Like the cardiac sphincter, it acts as a valve. It prevents food moving back into the stomach, and lets food enter the intestine when opened 	<ul style="list-style-type: none"> Powerful contractions churn the food, mixing it with the gastric juice PROTEINS are partially digested here; fats and carbohydrates are not well digested No nutrients are completely digested in the stomach. Therefore, the food must be sent on to the small intestine By the time the stomach is finished, the food is a soft, warm, grey to brown mush called CHYME

Structure	Components	Function	What happens to the food?
<p>Small Intestines</p>	<ul style="list-style-type: none"> • The SMALL INTESTINES are divided into three sections – the duodenum, the jejunum and the ileum • The DUODENUM: This is the first part of the small intestine. It occupies roughly 5% of the total length. It is tied to the stomach, and is formed in an S-shaped curve, which hold the pancreas. Ducts from the pancreas and the liver enters here • JEJUNUM: this central portion is the largest part of the small intestine, occupying 90% pf the length. It is not clearly separated from either the duodenum of the ileum • ILEUM: this last 5% is usually bunched up or contracted. It meets the large intestine at the ILEO-CECAL VALVE, which prevents food from moving back up into the small intestines 	<ul style="list-style-type: none"> • The small intestine has two major functions <ol style="list-style-type: none"> 1. To complete the digestion of food 2. To absorb nutrients • Digestion occurs primarily in the duodenum and the jejunum. This is where intestinal juice mixes with bile and pancreatic juice to provide the enzymes needed to finish the breakdown of food • Intestinal juice comes from the lining of the wall of the intestine. Unlike the stomach, which is acidic, the juices in the small intestine are alkaline • Absorption takes place once digestion is complete, in the final two thirds of the jejunum and in the ileum • The exception to this rule is animals whose cecum is enlarged and specialized, because this is where cellulose digestion and absorption occurs • The horse, rabbit and pig all have unique cecum • The walls of the small intestine contain two important parts: GLANDS, which secrete intestinal juices that aid in digestion; and VILLI • Villi are small finger-like projections in the lining of the intestine that greatly increases its surface area • Due to the villi, nutrients are more easily and more quickly absorbed. The villi are moving continuously and surrounded by digested food. As the digesta passes through the intestine this allows for maximum absorption of nutrients. 	<ul style="list-style-type: none"> • As food leaves the stomach, it is a semi-fluid acidic mass known as CHYME. Chyme is gradually released into the duodenum thanks to periodic openings of the pyloric sphincter • As soon as chyme enters the duodenum, it mixes with new secretions and turns from an acid to an alkaline mush • Once digestion is complete, the chyme becomes chyle, a milky material that contains all the nutrients of digestion • The nutrients are picked up by the villi that line the intestine, and ultimately make their way into the animal's bloodstream

Structure	Components	Function	What happens to the food?
Large Intestine (Colon)	<ul style="list-style-type: none"> The large intestine differs from the small in that it is a larger, lumpier and has a more fixed position. It is divided into the cecum and the colon 	<ul style="list-style-type: none"> No digestion and very little absorption take place in the large intestines. Its job is: <ul style="list-style-type: none"> To remove excess water from the non-absorbed foods To concentrate non-absorbed foods into feces 1. CECUM: this is usually an off shoot where the small and large intestines meet. In humans and carnivores, it is a small and simple, not much more than a holding tank for digested food that has had all its nutrients removed In non-ruminant herbivores and omnivores, the cecum is more important. For example, in the horse, it is a huge pocket 1.3 meters long. Its capacity is greater than that of the stomach and its lining contains villi, glands and mucus membrane 2. COLON: the colon is a reservoir for excrement <ul style="list-style-type: none"> It empties into the RECTUM, which opens to the outside at the ANUS The anus is controlled by two sphincters In animals that have been trained, the external voluntary sphincter allows feces to be held until it is convenient for voiding 	<ul style="list-style-type: none"> Specialized cecums act like rumens. They have billions of microorganisms that ferment and digest cellulose. Unlike rumens, little gas is produced

Activity #1 - Digestion Jeopardy

Do	<p>Time: 20 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Prompts from next page <p>Instructions:</p> <p>The questions are attached on the next page with the answers highlighted in yellow.</p> <p>Read out the question and get members to call out Browser vs Grazer in a buzz in Go for the Gold format. Go for the Gold is a competition where members increase their knowledge of 4-H project materials, agriculture, food, community events and more in a challenging and fun team atmosphere! The format can be found online at 4-hontario.ca under youth, 4-H events and competitions. The format in this game is like the snapper questions in the game (True or False), however the rest of the game often has multiple choice or long answer questions which are meant to test knowledge of 4-H members.</p>
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to introduce some fun facts related to digestion so that members can gain an appreciation for the future directions of this manual.</p>
Apply	<p>Discuss The Following Prompts As A Group:</p> <ul style="list-style-type: none">• Were there any questions that you did not know the answer to?• How might you find answers to your questions if you have any while taking this club? (Online, textbooks, leader, or expert resources).

Jeopardy Prompts

1. Digestion is:
 - a. The process whereby food is broken down into simpler compounds that can be absorbed into the body.
 - b. The process whereby food is chewed and mixed with saliva
 - c. The process whereby nutritious food is separated from harmful or non-nutritious food
 - d. All of the above
 - e. None of the above
2. Another name for the gut is the
 - a. Digestive pathway
 - b. Stomach
 - c. Abdomen
 - d. Alimentary canal
3. Which animals have the simplest digestive systems?
 - a. Herbivores
 - b. Carnivores
 - c. Omnivores
4. Carnivores have the simplest digestive system because
 - a. They are usually smaller animals
 - b. They are aggressive animals, and need simple stomachs so that they can eat a large amount of food in a short time
 - c. They eat mainly protein, and protein is easy to digest
5. Herbivores have specialized guts to allow them to digest
 - a. Carbohydrates
 - b. Cellulose
 - c. Lipids
 - d. Minerals
6. Which organ of the bird acts as its "back teeth"?
 - a. Gizzard
 - b. Crop
 - c. Ceca
7. Enzymes are catalysts, and catalysts help:
 - a. Determine which type of nutrient is in the gut
 - b. Move food smoothly through the system
 - c. Speed up chemical reactions
8. Which of these enzymes is NOT produced by the animal?
 - a. Cellulase
 - b. Lipase
 - c. Protease
 - d. Carbohydrase
9. The valve separating the esophagus from the stomach is called:

- a. The cardiac sphincter
 - b. The pyloric sphincter
 - c. The gastric sphincter
 - d. The esophageal sphincter
10. The valve separating the stomach from the intestine is called:
- a. The cardiac sphincter
 - b. The pyloric sphincter
 - c. The gastric sphincter
 - d. The intestinal sphincter
11. The inner lining of the stomach is the:
- a. Mucosa
 - b. Muscle layer
 - c. Connective tissue
12. Saliva helps in the chemical breakdown of
- a. Protein
 - b. Cellulose
 - c. Fats
 - d. Carbohydrates
13. Once food has been chewed, it is formed into a round mass before it is swallowed. This mass is called:
- a. Chyle
 - b. Chyme
 - c. Bolus
 - d. Gland
14. The environment of the stomach is
- a. Alkaline
 - b. Acidic
15. What are the three ingredients of gastric juice?
16. When partially digested food leaves the stomach, it is called
- a. Bolus
 - b. Gland
 - c. Chyle
 - d. Chyme
17. Stomatitis is an inflammation of the
- a. Stomach
 - b. Esophagus
 - c. Mouth
18. The specialized rubber tube used to push objects caught in the esophagus down into the stomach is a
- a. Plunger
 - b. Probang
 - c. Slide
 - d. Burgeon

19. Ruminants are:
 - a. Herbivores
 - b. Carnivores
 - c. Omnivores
20. How many compartments are there in the ruminant stomach?
21. Which compartment is the largest?
22. Which compartment is the driest?
23. Which compartment is a water reservoir?
24. Which compartment is also called the true stomach?
25. Rumination is the process whereby
 - a. Cellulose is broken down by microorganisms
 - b. Food in the stomach is brought back up to the mouth and rechewed
 - c. Animals carefully separate cellulose from other foods
26. Rumination takes longer if the food is
 - a. Soft
 - b. Coarse
 - c. Sweet
 - d. Fresh
27. Fermentation occurs in the:
 - a. Rumen
 - b. Omasum
 - c. Abomasum
 - d. Esophagus
28. Fatty acids are a by-product of fermentation. What happens to them after digestion?
 - a. They are voided as a waste product
 - b. They are used as a source of energy
 - c. Nothing happens to them; they simply stay in the lining of the stomach
29. Microorganisms are a good source of:
 - a. Cellulose
 - b. Fats
 - c. Proteins
 - d. Vitamins
30. A build-up of gas in the rumen is called:
 - a. Gastric impaction
 - b. Indigestion
 - c. Gastritis
 - d. Bloat

31. In severe cases of bloat, the gas must be removed by puncturing the rumen. The instrument used is a:
- Debloater
 - Trocar
 - Probang
 - Release valve
32. Hardware Disease occurs when metal objects penetrate the:
- Rumen
 - Reticulum
 - Abomasum
 - Omasum
33. Glands outside the gut that help in digestion are called
- Sub-guttural glands
 - Accessory glands
 - Gastro-cecal glands
34. Which salivary gland is found on each side of the base of the tongue?
- Parotid
 - Mandibular
 - Sublingual
35. The drier the food, the thicker the saliva. True False
36. Which of these functions is NOT performed by saliva?
- Lubricating the mouth and esophagus
 - Softening and wetting food
 - Partially digesting starches
 - Dividing large molecules of lipids
37. The pancreas is located
- Behind the stomach
 - In the loop of the duodenum
 - At the junction of the small and large intestines
 - Behind the angle of the jaw
38. Pancreatic juice contains
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 - Salt
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 - Oval
 - S-shaped
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 - Ileum
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 - Alkaline
54. Excess water is removed from waste food in the
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55. Once digestion is finished, chyme becomes
- Chiton
 - Bolus
 - Chymase
 - Chyle
56. Colic most commonly occurs in:
- Horses
 - Cows
 - Pigs
 - Cats
57. The process by which nutrients are taken into the bloodstream is:
- Absorption
 - Fermentation
 - Digestion
 - Assimilation

58. Where does most absorption occur?
- Stomach
 - Small intestine
 - Large intestine
 - Throughout the gut
59. Water is important to absorption because:
- It keeps the villi moist
 - It prevents food from drying out and sticking to the lining of the gut
 - It is the medium through which nutrients pass into the bloodstream
60. Assimilation is the process whereby
- Food is broken down
 - Nutrients are taken up by the blood
 - Nutrients are used by the body
 - Digestive juices are mixed with food
61. Assimilation
- Is a slow process
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 - 2 days
 - 1 day
 - 1 week
 - 1 month
64. The most serious effect of diarrhea is
- Dehydration
 - Lack of appetite
 - Inflammation of rectum
 - Vomiting

Jeopardy Prompts - ANSWER KEY

- Digestion is:
 - The process whereby food is broken down into simpler compounds that can be absorbed into the body.
 - The process whereby food is chewed and mixed with saliva
 - The process whereby nutritious food is separated from harmful or non-nutritious food
 - All of the above**
 - None of the above
- Another name for the gut is the
 - Digestive pathway
 - Stomach
 - Abdomen
 - Alimentary canal**
- Which animals have the simplest digestive systems?
 - Herbivores
 - Carnivores**
 - Omnivores
- Carnivores have the simplest digestive system because
 - They are usually smaller animals
 - They are aggressive animals, and need simple stomachs so that they can eat a large amount of food in a short time
 - They eat mainly protein, and protein is easy to digest**
- Herbivores have specialized guts to allow them to digest
 - Carbohydrates
 - Cellulose**
 - Lipids
 - Minerals
- Which organ of the bird acts as its "back teeth"?
 - Gizzard**
 - Crop
 - Ceca
- Enzymes are catalysts, and catalysts help:
 - Determine which type of nutrient is in the gut
 - Move food smoothly through the system
 - Speed up chemical reactions**
- Which of these enzymes is NOT produced by the animal?
 - Cellulase**
 - Lipase
 - Protease
 - Carbohydrase

9. The valve separating the esophagus from the stomach is called:
- The cardiac sphincter**
 - The pyloric sphincter
 - The gastric sphincter
 - The esophageal sphincter
10. The valve separating the stomach from the intestine is called:
- The cardiac sphincter
 - The pyloric sphincter**
 - The gastric sphincter
 - The intestinal sphincter
11. The inner lining of the stomach is the:
- Mucosa**
 - Muscle layer
 - Connective tissue
12. Saliva helps in the chemical breakdown of
- Protein
 - Cellulose
 - Fats
 - Carbohydrates**
13. Once food has been chewed, it is formed into a round mass before it is swallowed. This mass is called:
- Chyle
 - Chyme
 - Bolus**
 - Gland
14. The environment of the stomach is
- Alkaline
 - Acidic**
15. What are the three ingredients of gastric juice? (**Hydrochloric acid, the enzyme pepsin, mucus**)
16. When partially digested food leaves the stomach, it is called
- Bolus
 - Gland
 - Chyle
 - Chyme**
17. Stomatitis is an inflammation of the
- Stomach
 - Esophagus
 - Mouth**
18. The specialized rubber tube used to push objects caught in the esophagus down into the stomach is a
- Plunger
 - Probang**
 - Slide
 - Burgeon

19. Ruminants are:
- Herbivores**
 - Carnivores
 - Omnivores
20. How many compartments are there in the ruminant stomach? **(Four)**
21. Which compartment is the largest? **(Rumen)**
22. Which compartment is the driest? **(Omasum)**
23. Which compartment is a water reservoir? **(Reticulum)**
24. Which compartment is also called the true stomach? **(Abomasum)**
25. Rumination is the process whereby
- Cellulose is broken down by microorganisms
 - Food in the stomach is brought back up to the mouth and rechewed**
 - Animals carefully separate cellulose from other foods
26. Rumination takes longer if the food is
- Soft
 - Coarse**
 - Sweet
 - Fresh
27. Fermentation occurs in the:
- Rumen**
 - Omasum
 - Abomasum
 - Esophagus
28. Fatty acids are a by-product of fermentation. What happens to them after digestion?
- They are voided as a waste product
 - They are used as a source of energy**
 - Nothing happens to them; they simply stay in the lining of the stomach
29. Microorganisms are a good source of:
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30. A build-up of gas in the rumen is called:
- Gastric impaction
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Types Of Diets

Like humans, animals need food to survive. But before the food can provide the needed nutrients, it must be broken down into smaller compounds that can be absorbed by the blood and used by the body. This process is called digestion.

The digestive system is made of the Gastrointestinal Tract, also called the Alimentary Canal or Gut. It is a long, muscular tube that runs from one end of the animal to the other. At intervals, it widens into regions called the mouth, esophagus, stomach, small intestine, large intestine, rectum, and anus. Two other organs, the liver and pancreas, link up with the gut, and they provide important juices for digestion.

Carnivores or meat eaters have simple systems, because protein, the main ingredient of meat, is easy to digest.

Herbivores or plant eaters have more complex systems. This is because plant materials are harder to break down. The walls of plant cells are made of cellulose, and cellulose has strong chemical bonds, which makes it tough to break down. In order to digest it properly herbivores have specialized guts. Ruminants such as the cow and sheep have stomachs with four chambers to take care of this problem. Others such as the horse and rabbit have enlarged intestines.

Omnivores or animals that eat both meat and plant material, have a gut that falls somewhere in the middle. The pig for example, has a simple stomach with an enlarged front portion as well as a specialized intestine.

Domesticated birds have changed their gut to digest easily. In poultry, these changes include a crop, gizzard and ceca. The crop is a storage area for food directly in front of the stomach. The gizzard, found after the stomach, is in fact the bird's back teeth, helping break down hard foods such as seeds. The ceca are two dead-end sections that open out off the intestine. They are the storage sites for waste material.

Activity #2 - Place The Foods!

Do	<p>Time: 15 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Blank/Scrap piece of paper for each individual, writing instrument. <p>Instructions:</p> <p>Get members to think of ingredients/foods (hay or chicken or soybean meal) that might belong to each diet type and write them down in a list for herbivore and carnivore. Give members 3 minutes for this first task.</p> <p>Next, get members to pair with another member and add to their list and think about others. Give members 5 additional minutes.</p> <p>Next as a group, see how many unique items each pair has on their list. Count the total and the unique for each group.</p> <p>Additionally, leaders might bring in a few items of their own to add to the list at the end so that members can see and feel different types of feeds.</p>
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to identify the differences and similarities between diet types.</p>
Apply	<p>Discuss The Following Prompts As A Group:</p> <ul style="list-style-type: none">• What is an example of an animal that might eat items from both the carnivore and herbivore categories?• How might an animal's preferred diet be decided by their surroundings?

Introduction To Teeth

As with humans, animals have two sets of teeth. The first ones are temporary “baby” or “milk” or “deciduous” teeth. They are softer and fewer in number than the permanent teeth.

There are three classes of teeth and their purposes are:

1. Incisors – cutting
2. Canine – tearing or seizing
3. Molars and premolars – grinding or shearing

Different animals have different sizes and number of these teeth which are useful for their specific diet. This topic will be covered later but different species also have different teeth come in at different times and replaced by others at certain times:

Dog	<ul style="list-style-type: none">• No teeth at birth• From 3-6 months permanent incisors appear• From 6-7 months all permanent teeth are in
Bovine (Cow)	<ul style="list-style-type: none">• Central incisors are in at birth or by 2 weeks• At 2 weeks all temporary teeth are in• The permanent teeth appear slowly, starting at 6 months and ending at 4 years
Horse	<ul style="list-style-type: none">• Baby teeth appear between birth and 9 months• Permanent teeth appear between 6 months and 5 years
Goat/Sheep	<ul style="list-style-type: none">• First temporary incisors appear at 1-7 days• By 6 weeks all temporary teeth are in• Permanent teeth appear at 4 years of age
Pig	<ul style="list-style-type: none">• Canine teeth are present at birth• These “needles” teeth are removed to prevent injury to the sow• By 4 weeks almost all temporary teeth are in at 20 months

Estimating Age From Teeth!

You can often estimate the age of the animal by the number and type of teeth present. For example, in the sheep, one pair of permanent front teeth should come in each year from one to four years. Therefore, you can estimate the age of the animal by the number of permanent teeth that it has. From then on only an estimate of the age is possible from the mouth.

Veterinary Dentists???

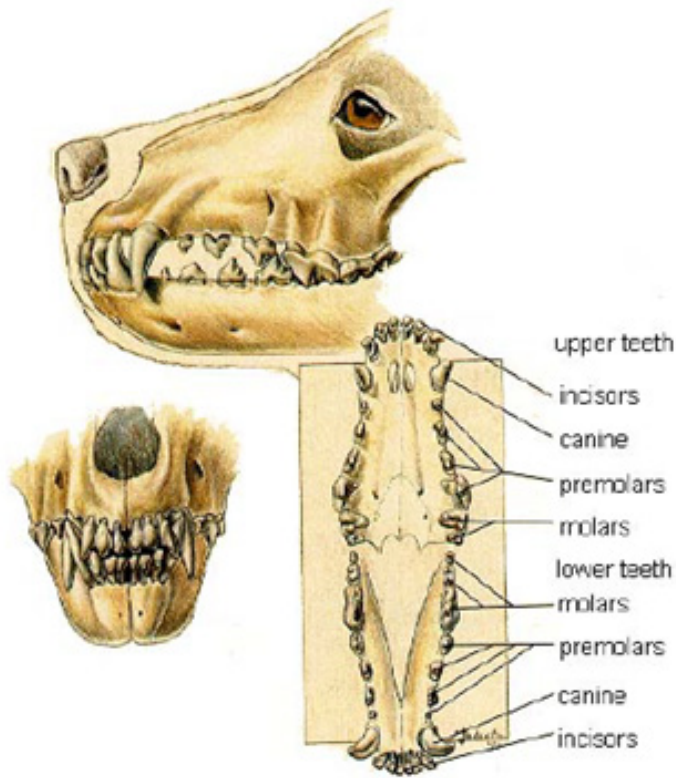
Teeth are necessary for animals to eat, and an animal must eat properly to maintain good health. Like humans, animals can develop plaque build-ups, cavities, periodontitis and gingivitis. Plaque is the major cause of periodontitis and gingivitis and if left untreated both can lead to systemic infection (i.e. infection that travels through the bloodstream). Dental care is available through a veterinarian.

Bad breath, medically known as “halitosis”, results from the bacterial infection of the gums causing periodontal disease. In rare cases, some diseases or situations can cause bad breath in the absence of, or in addition to, tooth/gum disease. Conditions such as kidney failure, diabetes, nasal or facial skin infections, cancers, or situations where the animal is ingesting feces or other materials, can cause bad breath with or without periodontal disease.

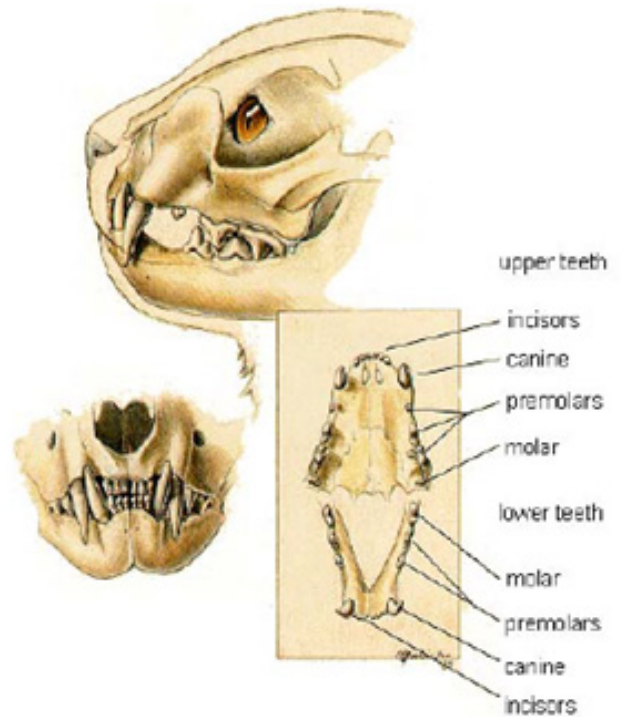
Both plaque and tartar can damage the teeth and gums. Disease starts with the gums –they become inflamed (red, swollen, and sore). The gums finally separate from the teeth, creating pockets where more bacteria, plaque and tartar build up. This in turn causes more damage, and finally it causes tooth and bone loss.

This affects the whole body too. Bacteria from these inflamed oral areas can enter the bloodstream and affect major body organs. The liver, kidneys, heart and lungs are most affected. Antibiotics are used prior to and after dental cleaning to prevent bacterial spread through the blood stream.

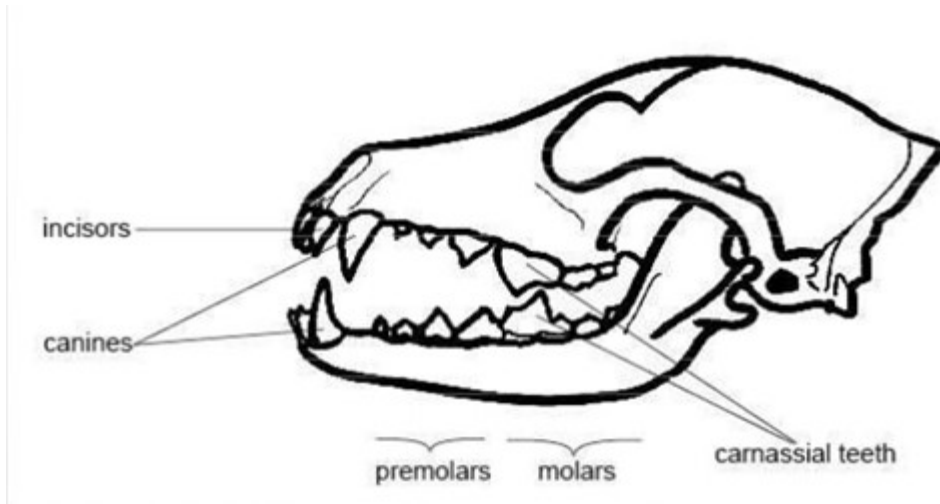
DOG TEETH



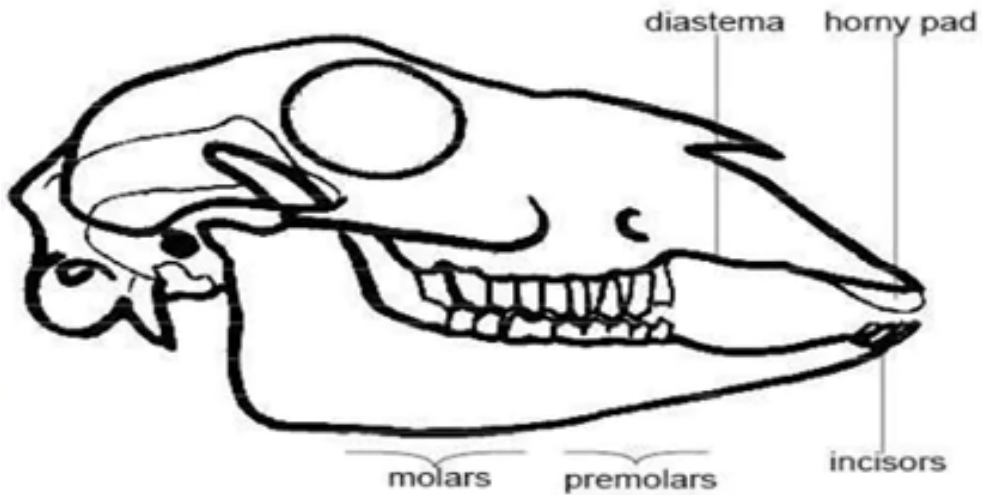
CAT TEETH



The following is some of the morphological differences between species:



Herbivores Skull and Teeth:



Omnivores are like yourself; they are a mix between both herbivores and omnivores and have similar features to both above.

Activity #3 - Form And Purpose

Do	<p>Time: 20 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Teeth and potentially jaws from various species <p>Instructions:</p> <p>Find different teeth of various species (a vet might have some teeth that they could lend you) and compare them. Pay attention to the size, the shape and how they wear.</p> <p>Identify the differences between form and structure and hypothesize why these teeth might be structured the way that they are.</p> <p>Get youth to hypothesize why this might be.</p>
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to identify the importance of different jaw sizes, teeth structures and overall composition for the purpose of that specific species.</p>
Apply	<p>Discuss The Following Prompts As A Group:</p> <ul style="list-style-type: none">• What is the structure you hypothesized for herbivores?• For carnivores?• For omnivores?• Did any structures surprise you? Might they be important for ripping or tearing or grinding?

Diseases Affecting The Oral Cavity

The topic information contained in this meeting will cover diseases affecting the oral cavity.

Stomatitis

Stomatitis is an inflammation of the mouth and can occur in all animals. It is caused by bruising or by chemical irritation.

CLINICAL SIGNS:

- Excessive salivation
- Evident pain in the mouth
- Bad breath

TREATMENT: Usually, treatment is simply a matter of removing the cause of the irritation. It could be a harmful plant or a chemical lying about the barn. Antibiotics may be necessary if the mouth is infected. Recovery is usually rapid.

PREVENTION: Keep animals off pastures that contain hard sharp grasses or plants, as these can injure the mouth. Buttercups, crocus, and cowslips are plants that can cause chemical damage, as can medicines that contain arsenics, mercurials and iodides. Such medicines should not be placed on the skin where the animal might lick at them. Do not give hot foods to an animal, as temperature can also injure the mouth.

Choking

Animals choke when food or foreign objects clog the esophagus. Large pieces of food (apples, potatoes), metal, glass or balls are common culprits. In horses, feeding dry beet pulp can lead to choking.

CLINICAL SIGNS:

- Coughing
- Retching
- Slobbering
- Forced swallowing
- May appear anxious (pawing at the ground, getting up and down and showing other signs of distress)

NOTE: After some time, the animal stops trying to swallow and becomes quiet - cattle may become bloated (this will be covered in the next meeting).

TREATMENT: Call your veterinarian – remove access to food and water and put in a place where the animal can't hurt itself. If the object is near the mouth and can be felt it may be possible to work it up with your hand. If it is lower down the object can be carefully pushed into the stomach with a probang (a rubber tube with a small wooden plug at one end). The esophagus is easily damaged or ruptured so the procedure is best performed by your veterinarian.

PREVENTION: Large pieces of food should never be fed to animals. Any object small and tempting enough to be swallowed should be placed out of their reach.

Contagious Ecthyma (ORF)

Also called sore mouth or scabby mouth. This viral disease usually occurs in young sheep and goats, and most often concentrates on the lips and muzzle. Though death rarely results, it is very contagious, and can cause

severe loss of condition. The virus has been known to survive at room temperature for up to 15 years, and in hot weather for up to 60 days. Incubation period is 2 to 10 days. ORF can occasionally be spread to people. When handling infected animals; gloves and proper hygiene are important.

CLINICAL SIGNS: Lesions start at the corners of the mouth and spread around the lips and muzzle. The first signs consist of small circular lesions, but often go unnoticed until they develop into pustules and form scabs. The scabs fall off in 1 to 4 weeks. In very severe cases, lesions will spread from the mouth to the face and to all parts of the gastrointestinal tract as well as the feet, scrotum or vulva and teats.

TREATMENT: There is no specific treatment for contagious ecthyma.

CONTROL: Infected animals should be kept away from the herd. After an attack of the disease, the animal has immunity for 2 to 3 years. A vaccine has been developed to control the disease. The use of the vaccine is not always recommended unless an outbreak is to be controlled as the animals will test positive for the virus after contraction. Consult a veterinarian if vaccination is considered.

PREVENTION: ORF cannot be completely prevented. However sanitary conditions and regular inspections of the herd will help. Once ORF is on the premises, prevention lies in keeping healthy animals from catching the infection. Strict isolation of infected animals is essential. The handler who treats them should always wash their hands, arms and clothes in a disinfectant before returning to the healthy animals to avoid spreading the disease.

Ptyalism

Ptyalism is an over secretion of saliva and occurs mainly in small animals. Drugs, poisons, local irritations or inflammations such as stomatitis, infectious diseases such as rabies, and growth on the salivary glands, can all lead to ptyalism.

CLINICAL SIGNS: excess saliva dripping from the mouth. Care should be taken that rabies is not the cause of the salivation before an examination is carried out. (Rabies does not cause excess salivation). It paralyzes the muscles of the mouth so that the normal amount of saliva produced cannot be swallowed.

TREATMENT: The underlying cause of the disease must be discovered and treated. If poisoning is at fault, it must be cleared out of the system. If an inflammation or irritation is suspected, clean the mouth and remove any foreign bodies or diseased teeth. If a nervous disorder is the cause, sedatives or tranquilizers are helpful.

Aptalism

The opposite of ptyalism, aptalism is a decrease or absence of saliva, and it also occurs in small animals. Certain drugs can have this effect, as can anesthetics. Extreme dehydration and a diseased salivary gland are two other possible causes.

CLINICAL SIGNS: very dry mouth

TREATMENT: The cause must be determined and corrected. Mouthwashes will relieve the discomfort. Fluids should be administered in cases of acute fever and dehydration.

PREVENTION: Poisons and other irritants should be kept safely out of the way. As these disorders often indicate problems, prevention lies in curing the primary disease.

Meeting 2 - Fill Your Guts

Setting Objectives:

To identify the structure and role of the stomach and to outline the differences between ruminant, monogastric, hindgut and avian digestive systems.

Suggested Learning Outcomes:

- To document the purpose of digestion.
- To outline the role of the stomach and other digestive system parts for each diet category.
- To outline, what constitutes a displaced abomasum and how it can be corrected and prevented.

Suggested Roll Call Questions:

- Name an animal that ruminates
- Name a compartment of the ruminant stomach and their role.

SAMPLE MEETING AGENDA

Time: 2 hours 5 minutes

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	15-20 minutes
Topic Information, Discussion	From Food To Nutrient	10 minutes
Activities Related To Topic	Activity #1 - Bubble And Trouble	10 minutes
Topic Information, Discussion	Just Ruminating	15 minutes
Activities Related To Topic	Activity #2 - The Rumen Is Like A Factory	15 minutes
Topic Information, Discussion	An Upset Stomach?	15 minutes
Activities Related To Topic	Activity #3 - A Bad Twist	15 minutes
Wrap Up, Social Time And Adjournment		10 minutes

From Food to Nutrient

When digestion occurs, food is broken down in one of two ways:

- mechanically
- or
- chemically

Mechanical digestion includes chewing, tearing, crushing and mixing. Much of this happens in the mouth, with the help of the teeth and tongue. Mechanical digestion pre-treats the food, breaking it apart for the more important chemical digestion.

Chemical digestion happens with the help of enzymes.

Define It!!

What is an enzyme? Enzymes are naturally occurring substances that speed up or trigger a chemical reaction. They are called catalysts.

Different enzymes act best at different pH levels. What is pH? pH is the measure of acidity or alkalinity of a solution. A neutral solution has a pH of 7. A pH of 1 to 6 is acidic; 8-14 is basic or alkaline. Enzymes in the stomach like an acid pH, and so the contents of the stomach have a low pH. Enzymes that work in the intestines prefer an alkaline environment, and so the pH of the intestines is high.

Though most of the necessary enzymes are produced by the pancreas there is one exception. The enzyme needed to break down cellulose is not secreted by the animal. It is made by bacteria and protozoa that live in the gut.

Focus On Ruminant Digestion

Along with rumination there is a second process that helps herbivores digest cellulose.

This is fermentation. Fermentation occurs thanks to billions of bacteria and protozoa that live in the animal's rumen. They attack the food, soften it, break it down, and ferment or decompose it. These microorganisms in turn use the contents of the rumen to grow and multiply. However, as they multiply, they give off waste products. The most important of which are fatty acids and gas.

Belching is very important. As funny as it may sound, proper belching can be a matter of life or death. If the gas is blocked from escaping for even 15 minutes during feeding serious problems can arise. When the microorganisms are present in very high numbers they spill over into the rest of the stomach, where they are digested. Microorganisms in fact are a good source of proteins for ruminants.

DID YOU KNOW?



Enzymes are named according to the specific reactions they catalyze, and they end with the letters "ase". Enzymes that break down proteins are proteases; amylase works on carbohydrates; and lipases break down lipids (fats and oils).

Activity #1 - Bubble And Trouble

Do	<p>Time: 10 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Carbonated pop/soda (cola)• Balloon <p>Instructions:</p> <p>Go through the following steps to outline the role of belching for ruminants.</p> <ol style="list-style-type: none">1. Pour the pop into the balloon.2. Close the balloon and shake it.3. Get members to observe what happens.
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to demonstrate that proper belching is a matter of life or death for ruminants</p>
Apply	<p>Discuss The Following Prompts As A Group:</p> <ul style="list-style-type: none">• Emphasize that this is what would happen to the animal's rumen if the gas was not released. What might happen if the gas is not released? (bloat)• How might you prevent bloat in a ruminant animal? How might you treat it? (relieve the cause or treat the symptom?)

Just Ruminating! (Edited from the 4-H Ontario Goat Project)

The topic information contains information and illustrations about different types of digestive systems. After reviewing this section, you might wish to discuss why each type of animal has the type of digestive system that it does. You may also want to discuss:

- Cud chewing and why ruminants do it
- Encourage members to think of some reasons why ruminants chew cud
 - Ruminant animals chew cud because they must consume a large volume of plant material to get enough nutrients. This material is usually tough and fibrous and needs a great deal of chewing.

Overview Of Ruminants

There are several different types of digestive systems in animals. Each type is suited to the foods and behaviour of the animal it is a part of. All animals need the same kinds of nutrients to live, but different animals need different amounts of these nutrients. The type of food that an animal eats plays a big role in its ability to achieve nutrient balance.

Ruminants are able to eat grass, Hay, leaves and branches, which animals with simpler digestive systems are not able to eat. In fact, ruminants can eat very tough, fibrous plants that may even be tougher than those that other ruminants can digest. This is why ruminants can survive in areas that are not suitable for other livestock.

Ruminants include farm animals (goats, sheep and cows) and wild animals (buffalo, deer, moose and antelope).

What do these animals have in common?

- All of them eat vegetation (plants).
- Many of them would be prey for meat-eating animals (carnivores).

All these clues might help you to understand why these animals are ruminants. Ruminants must eat continuously and quickly as they move about in search of food. They cannot spend a great deal of time chewing their food as they eat it. They wait until later to chew their food by regurgitating it from the rumen back into their mouths. These regurgitations are collectively referred to as rumination.

What Does The Ruminant Do?

Ruminant animals digest the cellulose in roughage using microbes contained in the rumen (stomach). Microbes are types of bacteria and other single-celled organisms that break down plant material that has been eaten by the animal. They are very good at processing tough feed, like hay and whole grains.

The microbes turn the feeds into vitamins, proteins, minerals, and carbohydrates for the goat. These nutrients can then be digested by the animal, similarly as you and I do.

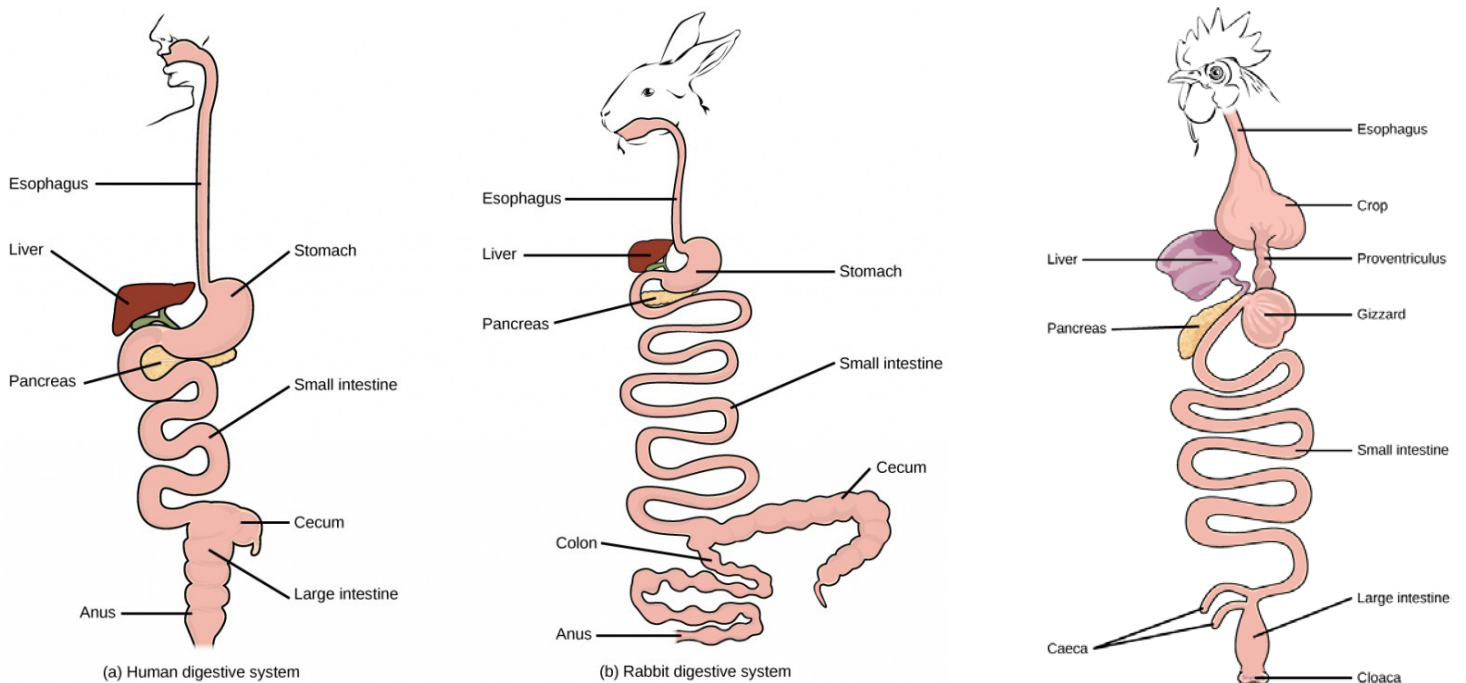
The digestive process is a little like a factory in which raw materials are refined into finished products. A good example is a pulp and paper mill in which logs are chopped up, boiled, fermented in chemicals and then compressed into paper.

The ruminant's digestive system is a complex "factory" that can process foods we cannot eat, like grass and hay, into milk or meat that we can eat.

We must remember that the basic nutrients must be in the food the ruminant eats so that it can turn these into energy and other products. Additionally, these nutrients must be balanced to avoid any unintended consequences.

How Ruminants Compare To Other Animals

As mentioned previously, goats are ruminants, but there are other digestive systems employed by vertebrates (animals that have a backbone). Monogastric (such as swine and humans) have a one-true stomach that breaks down food. For many of these species, fibre may be important for digestion. However, the fibre cannot be broken down any further. That rule goes for all animals except for a few exceptions, such as rabbits and horses. These animals have enlarged intestines and cecum to allow for more digestion of plant material to take place (through hind gut fermentation).



Overview of the differences between digestive systems. (image modified and used with permission from: <https://opentextbc.ca/biology/chapter/15-1-digestive-systems/>)

Avian Species (chicken, turkey, etc.) also appear a little differently than typical monogastric (swine or human). This is due to the pouch, known as a crop, which stores food and aids in digestion as birds do not have teeth. These bird species also use a gizzard that stores food soaked and mechanically ground.

Outside of the monogastric and ruminant realms, there is another type of digestive system that is commonly termed as camelids. These include llamas, alpacas and camels. Ultimately, these species are very similar to ruminants but should be mentioned here as they are distinct in their number of stomach chambers (3 vs 4 in ruminants).

The Parts Of The Machine

The **mouth** ingests food and chews it into smaller particles. Saliva mixes with the food and begins the digestive process. More specifically, the lips are goat's organ of prehension (how they gather food).

The **esophagus** moves the food from the mouth to the stomach by muscle contractions.

The **rumen** is the largest part of the stomach. It is also known as the first stomach or the paunch. Food enters and is agitated and partially digested by microbes.

The **reticulum** forms a cud (ball of food) and regurgitates it to the mouth for chewing. It is also known as the second stomach or the honeycomb because of its honeycomb appearance.

The **omasum** (oh-may-sum) extracts (removes) and absorbs fluids out of the food. This fluid contains nutrients. This is also known as the third stomach or the bible because its surface looks like the edges of pages of a large open book.

The **abomasum** (ah-bow-may-sum) contains digestive juices to digest food further. It is like our human stomach. In young goats, this is the stomach that does most of the work when kids are drinking large quantities of milk. A special passage called the esophageal groove closes off the other stomachs when the kid is drinking so that milk passes by them and comes right to the omasum and into the abomasum for digestion. The abomasum is also known as the fourth stomach.

The **small intestine** is like a long pipe where more digestion takes place. Most fluids and nutrients are absorbed through the walls of the small intestine. Most nutrient extraction takes place here.

The **cecum** (see-cum) is between the small and large intestine. It contains more micro-organisms to digest food further.

The **large intestine** absorbs water and adds mucous to the remaining material to help it continue through the digestive system.

The **anus** is the opening through which undigested food is eliminated from the body.

Activity #2 - The Rumen Is Like A Factory (Source: 4-H Ontario Goat Project)

Do

Time: 15 minutes

Materials:

- Four small bowls
- A small amount of sugar
- Warm water
- Cold water
- Saran wrap
- Two packages of dry yeast for baking

Instructions:

The following is an experiment to show how we can see the results of microscopic activity that is similar to rumination in some ways.

You need:

- Two bowls full of cold water
- 30 mL sugar
- Two bowls full of warm water
- Two pkg. yeast

Have the members prepare four small bowls of water. Get members to fill two bowls half full of warm water and put one tablespoon of sugar in one of the bowls. Next get members to fill two bowls half full of cold water and put one tablespoon of sugar in one of the bowls. Overall, there should be four bowls:

1. Warm Water & Sugar
2. Warm Water
3. Cold Water & Sugar
4. Cold Water

After this is done, sprinkle half a packet of yeast on top of the two bowls of cold water and the other package on the two bowls of warm water. Set these aside for a few minutes and proceed with the rest of the material in this section of the meeting. Cover all bowls loosely with saran wrap. Leave the experiment until later in the meeting.

Have members examine the yeast experiment to see what is happening. There should be a noticeable difference between the yeast action in the cold water without sugar and the warm water with sugar. Explain that the yeast in the bowl of cold water with no sugar is in an unfavourable environment. There is no food (sugar), and it is too cold so that nothing much will happen. On the other hand, in the bowl of warm water and sugar, the yeast has found a good home. The warm water is the temperature which yeast like best. The sugar supplies a carbohydrate food which the yeast will then transform into carbonic-acid gas (which helps bread to rise). In a similar manner, the microbes in the goat's rumen are living in a comfortable, warm environment. The goat eats cellulose foods (hay, grain, etc.) which become mixed with water in the rumen where the microbes are. They begin to break down this food and they, in turn, supply the goat with usable nutrients.

Reflect

Learning Outcomes:

The objective is to learn about how the ruminant animal works by stimulating how the right conditions can stimulate activity.

Apply

Discuss The Following Prompts As A Group:

- Did the cold bowl of water have anything observable?
- How about the warm water? What are the ideal conditions for the yeast? How might this relate to a microbial environment?
- What happened with the saran wrap covered bowls? Did the warm one inflate relative to the cold? Why did this happen and why might it explain the size of ruminant animals?

An Upset Stomach?

The topic information contained in this meeting will cover diseases affecting the stomach.

Bloat

Bloat occurs when the first and second stomachs become swollen with gases. (Remember the "Test it Out" experiment earlier?) It is very serious; the animal can die. The cause is usually too much young, lush pasture. The rumen overloads and gas will accumulate because it cannot escape. Instead of rising to the top, it stays mixed with the food to form a foam or froth, called frothy bloat.

CLINICAL SIGNS: Pronounced swelling of the left flank. In severe cases, the upper part of the flank rises above the level of the backbone. When tapped with the fingers, a drum-like sound can be heard. The animal moves uneasily and breathes with difficulty. Death may come within hours unless relief is obtained. A bloated cow should be tapped halfway between the last rib and the point of the hip bone, and 4 inches (10 cm) down from the side of the vertebrae to the short ribs.

TREATMENT: WORK FAST. Release the gas at once. Pass a stomach tube into the rumen until the gas pocket is reached. If a lot of froth is present it means gas has mixed with the foam and won't be easily released. Next, pass a pint of defoaming agent such as vegetable oil through the tube. If it won't go down inject it into the paunch with a syringe with an extra-long needle. If this doesn't work, release the gas by puncturing the rumen with a knife or trocar (a sharp pointed instrument with a tube that stays in the loin to allow gas to escape). This is called tapping and should not be done by the inexperienced. Do not let the animal drink any water until at least three hours after the bloat is over.

PREVENTION: Gradually introduce animals to lush legume pastures; never let them overeat such food. High-grain diets should also be fed with care. Commercial anti-foaming preparations are available to guard against frothy bloat, and these can be added to the concentrate portion of the animal's diet.

Displaced Abomasum

A displaced abomasum is one of the potential diseases that can affect a ruminant animal and is often referred to as a twisted stomach. This is a common problem in dairy cattle. Its causes are unknown, though a high grain or silage diet or other sudden changes in diet and ketosis are thought to be implicated. Ketosis is an accumulation in the blood of ketone bodies produced when fatty acids are broken down. The abomasum loses muscle activity, slows down and becomes distended with fluid and gas. As gas accumulates, the distended abomasum acts like a balloon. When this happens, the abomasum either moves up and to the left, or up and forward. In severe cases, abomasal torsion or twisting can occur.

CLINICAL SIGNS:

- Going off feed
- Decreased milk production
- Dehydration
- Reduction in manure passage
- When twisting happens- pain, kicks at stomach, gets up and down frequently, rapid dehydration, over 100 heart beats per minute, shock

TREATMENT: Treatment can vary from doing nothing, to surgical correction, to shipping the animal for slaughter. Putting the cow on a grass hay diet and removing any grain or silage will rarely make a difference. In more severe cases, surgery may be required to fix the abomasum to the abdominal wall to prevent further movement. In cases of twisting, surgery may only be partly successful, and it may be necessary for the cow to be destroyed. Consult your veterinarian.

PREVENTION: When a cow goes off feed remove silage and grain, and do not reintroduce these foods until the cow has returned to normal feeding. If metritis or ketosis is suspected, it should be treated. Once an animal has already suffered an episode of displaced abomasum it may be necessary to surgically tie the stomach in place to prevent subsequent displacements.

Gastric Impaction or Indigestion

Indigestion occurs when the first two compartments of the stomach are packed with food that won't digest. In rare cases, the third and even fourth compartments are overfilled. Improper feeding, bad feeds or gorging are usually the cause.

CLINICAL SIGNS:

- Going off feed
- Stops chewing their cud
- Constipation
- Moaning
- Arches its back and kicks at its belly - the animal may go down and become paralyzed as if in a stupor (in severe cases)

TREATMENT: If bloat accompanies indigestion treat bloat first. Animals often recover suddenly without treatment. The animal should not be put back on feed until the rumen has again become active. In very severe cases, it may be necessary to operate to remove the undigested food.

PREVENTION: As with bloat, overeating of grain or green foods should be avoided. Sudden changes from pasture feeding to dry feeds are also dangerous as they can lead to impaction.

Hardware Disease

Found in cattle, and occurs when foreign objects such as nails, wire or machinery parts are eaten. They are swallowed into the rumen where they often do little or no harm. However, once pushed into the smaller reticulum they puncture the wall and from there damage the diaphragm, liver, heart or lungs. Most heavy metal objects will probably fall directly into the reticulum.

CLINICAL SIGNS:

- Going off feed
- Weakness
- Showing obvious pain when moving
- May stand with its back feet lower than its front to relieve pressure on the abdomen

TREATMENT: Surgery may be required to remove the object. Antibiotics should be used to control infection. Never give laxatives to an animal suspected of having hardware disease. There is a special magnet made in the shape of a bolus that can be given to the animal. The animal eats it, and it remains in the reticulum to collect and immobilize any trash.

PREVENTION: The most logical preventive measure is to keep metal objects out of reach of cattle. Cow magnets are also practical tools to help prevent ingested objects from moving through the system.

Gastric Dilatation-Volvulus (GDV)

This disease affects dogs and if untreated can lead to a life-threatening condition. The disease is commonly associated with large meals which cause the stomach to fill with food and gas. If the amount of food and gas accumulation becomes too severe, the condition can cause neither to be expelled and pressure to increase as a result. The condition can cause inadequate circulation (either from preventing blood flow or preventing blood return to the heart), inadequate respiration (as the pressure in the stomach can prevent the diaphragm from inflating and deflating the lung) or stomach rupture. This disease can be found in all dogs but is typically more common with Great Danes, Weimaraners, St. Bernards, Irish setters, and Gordon setters.

CLINICAL SIGNS:

- An anxious look
- Looking at the abdomen
- Standing and stretching
- Drooling
- Swollen outward abdomen (distended abdomen)
- Attempting to vomit without producing anything (retching)

TREATMENT: The biggest thing is to stabilize the animal! Administering fluids and oxygen can be the two first measures prior to any medical intervention. Treatment for this disease is similar to the treatment of bloat. A tube is passed down the esophagus and then into the stomach to release fluid and gas that is trapped. This step can then be followed with a water flush to remove any remaining food particles. Once these initial procedures have been conducted, surgery may be necessary to return the stomach to the normal position.

PREVENTION: Spreading out the required food amount over 2 or more feedings has been demonstrated to contribute to lower risk for this disease. Additionally, those foods high in oil may contribute to this disease.

Activity #3 - A Bad Twist

Do	<p>Time: 20 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">•None <p>Instructions:</p> <p>This activity is deemed optional as it may displace some of the other activities in this section. In today's age, a displaced abomasum is becoming a more uncommon condition as the dairy industry moves to using higher forage diets.</p> <p>However, the condition can still occur. Therefore, you can have a vet discuss the procedure and if possible senior members can go on a farm call where this procedure will be performed.</p>
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to go over a disease that affects ruminating animals and to discuss the cause and treatment strategies used by veterinarians.</p>
Apply	

Meeting 3 - Getting In A Flow

Setting Objectives:

To identify the structure and role of the small intestine and the diseases associated with this vital organ.

Suggested Learning Outcomes:

- To outline the role of the small intestine in digestion.
- To emphasize the importance of surface area to digestion.
- To outline some of the common diseases and impairments of the small intestines.
- To briefly discuss hind gut fermenters.

Suggested Roll Call Questions:

- Give an example of a “hind gut” fermenter.
- Give a function of the small intestine.

SAMPLE MEETING AGENDA

Time: 2 hours

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	15-20 minutes
Activities Related To Topic	Activity #1 - How Good are Villi?	25 minutes
Topic Information, Discussion	Sticking Around	10 minutes
Activities Related To Topic	Activity #2 - Hide And Seek!	15 minutes
Topic Information, Discussion	Hind Gut Fermenters	10 minutes
Topic Information, Discussion	Coil And Trouble	15 minutes
Wrap Up, Social Time And Adjournment		10 minutes

Activity #1 - How Good Are Villi?

Do	<p>Time: 20 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Flour• Water• Paper• Towels <p>Instructions:</p> <p>This activity will introduce members to the importance of the villi within the small intestine.</p> <p>Get a senior member to complete the following tasks (get them to organize this if possible):</p> <ol style="list-style-type: none">1. Mixing flour and water create a very fluid flour and water paste.2. Divide members into groups of three. Ask them to make three puddles of the flour and water paste on a flat work surface.3. Supply each group with seven sheets of paper towel. <p>Next as a leader:</p> <ol style="list-style-type: none">1. Designate each group member as 1, 2 or 32. The first member will receive one sheet of towel. Don NOT fold it!3. The second and third members will receive three sheets each and fold them accordion style so that the folds are one on top of another.4. Each member will now try to absorb his or her puddle. The first two members may only place their sheets over the puddles. The third may move the paper back and forth, as if they were moving villi.5. Which puddle is absorbed first? Last? Which most closely resembles villi?
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to discuss the importance of surface area for digestion.</p>
Apply	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• What did you demonstrate through this activity?• What did you learn?• How might you apply this to the digestive tract?• Why might some animals have longer or shorter digestive systems?

Sticking Around

This section will briefly touch on the importance of watching animals and preventing foreign bodies.

What are the signs of a foreign body?

The problems associated with foreign bodies depend on:

- Duration that the foreign body has been present.
- The current or final location of the foreign body.
- The Degree of obstruction that the body is causing.
- The toxicity of the materials that are obstructing (metals or other toxins).

However, several clinical signs can be denoted including:

- Vomiting
- Loss of appetite
- Anorexia
- Abdominal pain
- Dehydration
- Diarrhea

Diagnostics

The primary care veterinarian will likely recommend a number of different tests based on the symptoms observed, however, a radiograph (commonly called an X-ray), tells the story if there might be a foreign body involved.

Treatment

It is important to note that surgical care is not always required for gastrointestinal foreign bodies (lower digestive system obstructions) but the prognosis can be examined when the radiographs are taken. The key factors are size, location and texture as small and smooth foreign bodies have a higher chance of passing. Those blockages in the esophageal or upper digestive tract (esophageal foreign bodies), may require surgery (endoscopic removal) to gain access and remove. Additional work may be needed to correct any physical changes caused by the obstruction.

What is a Foreign Body?

A foreign body occurs when pets or other animals consume items that will not pass through the gastrointestinal tract or be digested.

Do It!

In the next activity we will discuss radiographs and how to interpret those along with the sizes that will pass. It can also be fun to talk about the types of objects that have been recovered!

DID YOU KNOW?



The most common foreign body surgeries involve the following items:
Sewing needles or other string like objects in cats. Bones, corn cobs, and dental chews in dogs.

Activity #2 - Hide And Seek!

Do	<p>Time: 15 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Radiographs <p>Instructions:</p> <p>Go to your veterinarian or get some images of some foreign bodies in radiographs.</p> <p>Discuss some treatment decisions that might be taken for these different foreign bodies.</p>
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to have members exposed to radiographs and to visually see the effects of foreign bodies.</p>
Apply	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• Are there any questions you might have about foreign bodies?

Hind Gut Fermenters

In the last meeting we discussed ruminants; animals that use different chambers of their stomach to break down fiber from plants. We also briefly broke down the other types of monogastric (single stomach animals) and how these animals differ in terms of their digestive systems.

Differing from ruminants, hindgut fermenters have a smaller undivided stomach with a larger cecum (area between small and large intestines) and colon. These types of fermenters are monogastric but have microbes that live in their hind gut.

These animals have adapted this method of digestion, but it is not as efficient as a ruminant animal as the microbes live in a location after the small intestine (the primary nutrient absorption center). This means that the microbes themselves cannot be digested as they could be in other ruminant animals.

Horses

Horses get around this disadvantage through their location of the cecum which projects from the side of the small intestines. As a result, feed can move forward and backwards between the small intestines and the colon which are aided by smooth muscle movements called reverse peristaltic movements. This process is known as intestinal reflux and allows for the microbes to also be digested by the small intestines as would happen in ruminant animals.

Other Hind Gut Fermenters

Rabbits, sloths, rodents, elephants, and rhinos are also hindgut fermenters. However, these animals may have different ways of fermenting their food as compared to horses. While elephants and rhinos may be like horses, rabbits and rodents mechanically digest their food once and pass it as their feces. These animals then eat these feces, pass this through their stomach and bypass their caecum and pass as a different form of feces that they do not ingest. This type of hindgut fermentation is known as coprophagy.

Define It!

A peristaltic movement is a contraction of the muscles in the gut wall which propel contents (food) along. A reverse movement would be food that goes the opposite direction.

Coil And Trouble

Johne's Disease

Horses get around this disadvantage through their location of the cecum which projects from the side of the small intestines. As a result, feed can move forward and backwards between the small intestines and the colon which are aided by smooth muscle movements called reverse peristaltic movements. This process is known as intestinal reflux and allows for the microbes to also be digested by the small intestines as would happen in ruminant animals.

CLINICAL SIGNS:

- General loss of conditioning in the animal
- Diarrhea
- Rough coat
- Dry skin
- Loss of appetite (appears towards the end of the disease)

TREATMENT: There is no known cure. Practically all animals die within one month to two years after symptoms appear. Therefore, the best treatment is prevention.

PREVENTION: Prevention is aimed at halting the spread of the disease. It is especially important to protect young animals since they are most susceptible to infection. Good sanitation to reduce the exposure of animals to the manure of infected cattle is essential.

Coccidiosis

This disease is one of the most widespread among all farm animals except horses. It is also referred to as bloody scours. It causes major losses to poultry and serious losses to calves and lambs.

The parasites that cause the disease are protozoa called coccidia, and they enter the body through the food and water supply. When they reach the intestines in large enough numbers, they invade the walls. The walls thicken and can no longer digest and absorb food properly. Inflammation and pinpoint bleeding of the mucus membrane occurs. The larger the number of coccidia the more severe the infection.

CLINICAL SIGNS:

- Bloody diarrhea
- Anemia
- Weight loss
- General weakness
- Severe straining accompanies excretion
- Stringy feces and full of mucus
- Dehydration
- Nervous twitching (appear near the end of fatal attacks)

Animals that do not die in the first two weeks of the illness can be expected to recover.

TREATMENT: Treatment to control the diarrhea should be initiated. Commercial preparations are available to help restore the electrolyte (sodium and chloride) balance lost during the disease in the animal. Consult your veterinarian.

Cleanliness is very important in preventing the disease, as this keeps down the number of coccidia in the environment.

PREVENTION: Coccidiosis is more likely to occur under conditions of poor sanitation and overcrowding, or after the stresses of weaning, shipping and sudden changes of feed. Proper animal management should be practiced ensuring that such conditions do not occur. There are also coccidiostats that can be added to feed to prevent the incidence of coccidiosis.

Colic

Colic is a vague term applied to any abdominal pain. It occurs in all animals, especially horses. The list of causes includes acute indigestion, severe organic disorders, parasite infestations, gorging, mouldy foods, food caught somewhere in the gut and eating foreign material such as sand.

CLINICAL SIGNS:

- Obvious pain in the abdomen
- Rolling
- Looking at abdomen repeatedly
- Anorexia
- Kicking at the belly
- Sweating
- Blowing
- Excess gas
-

TREATMENT: Expert help is needed if colic persists more than 1 hour or if the animal is in extreme pain. Place the animal in a large airy protected area and remove all restraint. Often, it is simply a matter of walking the animal around and waiting for the discomfort to pass.

PREVENTION: Prevention lies in sound feeding practices but colic is not completely preventable. Feed good quality foods, neither too bulky nor too concentrated on a regular schedule. Provide lots of clean water, and always water working horses before feeding them. Beware of sudden changes to diet or routine, and exercise animals regularly. Also consider an appropriate deworming program as recommend by your veterinarian.

Meeting 4 - The Digestion Sidekicks

Setting Objectives:

To identify the different components of the digestive system that aid in breaking down food into nutrients.

Suggested Learning Outcomes:

- To outline the role of the pancreas, gall bladder, and liver.
- To cover some key types of enzymes.
- To discuss some of the remaining diseases that affect digestion.

Suggested Roll Call Questions:

- Give an example of an enzyme. What does it do?
- Name an organ that aids in digestion.

SAMPLE MEETING AGENDA

Time: 2 hours

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	15-20 minutes
Topic Information, Discussion	Digestive Accomplices: The Accessory Organs	10 minutes
Activities Related To Topic	Activity #1 - Make An Emulsion!	15 minutes
Activities Related To Topic	Activity #2 - pH In The Gut	25 minutes
Topic Information, Discussion	Ailments Of Digestions	10 minutes
Activities Related To Topic	Activity #3 - Enzyme Action	15 minutes
Wrap Up, Social Time And Adjournment		10 minutes

Digestive Accomplices: The Accessory Organs

The Salivary Glands

The salivary glands located in the mouth secrete saliva, a liquid mixture of mucus and a carbohydrate-splitting enzyme. The most important component is mucus, whose job is to add moisture to dry food, to lubricate both the mouth and the food and to ease the passage of food down the esophagus. Saliva is excreted by three salivary glands:

1. The PAROTID GLAND, located below the ears and behind the angle of the jaw.
2. The MANDIBULAR or SUBMAXILLARY GLAND, directly below the parotid.
3. The SUBLINGUAL GLAND, found on each side of the base of the tongue. The presence of food in the mouth or even the sight or smell of it can trigger the release of saliva. When dry food is in the mouth the saliva is abundant and very watery. When the food is moist the saliva is thicker, and only enough is secreted to lubricate the food during swallowing. Secretion rates are highest during feeding, and lowest immediately afterwards.

Pancreatic Juice

The pancreas is a gland found in the first loop of the duodenum. It links up with the duodenum by a duct. Its shape is lobular, somewhat like a bunch of grapes, and it has two major functions. One is to produce and secrete the hormone insulin. The other is to produce and secrete pancreatic juice. It is this second function that concerns us. Pancreatic juice contains sodium carbonate, sodium bicarbonate and several important enzymes that help break down protein, carbohydrates and fats. The sodium bicarbonate is important because it helps neutralize the acidity of the chyme that comes from the stomach.

Bile

Bile is a greenish-yellow liquid secreted by the liver. The liver is the largest gland in the body, whose other duties include removing poisons, producing urea and desaturating fatty acids. It is located below the diaphragm and is shaped much like a flattened mushroom cap. Close to the liver is a smaller, round organ called the gall bladder. It stores bile for release into the duodenum, and also concentrates the bile and adds mucus to it. All domestic animals except the horse have a gall bladder. Like the pancreas, it is under hormonal control. Bile is made up largely of water, bile salts, bile pigments and cholesterol. The bile salts are important in the digestion and absorption of fats. They emulsify fats, which means that they divide large droplets of fat into tiny globules and keep them that way. Bile salts are also thought to speed up the activity of pancreatic enzymes. Bile also helps keep the contents of the intestine fluid, and prevents the food from fermenting or going bad. Bile is also the thing that gives feces their colour.

Activity #1 - Make An Emulsion!

Do	<p>Time: 15 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Eggs• Oil• Vinegar <p>Instructions:</p> <p>As a leader go through the following prompts:</p> <ol style="list-style-type: none">1. Ask members to explain what would happen if they tried to mix oil and vinegar together (No matter how hard you shake the two, the oil eventually separates into globules and rises to the top.)2. Explain that this can be prevented by adding a third substance that stops the oil from separating. This substance helps make an emulsion and is called an emulsifier. <p>Get members to:</p> <ol style="list-style-type: none">1. Add ½ cup of vinegar to ½ cup of oil. Shake. What happens?2. Let the mixture sit for several minutes. What happens?3. Add an egg to the oil and vinegar. Shake. What happens?4. Let the mixture sit for several minutes. What happens? (You have just made mayonnaise).
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to outline the importance of bile for digestion.</p>
Apply	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• What ingredient would be the bile in this recipe? (egg)• Can you think of any other tasks that bile performs? (retain contents of the intestinal fluid and prevents the food from fermenting and going bad)

Activity #2 - pH In The Gut

Do	<p>Time: 25 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Vinegar• Flour• Unsweetened red grape juice• Baking soda• Water• Drinking glasses <p>Instructions:</p> <p>Allow members to make a liquid past of flour and vinegar. Discuss: Is vinegar acidic or alkaline? Where in the gut is there an acidic environment? (stomach).</p> <p>Add a few drops of unsweetened red grape juice (the juice acts like litmus paper. It is red in an acid mixture, but turns green in an alkaline mixture).</p> <p>Add a few drops of baking soda that have been mixed with water (baking soda is sodium bicarbonate). Where in the digestive system is this found?</p> <p>What reaction do you get? Are the contents of the glass now acidic or alkaline?</p>
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to discuss the different pH environments found in the body.</p>
Apply	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• How might the different pH environments aid in digestion?

Ailments Of Digestions

Diarrhea

This is not a disease but a symptom which may indicate nothing more than a poor diet, or something as serious as a viral infection.

Continuous diarrhea is always serious because not only are digestion and absorption hampered, but the loss of fluid leads to dehydration. Dehydration is the most frequent cause of death if treatment is not undertaken in time.

If the diarrhea persists for 48 hours or more veterinary advice should be sought. Young animals such as calves and foals are more likely to become dehydrated than older animals.

Causes include poisons, infection of the intestinal wall and parasites.

TREATMENT: The treatment must address the specific cause of the diarrhea, but with persisting diarrhea, it will be necessary to replace the lost fluids. A general treatment for diarrhea consists of withholding all energy feeds and introducing anti-diarrheal medicine to the animal. Your veterinarian will advise you as to the best one for your needs.

PREVENTION: The best treatment of diarrhea is prevention. Be sure your animal receives high quality feed, and regular check-ups by a veterinarian to ensure that its system is in good working order. Many causes of diarrhea are picked up from manure in the environment. Good sanitation is a must.

Pancreatitis

Pancreatitis tends to affect middle-aged, overweight and inactive dogs and cats. Its exact cause is unknown, but too much food, infection, trauma and the presence of bile in the pancreas are all thought to be involved.

SYMPTOMS:

- Acute (dogs only):
 - o Vomiting
 - o Abdominal pain
 - o Shock
- Chronic cases (dogs and cats):
 - o Mild vomiting
 - o Mild abdominal pain
 - o Stools orange or clay-colored and rancid-smelling
 - o Ravenous appetite

TREATMENT: In acute cases, ease the pain with painkillers and treat the shock with an electrolyte solution. Good nursing is essential. Antibiotics may be given to fight any secondary infections. In chronic pancreatitis, special low-fat, high protein and carbohydrate diets must be given for the rest of the animal's life, as well as medication to prevent further attacks.

PREVENTION: Do not allow cats and especially dogs to become overweight.

Acute Infectious Hepatitis

This is caused by any number of infections, the most common of which are canine infectious hepatitis, leptospirosis and clostridial infections.

Abscess of the liver

This is common in cattle, usually due to a disorder of the rumen that results from heavy grain feeding. Most liver disorders are the result of parasitism or the spread of infection from the gut.

PREVENTION (HEPATITIS AND ABSCESSSES OF THE LIVER): These conditions usually signal some other disease, and their prevention therefore lies in treating the primary disorder.

Activity #3 - Enzyme Action

Do	<p>Time: 15 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Starchy food samples, such as soda crackers or bread <p>Instructions:</p> <p>Provide members with small pieces of bread or soda crackers.</p> <p>Instruct them to chew the food, without swallowing, until they notice a change in taste.</p> <p>Ask for their explanation of what is happening in their mouth.</p> <p>Explain that the starch is beginning to be digested by enzymes in their saliva.</p>
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to have members go over how enzymes are at work even in their own body.</p>
Apply	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• The enzyme you just worked with is amylase. It starts to digest starch in saliva.• Do you know of any other enzymes that conduct a different function?• How can you typically tell that something is an enzyme?

Meeting 5 - What Goes In Must Come Out!

Setting Objectives:

To identify the different components that aid in detoxifying and elimination of waste from the body.

Suggested Learning Outcomes:

- To cover the organs involved with detoxification and urine formation.
- To explore fecal formation and the end of digestion.
- To discuss tests to examine parasite load.

Suggested Roll Call Questions:

- What is in urine?
- How do animals excrete waste? Why?

SAMPLE MEETING AGENDA

Time: 1 hour 45 minutes

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	15-20 minutes
Topic Information, Discussion	Urine Formation And Excrement	10 minutes
Topic Information, Discussion	"The Blocked Cat"	10 minutes
Topic Information, Discussion	Tail End Of Digestion	10 minutes
Activities Related To Topic	Activity #1 - Fecal Floats	30 minutes
Wrap Up, Social Time And Adjournment		10 minutes

Urine Formation And Excrement

Have you ever had a whole bunch of water or other fluids to drink and then had to pee really, really bad? This is because whatever you drink, must come out somehow! Urine (or pee) is the body's way of getting rid of extra water and waste that it doesn't need. It accomplishes this through the workings of the urinary system.

The urinary tract involves several structures:

Kidneys: 2 bean-shaped organs that work by filtering the blood, removing the waste and producing urine

Ureters: Two tubes that carry the urine from the kidney to the bladder

Bladder: A storage "balloon" for the urine

Urethra: Tube that transports the urine from the bladder out of the body

What Is Urine Made Of?

When blood goes through the kidney to get filtered, nutrients that the body requires (like water, glucose, protein and other essential nutrients) remain in the blood. Waste products and any excess nutrients are then filtered out of the blood and contribute to the production of urine.

Urine is composed of:

- Excess water
- Urea (waste product of protein breakdown)
- Creatinine (waste product from muscle breakdown)
- Salts
- Ammonia
- Bile by-products from the liver
- Urochrome (pigmented blood product giving urine its yellow colour)

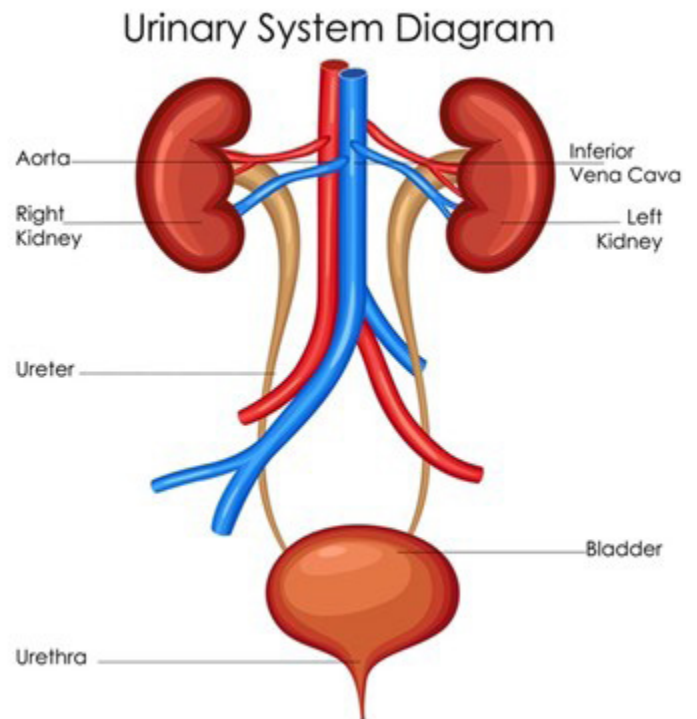


Image from: <https://www.news-medical.net/health/Structure-of-the-Bladder.aspx>

“The Blocked Cat”

When your cat stops urinating, this signifies an emergency!

If urine flow stops, waste products that normally are eliminated from the body through the urine begin to build-up in the body to dangerous levels, impacting how the body works. The most common way that this presents in the veterinary clinic is in the form of a blocked cat. One of the most common ways that a cat becomes blocked is when the cat’s urethra (the tube carrying urine from the bladder to the external environment) becomes obstructed, often by a plug like a bladder stone. Veterinary ER hospitals typically see between 2-3 cats every week that cannot urinate, demonstrating that this is a common and life-threatening problem that requires immediate attention. Most commonly, this condition occurs in male cats. Other factors, such as dehydration, lifestyle, diet and infectious agents can also increase the likelihood that a cat becomes blocked.

Blocked cats commonly show these signs:

- Howling/crying
- Hiding
- Straining in the litterbox repeatedly (which can often be mistaken for the cat being constipated)
- Licking the genitals

If you see these signs in your cat, seek immediate medical attention from your veterinarian.

Tail End Of Digestion

Food trip through the digestive system ends at the large intestine. This organ differs from the small intestine due to its size (larger than the small intestine), it is lumpier and it has a more fixed position in the animal. Typically, the large intestine is divided into the cecum and the colon.

The cecum is usually an off shoot where the small and large intestines meet. The cecum is responsible for hind-gut fermentation in some animals that we discussed earlier. However, in some humans and carnivores, it is not for holding and more to remove any remaining nutrients that may not have been absorbed in the small intestines.

The colon is a reservoir for excitement. It helps extract any remaining water and then forms a consolidated mass that is further concentrated in the rectum which is then excreted through the anus.

That is where the story of digestion ends!

Activity #1 - Enzyme Action

Do	<p>Time: 30 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Fecal Float materials <p>Instructions:</p> <p>Fecal flotation is a routine test in veterinary medicine to determine if an animal is infected with internal parasites or worms. The test does not detect the parasite themselves (in most cases) but instead detects the eggs from mature parasites that are shed into the stool.</p> <p>In this activity, get a vet or vet tech to walk through the test steps:</p> <ol style="list-style-type: none">1. Mix the stool material with a zinc sulfate, sodium nitrate, or other special fecal float solution that provide the right bouncy for the eggs to float to the top while the fecal debris stays on the bottom.2. Collect the eggs at the top of the surface (if present) with a glass slide. You may not be able to see them so collect the top layer regardless.3. Examine the slide under a microscope with the appearance of eggs as an indicator of parasite presence.4. Additionally the amount of eggs counted can be an indication of severity of infection but this can be very subjective.5. <p>This type of test is often performed on young animals so there is a high chance that the veterinarian is doing this procedure already.</p>
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to have members use fecal samples to examine if there is parasite load present.</p>
Apply	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• Are there any questions you might have about the steps of the procedure?

Meeting 6 - Good Nutrition And Scoring!

Setting Objectives:

To briefly discuss an important tool to examine nutrition and to identify good body condition for a number of species.

Suggested Learning Outcomes:

- To briefly cover the importance of good nutrition for health.
- To learn about body condition scoring systems for a number of animals

Suggested Roll Call Questions:

- What is body condition?

SAMPLE MEETING AGENDA

Time: 2 hours 10 minutes

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	15-20 minutes
Topic Information, Discussion	Adding A Tool To The Toolbox	10 minutes
Activities Related To Topic	Activity #1 - What's The Score?	30 minutes
Extra Activities	Achievement Planning Use this time to plan your achievement program/activity	30 minutes
Wrap Up, Social Time And Adjournment		15 minutes

Ensuring Good Nutrition And Body Condition Scoring

Body Condition Scoring (BCS) is a tool used by animal care providers to assess an animal's current health status. It is useful in determining if the animal's nutrition is adequate or if it requires modification. An animal at its ideal weight and body condition will perform at its greatest potential and will be most economical. If it is intended for breeding, it will produce healthier offspring than under or overweight animals.

As well, animals not at their ideal body weight and condition may have erratic heats, experience difficulty becoming pregnant, experience difficulty during birth, and may not produce enough colostrum.

Body Condition Scoring can help reduce economic losses: carefully planned nutrition minimizes overfeeding which results in financial loss and contributes to high productivity. It is important to remember that the body condition of an animal cannot be changed quickly (it may take as long as eight weeks to modify condition by one score, depending on the animal and species).

Rapid weight loss or gain can be shocking to an animal's body and may cause more harm than good. The best time to modify the condition of a breeding animal is at weaning. It is acceptable to cull breeding animals that show no sign of change in body condition after four weeks on improved nutrition. Improved nutrition may not be enough... there are other factors that contribute to an animal's body condition. Disease, especially tooth decay, may contribute to an animal's unwillingness to eat and can be alleviated with treatment.

Things to consider:

- Age of animal, breed, frame size (older animals tend to carry less condition than younger animals)
- How the animal feels or looks at observation time: do not base evaluation on gut fill or thickness of hair.

Condition scoring is a useful technique to learn and the information gained is very useful in managing animals. Specific criteria for body condition scores are outlined in the following pages.

Activity #1 - What's The Score?

Do	<p>Time: 30 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Body Condition Scoring Fact Sheet <p>Instructions:</p> <p>Pick one or more of the species that are attached as fact sheets. Go through the sheet and discuss the scoring method and key characteristics.</p> <p>Outline the key components to look for and reason for scoring.</p>
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to score one or more animals.</p>
Apply	<p>Discuss The Following Prompts As a Group:</p> <ul style="list-style-type: none">• What is optimal for your animal?• Where does your animal site?

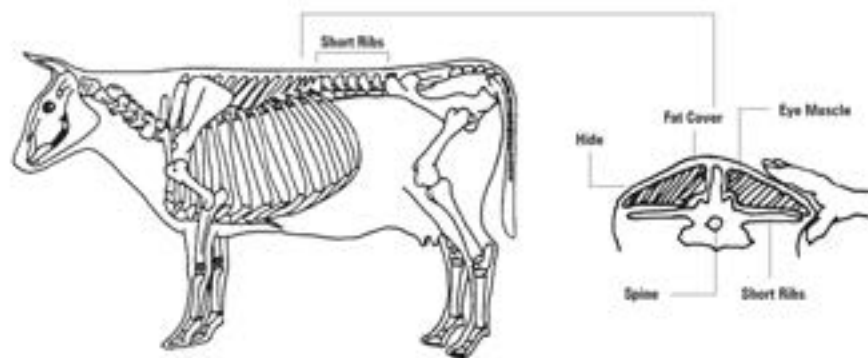


Body Condition Scoring

Body condition scoring (BCS) is a hands-on method of assessing the amount of fat cover on an animal, and is an important tool in managing beef cattle and optimizing the use of feed resources. In Canada, we use a 5-point BCS system, originally developed in Scotland. American beef producers typically use a 9-point system.

BCS is determined by assessing the degree of muscle and fat cover at specific landmarks on an animal's body, specifically over the spinous (vertical) and transverse (horizontal) processes of the short ribs (loin) and (in fatter cattle) the tail head and ribs.

Be aware that body condition scores are most applicable to mature cattle and may be of little use for cattle under one year of age.



BCS 1



BCS 1

BCS 2



BCS 2

BCS 3



BCS 3

BCS 4



BCS 4

BCS 5



BCS 5

Adapted from: *Alberta Agriculture and Food*. Body Condition: Implications for Managing Beef Cows. *Agdex 420/40-1*. Available: [www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/agdex9622/\\$FILE/body-condition-implications-for-managing-beef-cows.pdf](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex9622/$FILE/body-condition-implications-for-managing-beef-cows.pdf). Accessed October 2, 2012.

What's the Score: Beef Cow – Body Condition Scoring (BCS) Guide. *Alberta Agriculture*. Available: [www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/agdex9622/\\$FILE/bcs-beef-cow.pdf](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex9622/$FILE/bcs-beef-cow.pdf)



Body Condition Scoring

Body condition scoring (BCS) is a method of assessing the amount of fat cover on an animal; the 5 point system for bison, explained below, uses primarily visual clues since hands-on examination is impractical. Most of the information in this section is adapted from *What's the Score: Bison – Body Condition Scoring (BCS) Guide* from Alberta Agriculture. BCS is an important management tool. It allows producers to monitor and evaluate their feeding program, and to make adjustments when needed.

The BCS system used below is a 5 point scale, where a score of 1 means that the animal is extremely thin or emaciated and a score of 5 means that the animal is very fat.

Bison's nutritional requirements and feed intake vary with day length/season, and a certain amount of weight loss is expected over the winter months. However, to accommodate this winter weight loss, bison are to be in good condition in the fall. Adult bison should not lose more than 1 to 1.5 body condition score during the winter feeding. The following table outlines target BCS for different classes of animal at different times of the year.

Table C.1 – Seasonal body condition score targets for breeding herds¹

Class	August	September	January	May
Breeding Cows	3/5	3/5	3/5	2/5
Breeding Heifers >2 yr ²	3/5	3/5	3/5	2/5
Bulls	3/5	2/5	2/5	2/5
Replacement Breeding Heifers <2yr ²	3/5 Target 380 kg ⁴	4/5	3/5	3/5
Yearlings 1–2 yr ²	3/5 Target 275 kg ⁴	3/5	2/5	3/5
Older Cows >18 yr ³	2.5/5	2/5	2/5	2

¹Individual variation in body condition is expected in any population, the target scores are intended to reflect the group average.

²as of May

³Older cows should be monitored closely and if they drop to a BCS of 1.5 be culled from the herd before they risk becoming compromised (see *Section 6 – Transportation*)

⁴(21).

There are several features of bison anatomy that make condition scoring bison different from scoring cattle. Special attention is given to the hip bones, rump, and hump.

Body condition scoring should be performed using a consistent procedure, by an experienced person or one who has been mentored in the process. Evaluate the key landmarks of the hump, ribs, spine, hip bones, rump, and tail head, and then take in the overall appearance of the animal. Consider factors such as hair coat and the animal's age, and then record the score on a 1 to 5 scale; half points (2.5/5) or a range (2–3/5) may be used, especially if the scoring is visual only. All animals should be evaluated and scored if possible, or if that is impractical, a large cross-section of each class of animal in the herd should be scored. Determine the average for each class and note any particularly thin or fat animals. Adjust feeding and management as necessary in order to meet BCS targets and take corrective action for individuals outside of the target ranges.

Body Condition

Score



UNDER IDEAL

- 1 Ribs visible on shorthaired cats. No palpable fat. Severe abdominal tuck. Lumbar vertebrae and wings of ilia easily palpated.
- 2 Ribs easily visible on shorthaired cats. Lumbar vertebrae obvious. Pronounced abdominal tuck. No palpable fat.
- 3 Ribs easily palpable with minimal fat covering. Lumbar vertebrae obvious. Obvious waist behind ribs. Minimal abdominal fat.
- 4 Ribs palpable with minimal fat covering. Noticeable waist behind ribs. Slight abdominal tuck. Abdominal fat pad absent.

IDEAL

- 5 Well-proportioned. Observe waist behind ribs. Ribs palpable with slight fat covering. Abdominal fat pad minimal.

OVER IDEAL

- 6 Ribs palpable with slight excess fat covering. Waist and abdominal fat pad distinguishable but not obvious. Abdominal tuck absent.
- 7 Ribs not easily palpated with moderate fat covering. Waist poorly discernible. Obvious rounding of abdomen. Moderate abdominal fat pad.
- 8 Ribs not palpable with excess fat covering. Waist absent. Obvious rounding of abdomen with prominent abdominal fat pad. Fat deposits present over lumbar area.
- 9 Ribs not palpable under heavy fat cover. Heavy fat deposits over lumbar area, face and limbs. Distention of abdomen with no waist. Extensive abdominal fat deposits.

Bjornvad CR, et al. Evaluation of a nine-point body condition scoring system in physically inactive pet cats. *AJVR* 2011;72:433-437.
Lafamme DP. Development and validation of a body condition score system for cats: A clinical tool. *Feline Pract* 1997;25:13-18.



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Committee

Body Condition

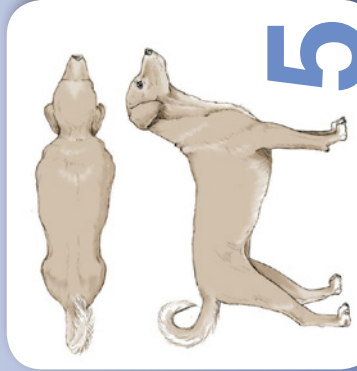
Score



1



3



5



7



9

UNDER IDEAL

- 1 Ribs, lumbar vertebrae, pelvic bones and all bony prominences evident from a distance. No discernible body fat. Obvious loss of muscle mass.
- 2 Ribs, lumbar vertebrae and pelvic bones easily visible. No palpable fat. Some evidence of other bony prominences. Minimal loss of muscle mass.
- 3 Ribs easily palpated and may be visible with no palpable fat. Tops of lumbar vertebrae visible. Pelvic bones becoming prominent. Obvious waist and abdominal tuck.

IDEAL

- 4 Ribs easily palpable, with minimal fat covering. Waist easily noted, viewed from above. Abdominal tuck evident.
- 5 Ribs palpable without excess fat covering. Waist observed behind ribs when viewed from above. Abdomen tucked up when viewed from side.

OVER IDEAL

- 6 Ribs palpable with slight excess fat covering. Waist is discernible viewed from above but is not prominent. Abdominal tuck apparent.
- 7 Ribs palpable with difficulty; heavy fat cover. Noticeable fat deposits over lumbar area and base of tail. Waist absent or barely visible. Abdominal tuck may be present.
- 8 Ribs not palpable under very heavy fat cover, or palpable only with significant pressure. Heavy fat deposits over lumbar area and base of tail. Waist absent. No abdominal tuck. Obvious abdominal distention may be present.
- 9 Massive fat deposits over thorax, spine and base of tail. Waist and abdominal tuck absent. Fat deposits on neck and limbs. Obvious abdominal distention.

Georffin A, et al. Comparison of a bioimpedance monitor with dual-energy x-ray absorptiometry for noninvasive estimation of percentage body fat in dogs. *AJVR* 2010;71:393-398.
 Jean-Louis L, et al. Effect of breed on body composition and comparison between various methods to estimate body composition in dogs. *Res Vet Sci* 2010;88:227-232.
 Kealy RD, et al. Effects of diet restriction on life span and age-related changes in dogs. *JAVMA* 2002;220:1315-1320.
 Lathem DP. Development and validation of a body condition score system for dogs. *Canine Pract* 1997;22:10-15.

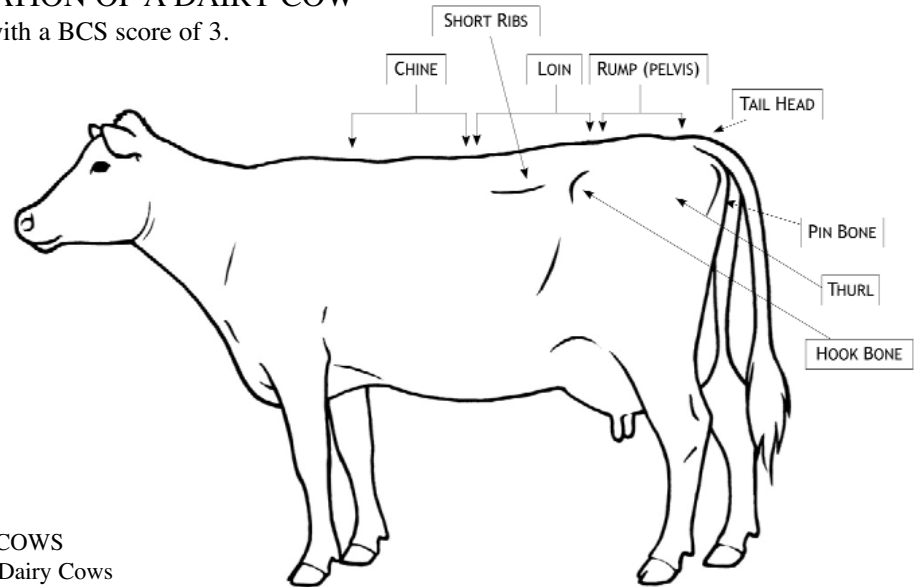




Body Condition Scoring Chart

LABELLED ILLUSTRATION OF A DAIRY COW

Illustration of a Dairy Cow with a BCS score of 3.



BODY CONDITION SCORES FOR DAIRY COWS

Overview of all the body condition scores for Dairy Cows

BCS 1:

SHORT RIBS:

- Ends sharp to touch
- Loin prominent, shelf-like appearance
- Obvious scalloping over top and ends

BACKBONE:

- Vertebrae prominent in chine, loin and rump area
- Individual bones easily visible

HOOKE AND PIN BONES:

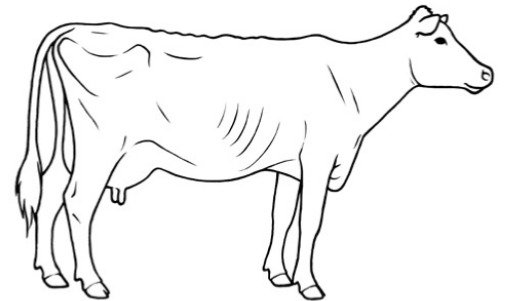
- Sharply defined, very angular in appearance
- No discernable fat pad

THURL (area over pelvis):

- Severe “V shaped” depression without fat cover

TAIL HEAD:

- Sunken and hollow on either side of tail head with obvious folds of skin
- Ligaments connecting pin bones to spine are sharply defined
- Vulva prominent.



BCS 2

SHORT RIBS:

- Ends not as prominent as BCS 1, but can be felt
- Edges easily felt, with slight fat cover, and slightly more rounded appearance
- Overhanging shelf effect less apparent

BACKBONE:

- Vertebrae in chine, loin and rump area, less visually distinct
- Easily feel individual vertebrae

HOOKE AND PIN BONES:

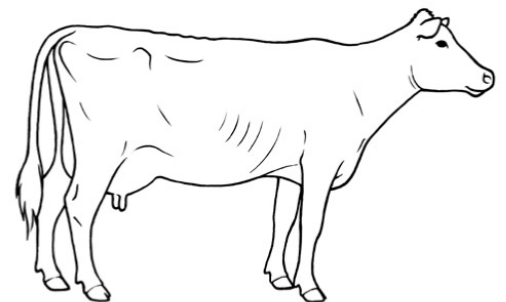
- Bones still prominent, angular
- No fat pad palpable

THURL (area over pelvis):

- Less severe “V shaped” depression
- Little tissue cover

TAIL HEAD:

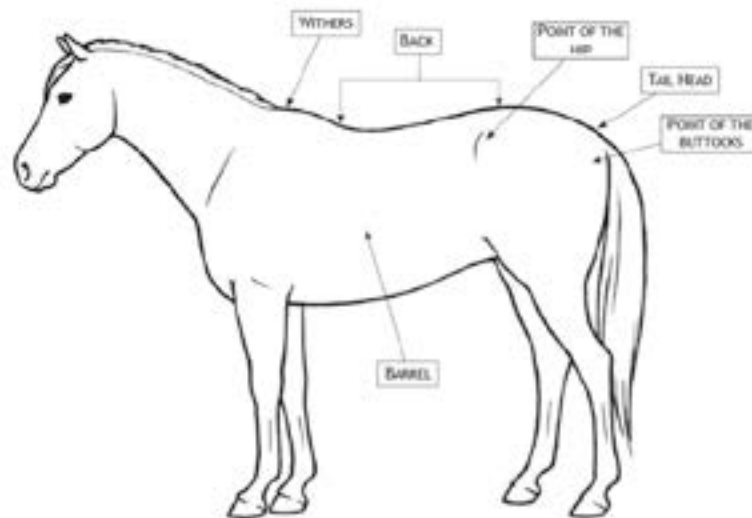
- Both sides of the tail head are sunken and hollow
- Sharply defined ligaments connecting pin bones to spine





Body Condition Scoring - Horses and Ponies

LABELLED ILLUSTRATION OF A HORSE¹



BCS 1

WHOLE BODY

- Poor condition
- Extremely emaciated
- No fat tissue felt

NECK

- Bone structure visible

WITHERS

- Bone structure easily visible

BACK

- Spinous processes project prominently

TAIL HEAD

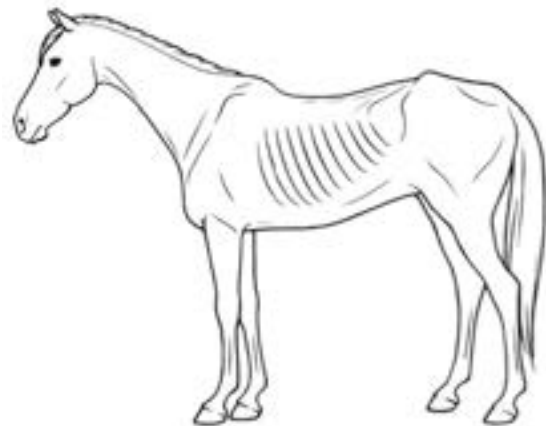
- Tail head, point of the buttocks and point of the hip project prominently

RIBS

- Project prominently

SHOULDER

- Bone structure easily noticeable



¹ Adapted from: What's the Score? Body Condition Scoring for Livestock CD-ROM CD 400/40-1 with permission of Alberta Agriculture and Rural Development. www.agriculture.alberta.ca Copies of the CD can be ordered on-line at: [www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/agdex9622](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex9622)

How to body condition score (BCS):

The hair coat can often prevent you from seeing the true shape of a goat and therefore, it is important that the hands-on assessment is done. A visual assessment alone is not adequate to assess poor body condition.

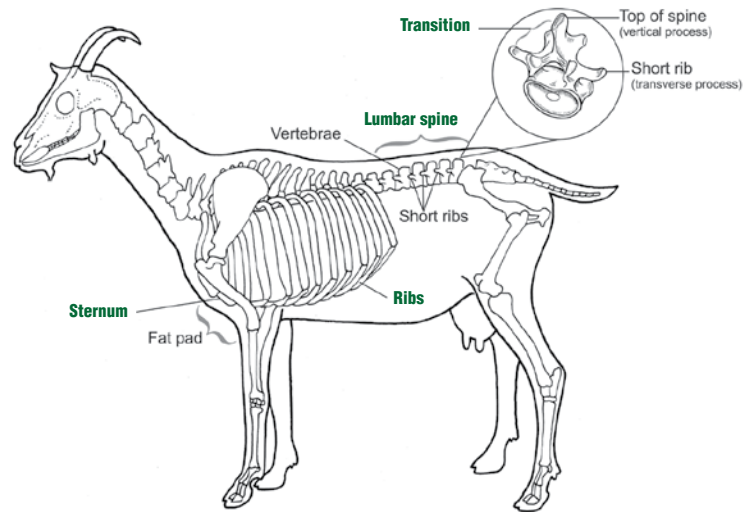
If you cannot score all your goats, choose a subset of goats in your herd. Alternatively, combine body condition scoring with other routine husbandry procedures such as hoof trimming or vaccination. Recording BCS is important as it may help you identify changes in an individual animal that may indicate disease or inform breeding and culling decisions. With practice, body condition scoring should take only 10-15 seconds per animal.

The three main locations to assess when performing body condition scoring are the lumbar spine, ribs, and sternum/breast bone (see figure 1). You are feeling for the bones in the goat. The amount of fat and muscle the goat has will change your ability to feel the bones underneath. If it is easy to feel the bones, the goat doesn't have enough fat and muscle. If you have trouble feeling the bones, the goat may have too much fat.

Tip: Giving each goat a specific body condition score is not as important as being able to determine if your goat is under-conditioned (too thin), over-conditioned (too fat), or properly conditioned (healthy weight).

Ideal body condition (acceptable range):

- For most stages of production: 3.0 (2.5-4.0)**
- At kidding or before winter: 3.5 (3.0-3.5)**
- Does at breeding: 3.0 (2.5-3.5)**
- Bucks at breeding: 3.0 (3.0-3.5)**
- Does may lose up to one point during peak lactation, but should be allowed to regain this before kidding.**



Lumbar Spine: This is the part of goat behind the ribcage and in front of the tail, also known as the loin. The spine is made up of many connected vertebrae. Vertebrae have three processes that stick out – one on each side (short ribs) and one straight up (top of spine). Move your fingers from one vertebrae to the next, noting the shape of the space the between processes on the sides and top. See if you can slip your fingers under the short ribs or pinch the top of the spine. Feel the amount of fat or muscle in the space between the top of the spine and the short ribs (transition) (see figure 1).

Ribs: Assess the amount of muscle and fat cover over the ribs, behind the front leg. Try to push your fingers into the space between two ribs and note how much pressure it takes to feel for this space.

Tip: Having an independent person perform body condition scoring on your goats may be beneficial. If the majority of your goats are a little over- or under-conditioned, you may think that is normal. You can always ask your veterinarian or nutritionist to perform body condition scoring on your goats and compare your assessments.

Sternum: Assess the amount of muscle and fat over the sternum or breastbone, between the goat's front legs. This area has cartilage (slightly softer than bone) that connects the ribs to the breast bone. Note how easily the cartilage is felt. Grasp the fat pad on the sternum/breast bone to judge how large it is and whether you can move it.

Tip: Body condition scoring is not about ranking your goats, but comparing them to the scale. Do not pick a doe that you think has an ideal BCS and compare everyone to her. Each goat should be compared to the BCS chart.



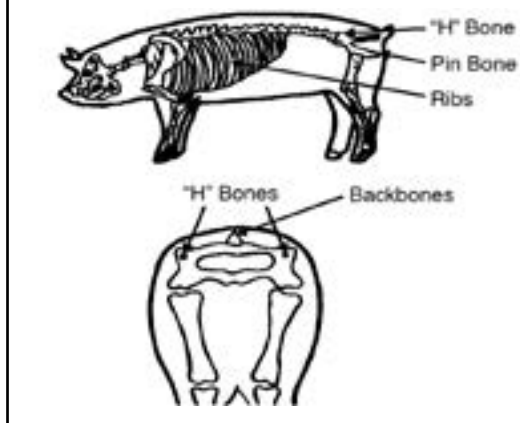
Sow Body Condition Scoring System

This scoring system (14) uses finger or hand pressure at key points on the sow's body to arrive at a number, or score.

The points used on the sow's body are those areas where the only tissue between the skin and bones is fat tissue. These areas on the sow include the ribs, back bone, "H" bones, and "pin" bones (Figure 1). By assessing the ease or difficulty of feeling these bones, you can estimate the fat stores of the sow. It is important to rely on more than one of these areas when assessing body condition. Different animals may deposit fat in differing degrees at different locations.

Relationship between condition score and back-fat level (14)

Figure 1. Location of ribs, backbone, "H" bones, and "pin" bones on the sow.



Condition Score	Approximate Level of Backfat	
	Inches (in)	Millimeters (mm)
1	< 0.6	< 15
2	0.6-0.7	15-18
3	0.7-0.8	18-20
4	0.8-0.9	20-23
5	> 0.9	> 23



Body Condition Scoring

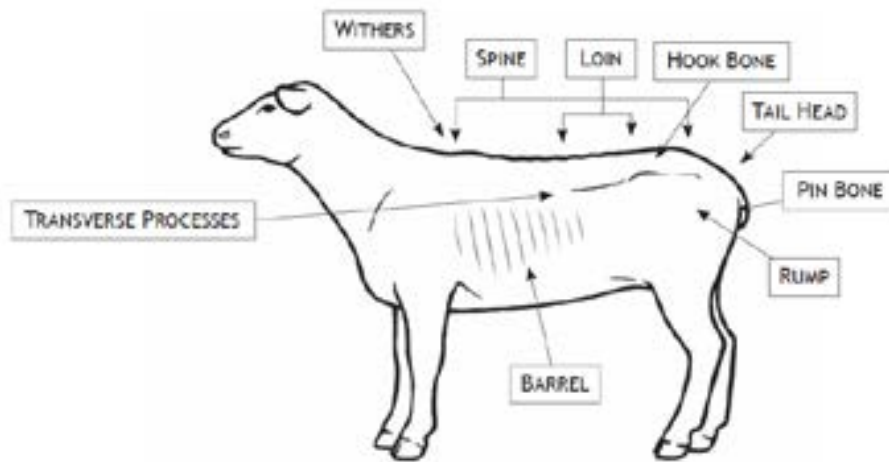
Body condition scoring (BCS) is a hands-on method of assessing the amount of fat and muscle cover on an animal. Proper scoring involves both physical palpation and visual assessment of specific anatomical sites.

Body condition score	Description
1 Very thin	<ul style="list-style-type: none"> - Hip bones, ribs, and spine project prominently - Loss of muscle and no fat cover - Rump area curves in
2 Thin	<ul style="list-style-type: none"> - Hip bones, ribs, and spine are easily felt - Loss of muscle and very little fat cover - Rump area is flat
3 Ideal	<ul style="list-style-type: none"> - Hip bones, ribs, and spine are easily felt but are rounded, not sharp - No abdominal bulge - Rump area is flat
4 Overweight	<ul style="list-style-type: none"> - Pressure is needed to feel the ribs, spine, and hip bones - Some fat layers - The rump is rounded
5 Obese	<ul style="list-style-type: none"> - Very hard to feel the spine and hip bones; ribs cannot be felt - Abdomen sags with obvious fat padding - Rump bulges out



Body Condition Scoring

Illustration of a sheep with a BCS score of 2.¹



CROSS SECTION OF THE LOIN AREA

BODY CONDITION SCORING OF SHEEP

Throughout the production cycle, sheep producers must know whether or not their sheep are in condition (too thin, too fat, or just right) for the stage of production: breeding, late pregnancy, lactation.

Weight at a given stage of production is the good indicator, but as there is a wide variation in mature size between individuals and breeds, it is extremely difficult to use weight to determine proper condition. Body condition scoring describes the condition of a sheep, is convenient and is much more accurate than a simple eye appraisal.

A body condition score estimates condition of muscling and fat development. Scoring is based on feeling the level of muscling and fat deposition over and around the vertebrae in the loin region (Figures 1-3). In addition to the central spinal column, loin vertebrae have a vertical bone protrusion (spinous process) and a short horizontal protrusion on each side (transverse process). Both of these protrusions are felt and used to assess an individual body condition score.

FIGURE 1

Feel for the spine in the centre of the sheep's back, behind its last rib and in front of its hip bone.

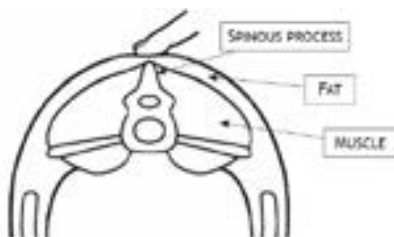


FIGURE 2

Feel for the tips of the transverse processes.



FIGURE 3

Feel for fullness of muscle and fat cover.



¹ The source of the materials is www.agriculture.alberta.ca. The use of these materials by the National Farm Animal Care Council (NFACC) is done without any affiliation with or endorsement by the Government of Alberta. Reliance upon NFACC's use of these materials is at the risk of the end user.



Reproductive System

Meeting 1 - Orientation To The Reproductive System

Setting Objectives:

To identify the structure and function of the female reproductive system.

Suggested Learning Outcomes:

- Identify the structures of the female reproductive system
- Identify the structures of the male reproductive system.

Suggested Roll Call Questions:

- What was the largest litter of animals you have seen?
- Name one structure of the female reproductive system. What is its function?

SAMPLE MEETING AGENDA

Time: 1 hour 40 minutes

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	20-25 minutes
Topic Information, Discussion	Parts Of The Female Reproductive System	10 minutes
Topic Information, Discussion	Parts Of The Male Reproductive System	10 minutes
Activities Related To Topic	Activity #1 - Label Me!	30 minutes
Wrap up, Social Time And Adjournment		10 minutes

Parts Of The Female Reproductive System

Every mammal has its own special way of producing offspring. The process is called reproduction. To be successful, it needs a healthy reproductive system. The reproductive system is a group of body parts called organs that work together to produce, carry and deliver an animal's young into the world.

All female mammals have the same basic reproductive system. First are the ovaries. There are two of them. They are usually round, although sometimes can be bean shaped. Ova, also known as eggs, are produced in the ovary. Inside the ova are the chromosomes. They contain one half of the genetic information. The other half comes from sperm from the male. The chromosomes contain the genetic information for the growth and development of the animal.

A fluid filled follicle containing an egg begins to grow in the ovary. This bursts and releases the egg from the ovary. This process is called ovulation. The collapsed follicle turns into a hard raised structure. This is called the corpus luteum or sometimes called the C.L.

Once the egg is released it is picked up by the oviduct, also called the fallopian tube. The egg travels down this tube. If it meets up with a sperm cell from a male, then fertilization occurs. This single cell is now ready to grow and develop into a newborn animal. The cell continues to divide into many cells. This mass of cells is now called an embryo.

The oviduct opens into the horns of the uterus, which then enters the body of the uterus. The uterus is Y-shaped and is a flexible muscular tube. By the time the embryo enters the uterus, it will become a cluster of microscopic cells. The embryo then attaches to the inner lining of the uterus. This is called implantation. Now the embryo is called a fetus. This is a very important time for the mother as it is a signal to her body that she is pregnant.

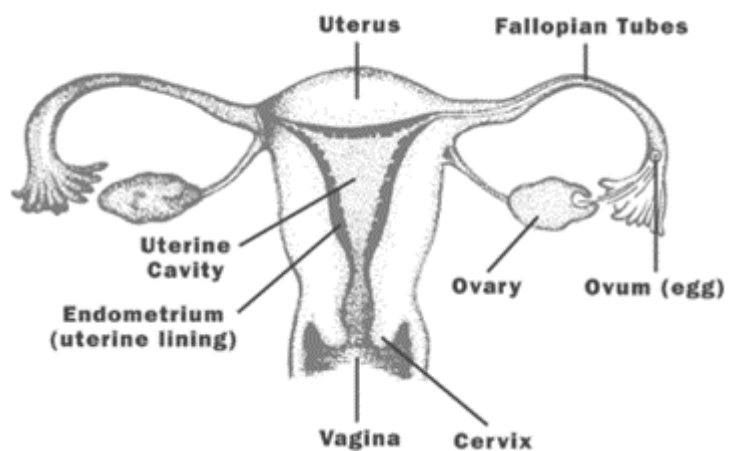
See the diagram for the structure of the female reproductive system. Try to identify the path an egg would take once released from the ovary.

The lining of the uterus and the fetus begin to form a fluid filled membrane in which the fetus will grow until birth. This is called the placenta.

The placenta allows nutrients and oxygen to pass from the mother to the fetus and carbon dioxide and waste material to pass in the other direction via the umbilical cord. In addition, the placenta acts as a shock absorber, and a barrier to some diseases.

The outer entrance to the uterus is the cervix. It relaxes during estrus to allow the male's sperm to enter the uterus and move up into the fallopian tube. It also relaxes at birth to allow the passage of the fetus. At all other times, the cervix is closed. This is to prevent infection in the uterus.

The vagina is the canal that leads from the uterus to the outside. At the other end of the uterus is the vulva. This is the part of the reproductive system that you can see. The cervix, vagina and vulva are very flexible. They will expand many times their normal size to allow the fetus to be delivered during birth.

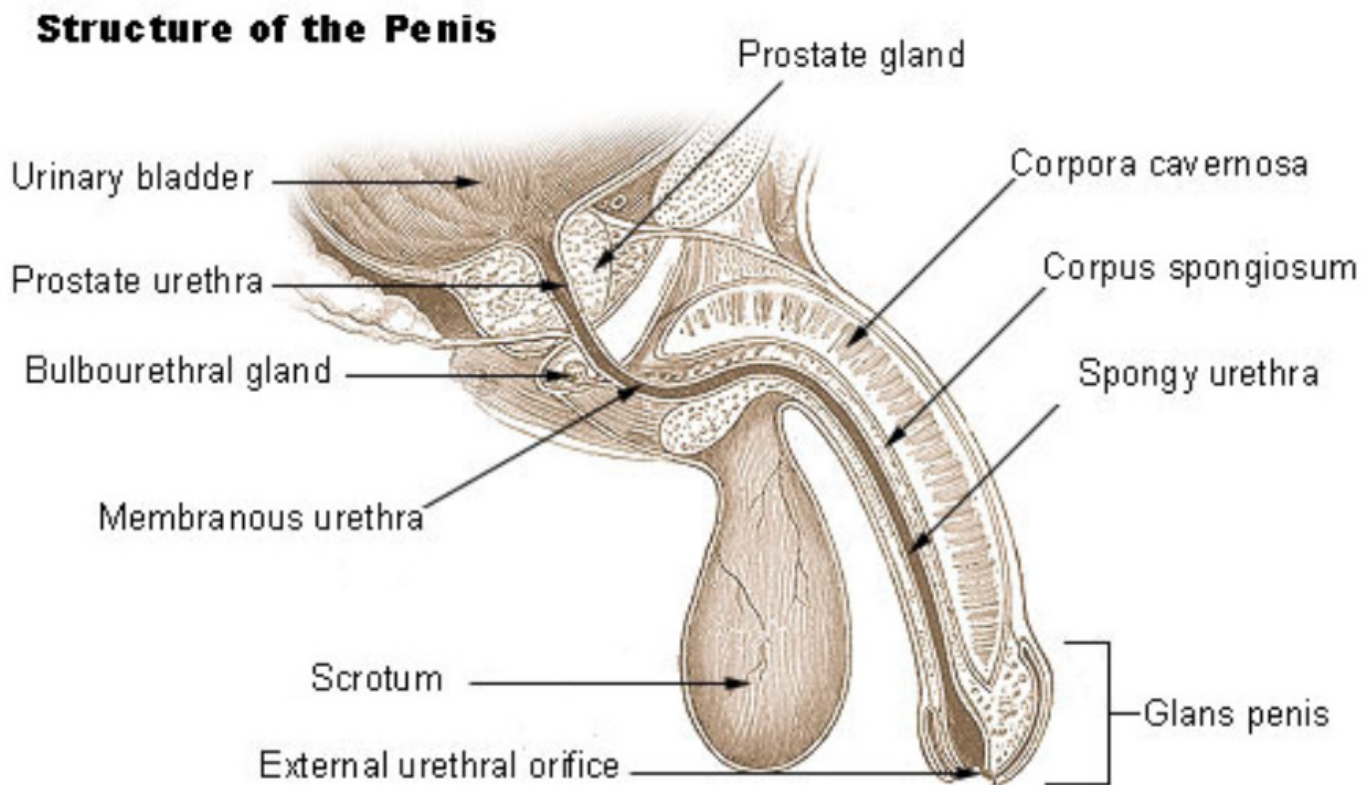


Parts Of The Male Reproductive System

Each male has two testicles. They produce millions of microscopic cells called sperms. These cells contain half of the chromosomes needed to form a complete embryo. In humans the sperm contains 23 chromosomes.

Both testicles are inside the scrotum, which can be seen between the animal's hind legs. The testicles hang outside the animal's body to remain at a slightly cooler temperature. This is necessary for the health of the sperm cells.

During breeding, sperm travels through a thin tube called the **ductus deferens** and enters a larger tube called the urethra. The **urethra** travels through the center of the penis. The penis is not usually visible unless the animal is passing urine or breeding. Otherwise, it is hidden by a fold of skin called the **sheath**.



Activity #1 - Label Me!

Do	<p>Time: 15 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Label Me Activity sheets <p>Instructions:</p> <p>The purpose of this activity is to expose members to the male and female anatomy of animals that might be seen in a food animal practice.</p> <p>Included on the next pages is male and female reproductive systems of a cow, sheep and pig. They are numbered sequentially for male to female with an activity sheet attached for members to use to structure their answers.</p> <p>Get members to work individually, then in pairs and then in smaller groups. Finally bring all members together and see how many unique parts they can get.</p>
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to identify the differences between species and for members to label the female and male anatomy of those species.</p>
Apply	<p>Discuss The Following Prompts As A Group:</p> <ul style="list-style-type: none">• Did you notice any major differences between the species (if you looked at multiple)?

REPRODUCTIVE TRACT OF THE BULL

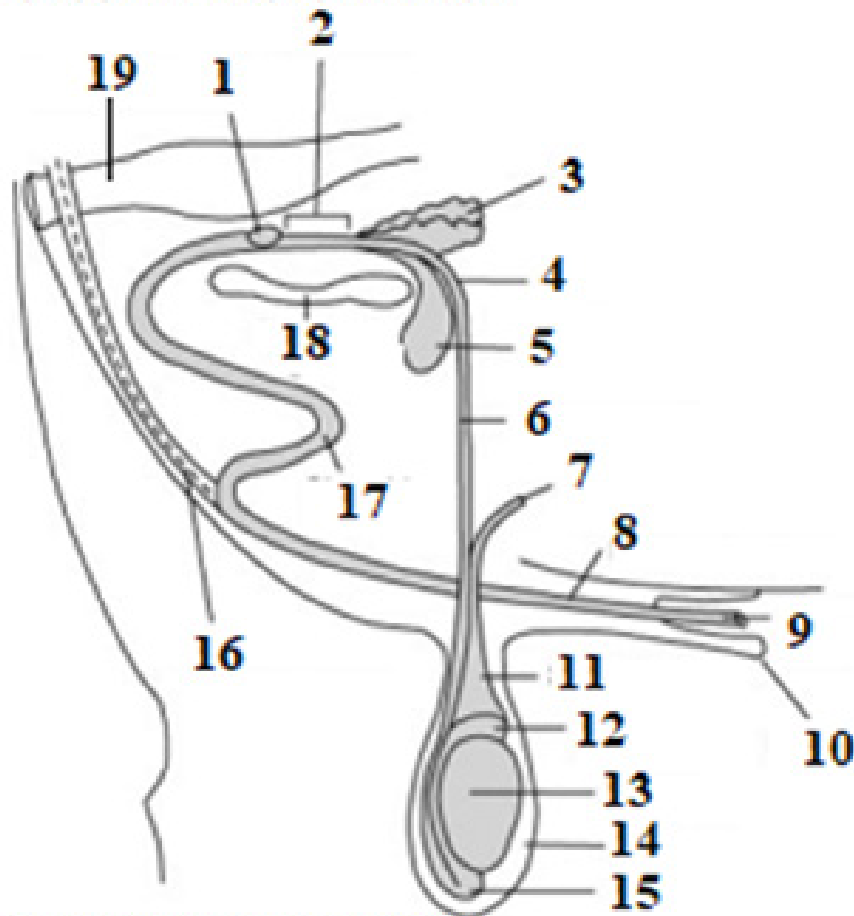
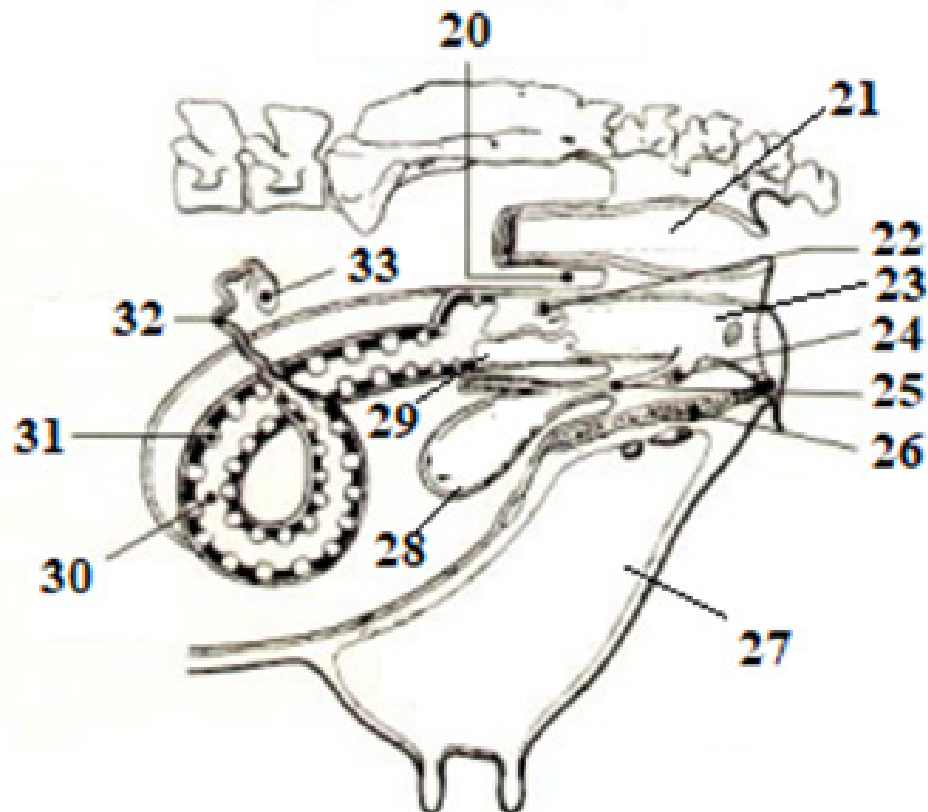
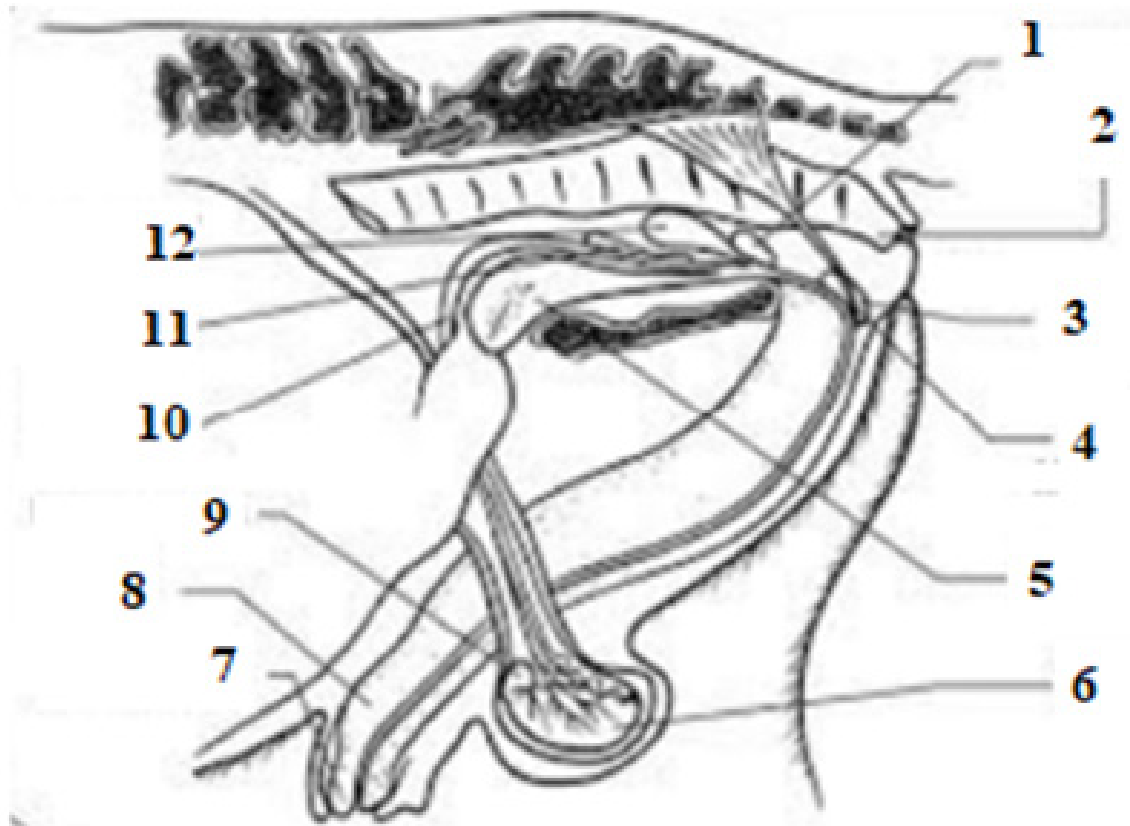


Image from: <http://extension.missouri.edu/p/G2016>

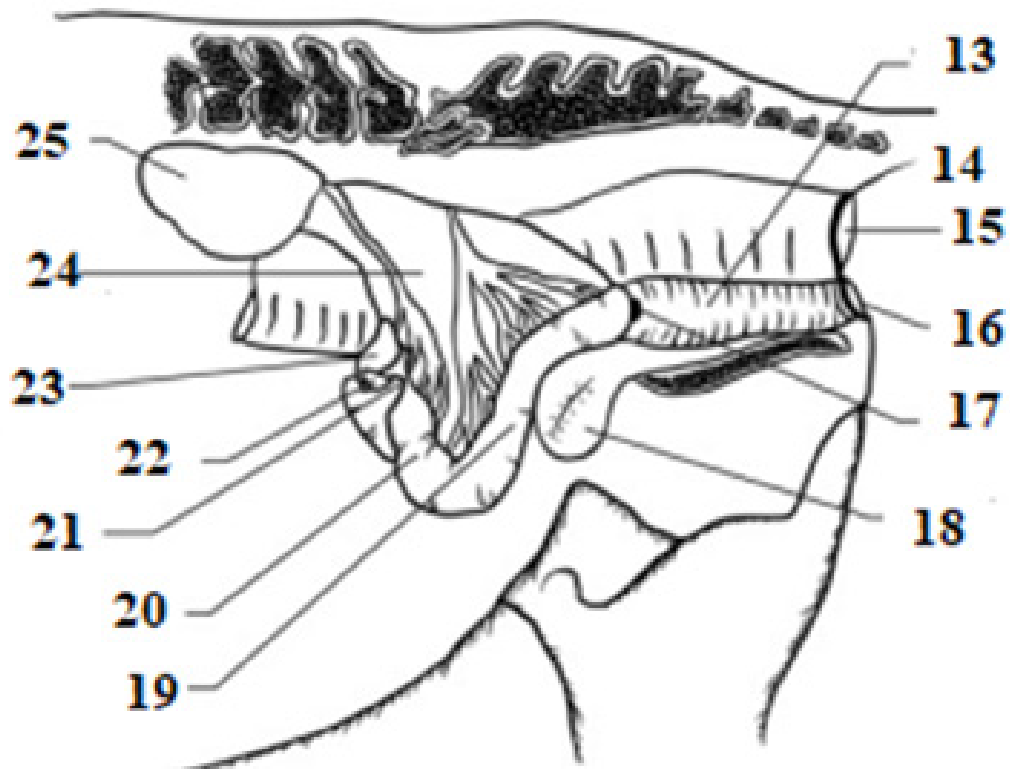
REPRODUCTIVE TRACT OF THE COW



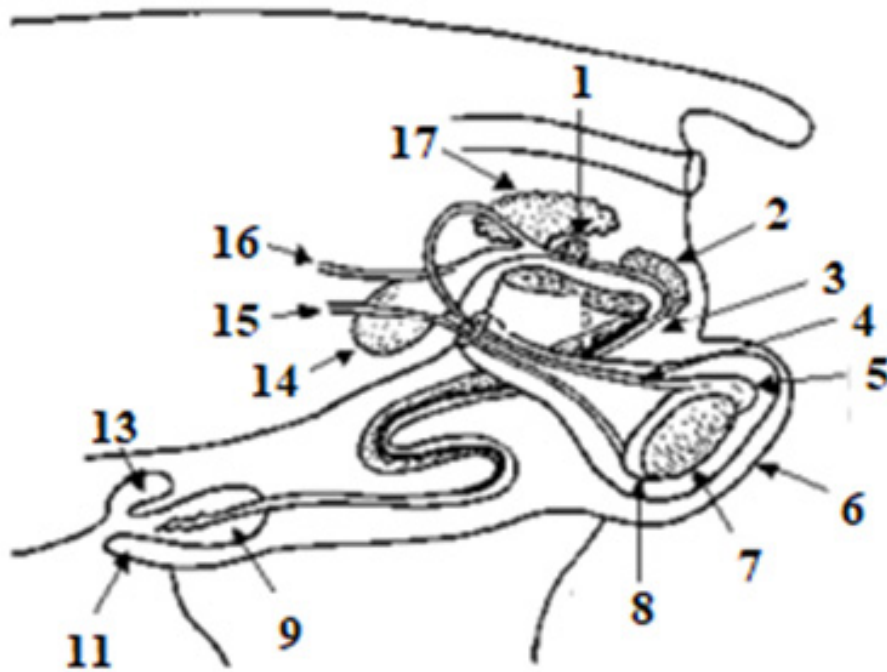
REPRODUCTIVE TRACT OF THE RAM



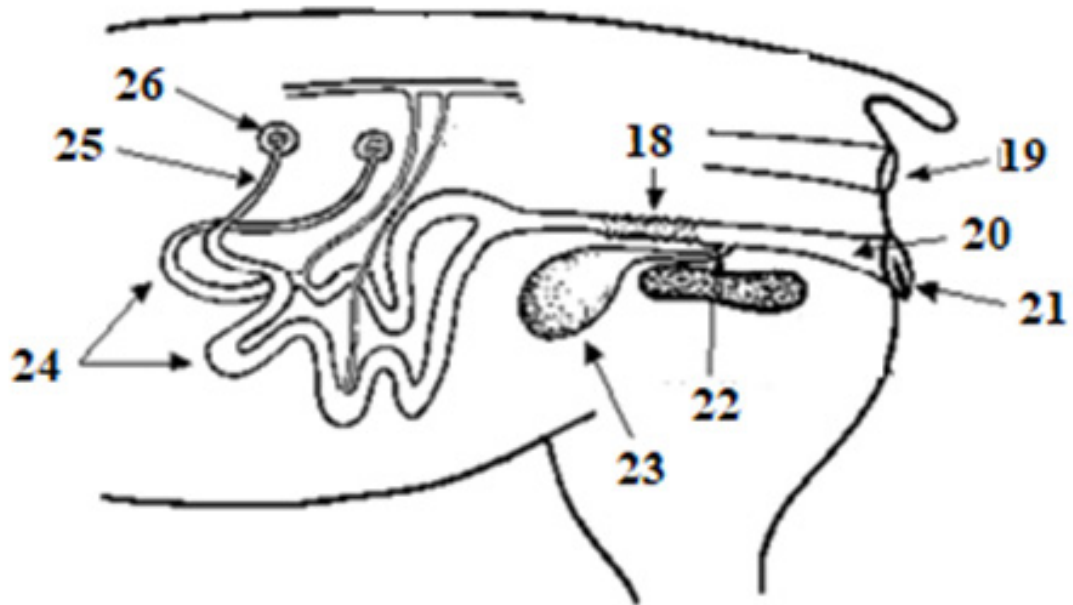
REPRODUCTIVE TRACT OF THE EWE



REPRODUCTIVE TRACT OF THE BOAR



REPRODUCTIVE TRACT OF THE SOW



Images from: <http://www.thepigsite.com/pighealth/article/1/reproductive-system/>

Label Me! Cow

1.	12.	23.
2.	13.	24.
3.	14.	25.
4.	15.	26.
5.	16.	27.
6.	17.	28.
7.	18.	29.
8.	19.	30.
9.	20.	31.
10.	21.	32.
11.	22.	33.

Label Me! Cow - ANSWER KEY

1. Cowper's Gland	12. Head of Epididymus	23. Vagina
2. Prostate Gland	13. Testicle	24. Suburethral Diverticulum
3. Seminal Vesicle	14. Scrotum	25. Urethra
4. Ampulla	15. Tail of Epididymus	26. Pelvis
5. Urinary Bladder	16. Refractor Muscles	27. Mammary Gland
6. Vas Deferens	17. Sigmoid Flexure	28. Bladder
7. Spermatic Blood Vessels and Nerves	18. Symphysis of Pelvis	29. Cervix
8. Penis	19. Rectum	30. Uterine Horn
9. Glans Penis	20. Rectogenital Pouch	31. Caruncle
10. Sheath	21. Rectum	32. Oviduct
11. Spermatic Cord	22. Fornix Vagina	33. Ovary

Label Me! Sheep

1.	12.	23.
2.	13.	24.
3.	14.	25.
4.	15.	26.
5.	16.	27.
6.	17.	28.
7.	18.	29.
8.	19.	30.
9.	20.	31.
10.	21.	32.
11.	22.	33.

Label Me! Sheep - ANSWER KEY

1. Prostate	12. Vesicular Glands	23. Ovary
2. Rectum	13. Vagina	24. Broad Ligament
3. Bulbourethral Glands	14. Base of Tail	25. Kidney
4. Retractor Penis Muscle	15. Anus	
5. Bladder	16. Vulva	
6. Testis	17. Cervix	
7. Glans Penis	18. Bladder	
8. Penis	19. Uterine body	
9. Epididymis	20. Uterine horn	
10. Deferent Duct	21. Oviduct	
11. Ampulla	22. Infundibulum	

Label Me! Porcine

1.	12.	23.
2.	13.	24.
3.	14.	25.
4.	15.	26.
5.	16.	27.
6.	17.	28.
7.	18.	29.
8.	19.	30.
9.	20.	31.
10.	21.	32.
11.	22.	33.

Label Me! Porcine - ANSWER KEY

1. Prostate Gland	14. Bladder	24. Horns of Uterus
2. Bulbourethral Gland	15. Spermatic Blood Vessel	25. Oviduct
3. Urethra	14. Scrotum	26. Ovary
4. Vas Deferens	16. Ureter	
5. Epididymis (Tail)	17. Seminal Vesicles	
6. Scrotum	18. Cervix	
7. Testicle	19. Rectum	
8. Epididymis (Head)	20. Vagina	
9. Penis	21. Vulva	
11. Prepuce	22. Urethra	
13. Preputial Sac	23. Bladder	

Meeting 2 - Cycles And Hormones!

Setting Objectives:

To identify the stages of the female reproductive cycle, the hormones involved and signs of estrus in animals.

Suggested Learning Outcomes:

- To identify the stages of the female reproductive cycle and what is occurring at each step.
- To identify the hormones involved in estrus and pregnancy.
- To identify signs of estrus in animals.

Suggested Roll Call Questions:

- Name one hormone involved in the reproductive system. Where does it come from and what is its function?
- Name a sign of estrus in an animal of your choice.

SAMPLE MEETING AGENDA

Time: 2 hours

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	15-20 minutes
Topic Information, Discussion	Female - Cycling, Breeding And Pregnancy	15 minutes
Activities Related To Topic	Activity #1 - Identify The Stage Of the Estrus Cycle	15 minutes
Topic Information, Discussion	Species Differences: Signs Of Estrus	15 minutes
Activities Related To Topic	Activity #2 - Identify Estrus	15 minutes
Topic Information, Discussion	Focus On The Hormones	15 minutes
Wrap Up, Social Time And Adjournment		10 minutes

Female - Cycling, Breeding And Pregnancy

Animals Have Cycles

When events occur in a certain order, when they start and finish at the same point and these events happen continuously, this is called a cycle. An example of a cycle would be the four seasons of the year. Another example would be the daily rising and setting of the sun. Animals have cycles too. The female mammal has two main reproductive cycles. They are the estrus and pregnancy cycles.

The Estrus Cycle

- This cycle starts with estrus, the time when the female is receptive to breeding by the male. Estrus is sometimes referred to as the animal being “in heat.” The behaviour of the female will change when she is in heat.
 - Common signs of an animal being in heat are:
 - » Stands to be mounted
 - » Change in activity level
 - » Changes in behaviour
- The follicle(s) in the ovary release the ova (egg). This is ovulation.
- Each follicle forms a corpus luteum (C.L.). If fertilization does not occur, the C.L. regresses.
- When this is complete, new follicles begin to mature. One or more will become the largest and estrus and ovulation will occur again.

Detecting The Estrus Cycle

- **OBSERVATION:** Estrus can be detected by watching the group’s behaviour at least 2-3 times per day. Often large animals will show signs of heat in the early morning or late evening. If artificial breeding is to be successful, visual detection of heats is very important. Lack of heat may indicate pregnancy.
- **PALPATION:** This means to “explore by touching.” Veterinarians can palpate the reproductive tract in cows and horses by placing their forearm, covered with a plastic glove, in the rectum of the animal. The rectum is the last part of the animal’s intestine. The reproductive tract lies just under the rectum and can easily be examined. Changes on the ovaries and in the uterus can be felt when detecting estrus or pregnancy. However, in small animals palpation can be done externally.
- **TECHNOLOGY:** In more recent years, the use of technology has been instrumental in improving heat detection on farms. We will discuss this more in Meeting 3.

The Pregnancy Cycle

- This cycle starts only if fertilization occurs. Fertilization occurs in the ampulla of the oviduct in bovine species.
- The C.L. does not shrink. Instead, it secretes hormones that signal back to the female, to tell her that she is pregnant. The predominant hormone is progesterone.
- Implantation of the embryo to the uterus occurs.
- The placenta forms around the fetus.
- The fetus grows, causing the uterus to expand.
- Birth takes place.
- The female produces milk for the newborn until it is weaned (old enough to feed itself and digest the nutrients in other feeds). This time period from birth till weaning is called lactation. If the animal continues to be milked the lactation period will extend past weaning.
- During this time, the estrus cycle starts again, and a new pregnancy cycle may begin.

Detecting The Pregnancy Cycle

- **PALPATION:** Palpation can be done to detect pregnancy in the same manner as in detecting estrus. Changes in the ovaries and in the uterus can be felt when detecting pregnancy. The hand feels the uterus under the rectum.
- **ULTRASOUND:** This method is commonly used in bovine, sheep, swine and horses to detect pregnancy. In very simplistic terms, an ultrasound works as sound waves bounce off the uterus and a picture forms on the ultrasound screen. Recent advances allow one to see early fetuses and even developing follicles.
- **LABORATORY/TESTING:** Progesterone levels can be measured in the milk and blood of animals to detect the estrus and pregnancy cycles. A low level of progesterone indicates no pregnancy and a normal estrus cycle. Other hormone levels can be also measured to determine pregnancy within the first three months. In addition, cells taken from the vagina of small animals can be examined under the microscope for changes associated with estrus.

The Birth Process

Birth is the journey the fetus makes from its protected environment inside the uterus of its mother to the world outside. It signals the end of pregnancy. The average length of pregnancy varies from between animals. For example, a pig's pregnancy term last for about 112 days (an easy way to remember this is 3 months, 3 weeks and 3 days), while a horse's lasts 330 days.

The birth process can be artificially started in most animals. The birth process is started by fetal cortisol levels rising, among other factors and hormones. Certain messages between the fetus, placenta, uterus, ovary and the brain of the pregnant female that starts the fetus on its journey.

The birth process is often divided into three stages:

STAGE 1: The mother animal becomes restless. Many animals look for a nesting area. This stage is longer in animals giving birth for the first time and may pass quickly in experienced animals. The animal's mammary glands (in the udder) further enlarge as they fill with milk. This stage ends when the cervix is fully opened, and the fetus is starting to enter the vagina (birth canal).

STAGE 2: When the fetus enters the birth canal the placenta is under pressure from being squeezed into a smaller space. This pressure causes the innermost sac of the placenta to break. The fluids inside the placenta (commonly called the water) are released and flow out the birth canal. In most animals the fetus comes through the birth canal and vulva with the nose just behind the front feet. On the other hand, piglets and human babies usually come out head-first. This stage ends when the fetus has passed by the vulva. The umbilical cord (the attachment of the fetus to the placenta) will either be broken off by the female during birth or cut by humans.

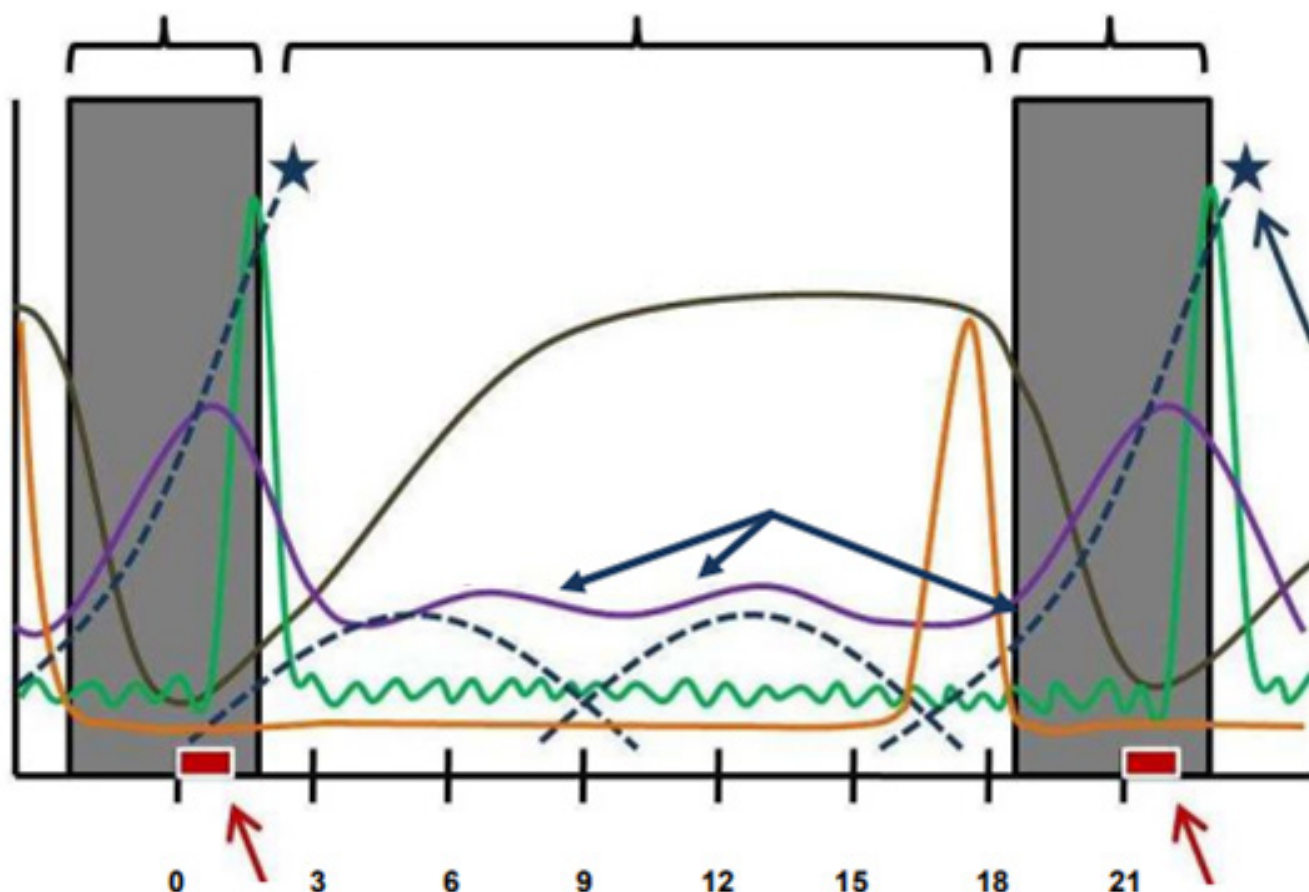
STAGE 3: At this stage the placenta is delivered. The placenta is often called the afterbirth. Some animals release this right after birth, while others may take up to 12 hours. Very few animals take more than 24 hours. If animals take this long, the placenta may be considered "retained".

Most animals encourage their young to suckle right after birth. Some animals, especially first-time mother should be watched very closely. They may feel threatened and confused by the newborn and reject or injure it.

Activity #1 - Identify The Stage Of The Estrus Cycle

Do	<p>Time: 15 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Diagram on next page <p>Instructions:</p> <p>On the diagram on the next page, use the word bank to fill in the image of a bovine estrus cycle.</p>
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to label the time points and hormones for different stages of estrus.</p>
Apply	<p>Discuss The Following Prompts As A Group:</p> <ul style="list-style-type: none">• What is the role of the hormones?• Identify some key points. What is happening?

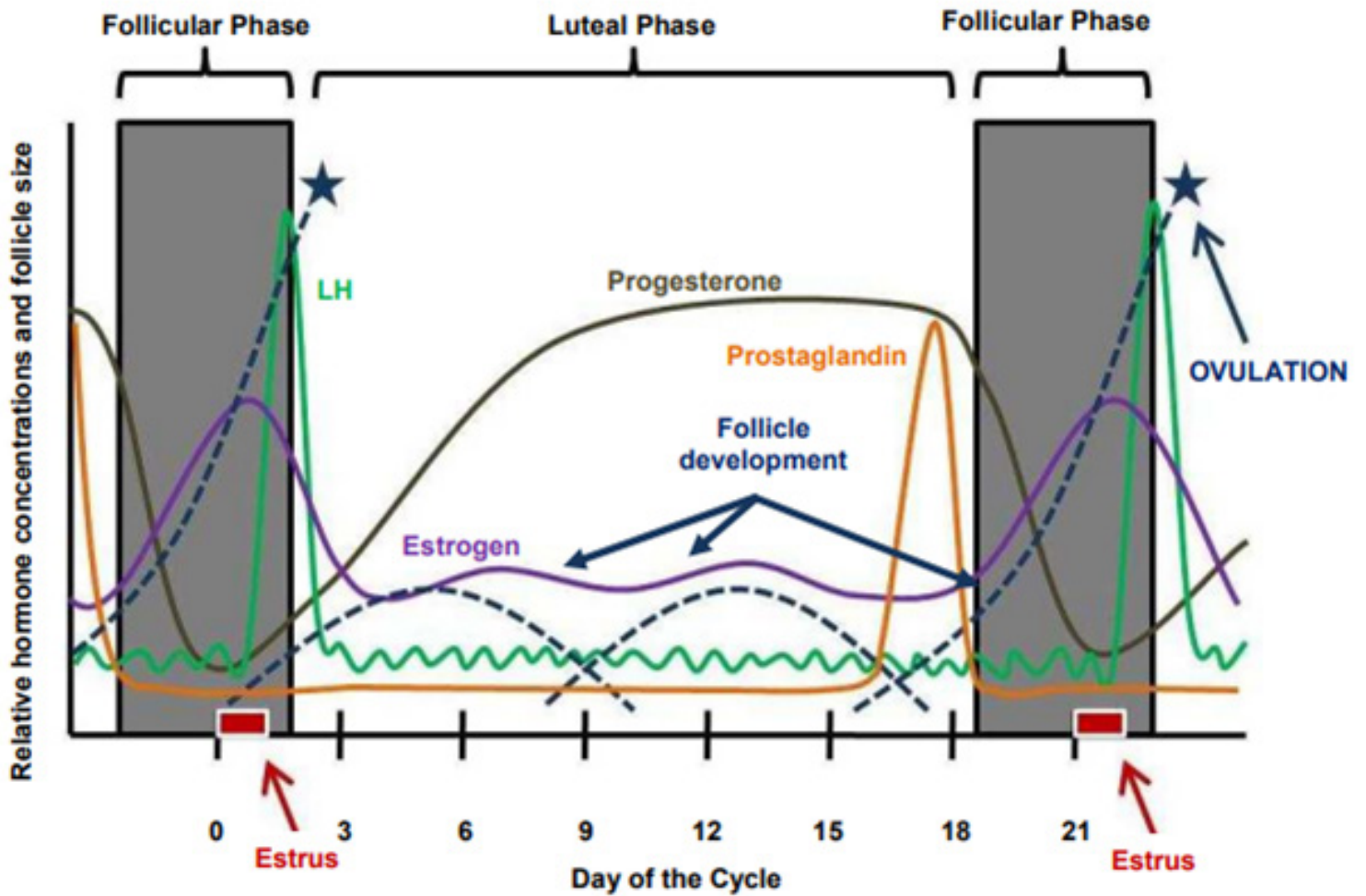
Identify the Stage of the Estrus Cycle - Fill In The Blanks



Source: <https://agsci.oregonstate.edu/sites/agscid7/files/eoarc/attachments/638.pdf>

Word Bank		
Day in Cycle	Prostaglandin	Follicular Phase
Estrus	Luteal Phase	Ovulation
Follicular Phase	Estrogen	
Estrus	Follicle Development	
LH	Relative hormone concentrates and follicle size	

Identify the Stage of the Estrus Cycle - ANSWER KEY



Species Differences: Signs Of Estrus

The following chart breaks down some of the differences between visual estrus detection between the different food animal species:

Animal	Vulva	Behaviour	Other Signs
Cow	<ul style="list-style-type: none"> swells and turns red protrusion of clear stringy mucous 	<ul style="list-style-type: none"> stands to be mounted will try to mount other cows walks around nosing, smelling and sniffing other cows reduces feed intake moos, bawls and becomes an all-around noisy animal 	<ul style="list-style-type: none"> milk production drops will stand motionless when you exert downward pressure on her back
Horse	<ul style="list-style-type: none"> swells, turns pink and wet thick to watery mucous discharge 	<ul style="list-style-type: none"> very excitable, whinnies often will bother other mares squats and urinates frequently in presence of a stallion 	<ul style="list-style-type: none"> some mares will not exhibit signs of heat and must be “teased” by bringing a stallion near and noting any changes in behaviour can become violent
Ewe	<ul style="list-style-type: none"> slight swelling and mucus discharge 	<ul style="list-style-type: none"> some excitability, though changes in behaviour are not always that obvious 	<ul style="list-style-type: none"> observe the ram’s behaviour, he can tell when the ewe is in estrus by her smell and will try to mount her
Goat Does	<ul style="list-style-type: none"> swells thick stringy mucous discharge 	<ul style="list-style-type: none"> twitches tail, bleats often runs around in a nervous state urinates often when buck is near 	<ul style="list-style-type: none"> will be singled out by buck milk production will increase, then fall for several days, then swing up again will assume recognizable breeding position when petted on the back
Sow	<ul style="list-style-type: none"> swells stringy mucous discharge 	<ul style="list-style-type: none"> restlessness off feed mounts other females squats and urinates often 	<ul style="list-style-type: none"> attracts boar will stand quietly if pressure is applied to its back

Activity #2 - Identify Estrus

Do	<p>Time: 15-30 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Barn or Flock (may need to be season specific). Videos also work. <p>Instructions:</p> <p>Get videos or watch the animals in small groups.</p> <p>See if you can see any of the behaviours of estrus in the animals you are observing.</p> <p>Discuss the breeding program on the farm in preparation for next meeting.</p>
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to get members to identify those behaviours associated with estrus either in person or as a group virtually.</p>
Apply	<p>Discuss The Following Prompts As A Group:</p> <ul style="list-style-type: none">• What were some of the signs you observed?• What is normal for your animal of choice?

Focus On The Hormones!

Hormones are chemicals released from one part of the animal's body that cause changes in other parts. Different types of hormones are produced by different body organs at certain times. They can be detected in the animal's blood. Some hormones play important roles in both male and female reproduction. Their levels will be high or low depending on the time in development, in the estrus cycle or in pregnancy.

Hormone	Source	Principle Effect	Additional Information
Follicle Stimulating Hormone (FSH)s	<ul style="list-style-type: none"> pituitary gland in the brain 	<ul style="list-style-type: none"> Stimulates growth of follicles Stimulates growth of sperm cells 	<ul style="list-style-type: none"> FSH levels in the blood are high late in estrus cycle Sometimes injected by veterinarians to induce ovulation
Luteinizing Hormone (LH)	<ul style="list-style-type: none"> pituitary gland in the brain 	<ul style="list-style-type: none"> activates the release of the ovum (egg) from the follicle (ovulation) controls the development of the corpus luteum stimulates secretion of the sex hormones (progesterone in the female and testosterone in the male) 	<ul style="list-style-type: none"> the hormone of choice for treating ovarian cysts
Estrogen	<ul style="list-style-type: none"> ovaries 	<ul style="list-style-type: none"> produced by the developing follicles stimulates "heat" and other signs of estrus 	<ul style="list-style-type: none"> estrogen level in the blood are high during estrus
Progesterone	<ul style="list-style-type: none"> ovaries 	<ul style="list-style-type: none"> produced by the corpus luteum helps prepare for and maintain pregnancy 	<ul style="list-style-type: none"> levels in the blood are low during ovulation and high during pregnancy
Prostaglandins	<ul style="list-style-type: none"> uterus 	<ul style="list-style-type: none"> causes the corpus luteum to shrink stimulates start of estrus and birth 	<ul style="list-style-type: none"> often injected to trigger birth or bring animal into heat
Prolactin	<ul style="list-style-type: none"> pituitary gland in the brain 	<ul style="list-style-type: none"> stimulates milk production and secretion by the mammary gland 	<ul style="list-style-type: none"> levels in the blood are high during lactation
Testosterone	<ul style="list-style-type: none"> testes 	<ul style="list-style-type: none"> responsible for development of the secondary sex organs and sex characteristics and behaviour 	<ul style="list-style-type: none"> fairly constant levels after puberty

Meeting 3 - Reproductive Technologies

Setting Objectives:

To identify the different technologies that allow the natural reproduction of agricultural animals to be assisted and to be tracked.

Suggested Learning Outcomes:

- To outline the technologies involved in AI, and IVF.
- To discuss reasons why breeding may fail and those techniques that can increase the likelihood of pregnancy.

Suggested Roll Call Questions:

- What happens during the process of an embryo transfer?
- How is sperm collected to be used for artificial insemination?

SAMPLE MEETING AGENDA

Time: 2 hours

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	15-20 minutes
Topic Information, Discussion	AI And IVF	10 minutes
Activities Related To Topic	Activity #1 - Experience It! Tour A Facility	1 hour
Topic Information, Discussion	Technological Heat Detection	15 minutes
Wrap Up, Social Time And Adjournment		10 minutes

AI And IVF

Natural Breeding

There are a lot of things that can go wrong during breeding, which can lead to failure.

The bull can fail at breeding in a few ways:

- Too Young - If the male is too young, the number of sperm he produces will be lower than that of a mature male. This reduces the chances of fertilization.
- Stress - High temperature, poor nutrition, breeding too often and obesity put stress on the reproductive system. This can lead to a low sperm count or poor sex drive.
- Infection - Infection of the reproductive system can result in deformed or low sperm counts. Sperm takes weeks or even months to form. It may take some time before the negative effects of infection are noticed. Rest and treatment are often the only way to get the male breeding again.

Natural mating is not always the method of choice when breeding animals. Other methods may be used. The reason for this includes:

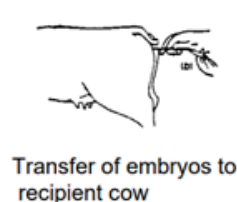
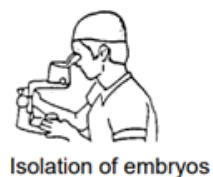
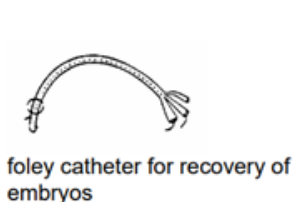
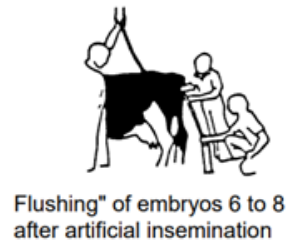
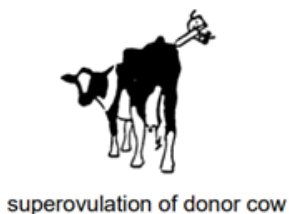
- More economical/more profitable
- Safer
- Greater variety of genetics available

Can A Cow Have Ten Calves Per Year?!

This is possible, but how?

The answer to this is by using embryo transfer.

- To start the process a cow is injected with follicle stimulating hormone (FSH) for a few days. This causes many more ova to be released than usual.
- Instead of one embryo in the uterine horn there could be many. These are “flushed” out of the cow with a special tube called a catheter and isolated with the help of a microscope.
- They can then be frozen for transfer later or transferred directly into another cow’s uterus by a method like artificial insemination. Once the eggs are transferred into a uterus, a cow can be bred by artificial insemination, (more about this later). The steps of embryo transfer in dairy cattle:



Can A Bull Produce Many Calves Per Year?!

The answer to this is yes, but how? Artificial insemination (A.I.) is a technique in which male semen is collected and implanted in the female.

- The male mounts a dummy female and ejaculates into an artificial vagina.
- The semen is then collected and mixed with an antibacterial agent. Penicillin is a common example.
- The semen can be immediately inserted into a female. More often it is frozen and shipped to a dairy or beef farm. When it is shipped it is no longer necessary to transport either the sire or dam.

Only trained inseminators should perform A.I. and all equipment should be sterilized. It is also crucial to keep the semen at the correct temperature or the sperm will not remain viable.

Activity #1 - Experience it! Tour A Facility

Do	<p>Time: 1 hour+</p> <p>Materials:</p> <ul style="list-style-type: none">• None <p>Instructions:</p> <p>This activity provides a good place to tour an AI or IVF facility.</p> <p>You can also use this time to see AI in action by shadowing an AI technician or farmer</p>
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to give members a hands-on activity to explore the worlds of AI and IVF.</p>
Apply	<p>Discuss The Following Prompts As A Group:</p> <ul style="list-style-type: none">• What is the role of the hormones in these procedures?• How can farmers use these technologies to improve their livestock?

Technological Heat Detection

In the last meeting we discussed visual heat detection and said that we would discuss technological improvements to heat detection at a subsequent meeting.

Poor reproduction is the number one reason that cows leave the farm. The importance of ensuring that cows become pregnant has led to several different technology developments.

Technologies

Type	Advantage	Disadvantages
Pedometer	<ul style="list-style-type: none"> Female bovines increase physical activity when in estrus. Can determine lying and standing time for your herd. 	<ul style="list-style-type: none"> Can be uncomfortable for animals to have leg pedometers. Does not monitor rumination which can be another useful heat detection and health metric.
Collar (Both Rumination and Activity)	<ul style="list-style-type: none"> Female bovines increase physical activity when in estrus. Give an idea of rumination which can be quite useful. 	<ul style="list-style-type: none"> Need to be placed in a specific place on the neck to be accurate. Do not know if standing or lying as they are both low activity.
Ear Tag	<ul style="list-style-type: none"> Monitors jaw movements to look at activity and vocalizations. 	<ul style="list-style-type: none"> 15-20% of ear tags are lost either through culling or through loss to the environment. Can be influenced by lameness as head goes up and down more in lame cows.
Milk Progesterone	<ul style="list-style-type: none"> Gold Standard for Heat Detection. Reduces the amount of false positive heats by 6% (one-time tests). It will also allow detection of other problems such as cystic ovaries. 	<ul style="list-style-type: none"> Higher cost to implement the system as this is a reoccurring expense.

Meeting 4 - Conception And Pregnancies

Setting Objectives:

To discuss the tools used to confirm and keep track of, failures, conception and pregnancy.

Suggested Learning Outcomes:

- To outline reproductive failure and the reasons behind it.
- To demonstrate techniques used to confirm pregnancies.
- To discuss the importance of record keeping.

Suggested Roll Call Questions:

- Name one method of measuring the reproductive health of a herd. How do you use it?

SAMPLE MEETING AGENDA

Time: 1 hour 55 minutes

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	15-20 minutes
Topic Information, Discussion	Female Reproductive Failure	15 minutes
Topic Information, Discussion	Checking Pregnancies	10 minutes
Activities Related To Topic	Activity #1 - Conducting A Pregnancy Check	30 minutes
Topic Information, Discussion	Importance Of Keeping Good Records	15 minutes
Wrap Up, Social time And Adjournment		10 minutes




Female Reproductive Failure

The female can fail at breeding by anestrus. This means “no estrus.” The animal does not come into heat. There are various types of anestrus:

- Lactational Anestrus: Pigs don’t cycle when nursing their young.
- Pregnancy: Animals don’t cycle when pregnant.
- Seasonal Anestrus: Some animals, such as the horse, only cycle during certain months during the year.
- Anestrus due to infection of illness: An unhealthy animal will often fail to come into heat. Infection of the uterus can prevent ovulation and estrus.
- Anestrus due to cystic ovaries: Common in dairy cattle, especially early in lactation. Cystic ovaries occur when the follicles enlarge but do not release the ova. This most often leads to anestrus, but it can also result in just the opposite, continuous estrus behaviour (also known as nymphomania)

Obviously trying to breed an anestrus female is sure to end in failure. You will have helped neither her nor her mate. To avoid such failures, practice the following preventative measures:

- Keep your animals healthy: A female needs proper nutrition in the months prior to becoming reproductively active. She should also be of sound health if she is to have the best chance of becoming pregnant and maintaining that pregnancy.
- Know your animal’s cycles: Learn when your animal should and should not be in “cycling.” Learn the signs of estrus for your animal.
- Keep records of reproductive events: If you know when an animal should be showing signs of estrus, judging by the last estrus or birth, then you will soon be alerted to the problem of anestrus.
- Close observation: Many high producing animals (e.g. dairy cattle) will not be truly anestrus. They will be having estrus cycles but not display the signs of heat. These animals are sometimes said to have “silent estrus.” This occurs when animals spend a lot of time in closed housing (e.g. swine and dairy cattle). Early detection and treatment by a veterinarian will prevent many “wasted” estrus cycles.

Reproductive Failure During Pregnancy		
Normal		As many as 40% of the embryos do not continue into pregnancy. This may be due to twinning (some animals can reject twins in the uterus very early, such as the horse, cow and sheep). This may also be due to faulty genetic information in the embryo. The early loss of embryos can be Nature's "safety valve" to reject an unhealthy fetus.
Infection		<p>The embryo and fetus are susceptible to many types of infection. Some of these are:</p> <ul style="list-style-type: none"> • Parvovirus - cat, swine, dog • Bovine Viral Diarrhea (BVD) - cattle • Equine Rhinopneumonitis - horses • Infectious Bovine Rhinotracheitis (IBR) - cattle • Leptospirosis - cattle, swine <p>All of the previously listed diseases are very important in Ontario, and they can cause a failure of pregnancy and death of the fetus. When a dead fetus is passed out of the uterus before the normal birth is due it is called an abortion.</p>
Stress		Transportation, high temperatures, sickness of the pregnant female or poor nutrition could all stress the fetus enough to cause its death and abortion.

Preventing Reproductive Failure		
Normal	→	<p>Abortions should be examined by a veterinarian to determine the cause if possible. This includes a study of both the fetus and the placenta. Special care should be taken NOT to come in contact with these tissues. Some diseases of animals are directly spread to humans. Diagnosis of the cause of abortion may prevent other abortions. However, remember that it is not always possible to determine the cause of an abortion.</p> <p>Wear gloves or use a clean shovel to collect tissues. Wash exposed skin and shovel well with soap and water immediately after handling tissues. Place fetus and placenta in a clean leak-proof bag or container. Keep tissues cool, and deliver as soon as possible to the vet lab or hold for your vet to examine.</p>
Vaccination	→	<p>Many infectious diseases can be prevented in animals by immunization. This is a method of boosting the animal's defenses against disease. A veterinarian will help select the proper vaccines for your animal(s). Immunization will protect the pregnant animal only if it is receiving proper feeding and other care. To prevent diseases that cause abortion it is best to vaccinate before and not during pregnancy. Under nourished animals respond poorly to vaccination and may not get immunity.</p>

Checking Pregnancies

While pregnancy loss can be unavoidable in some situations, the inefficiency caused by open animals within an operation can lead to severe problems. For meat and fibre producing operations, one less pregnancy means that there is one less animal that can be marketed for their product. For milking operations, one less pregnancy decreases the production capacity of a herd.

For companion animals, breeders can confirm pregnancies to ensure that they can make the right pregnancy decisions.

For years veterinarians have used a tool known as transrectal palpation to examine pregnancies and allow farmers to gain an idea of how long along the cow is in calf. This tool can also be used to confirm pregnancy if an abortion is suspected. Due to its widespread use and relative low cost, it is a preferred option for many producers.

In the early 1990's, the ultrasound machine became popular due to the amount of information that you can gain from this tool. Although rectal palpation remains the primary technique, ultrasound can be used in combination to identify structures, pregnancy status.

Experience It!

In the next activity you will get a chance to see how a veterinarian performs a pregnancy check to confirm if the animal is pregnant.

Activity #1 - Conducting A Pregnancy Check

Do	<p>Time: 30 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• None <p>Instructions:</p> <p>This activity provides a good place to accompany a vet on a pregnancy “preg” check to learn about ultrasound and palpations.</p>
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to allow members to learn about the pregnancy checking procedure.</p>
Apply	<p>Discuss The Following Prompts As A Group:</p> <ul style="list-style-type: none">• Get the members to ask the vet some questions.

Importance Of Keeping Good Records

You have probably learned about the reproductive health of individual animals. But most farm livestock live in groups, and it would be useful to measure the reproductive health of the group.

The ideas presented in this section could also be used for a dog or a cat breeding group. We will use the dairy herd as our example.

Imagine a dairy herd with 40 cows, 14 heifers and 8 calves.

Just think of all the reproductive events happening at any one time!

For example, let us take a look at the cows:

BLOSSOM: estrus cycle is just ending, she'll be in heat in 2 days

TOPAZ: has got a cystic left ovary and is not cycling

ORANGE PEEL: is due to calve any day

STAR: has just calved twins

MABEL: is showing signs that she is in heat, she will be bred tomorrow

JENNY: calved one month ago and has not displayed any signs that she has been in heat again

...and the list goes on for 34 more cows!

Few herd managers can keep all this information in their heads, and most people could not. Do you think you could keep this all in your head? The answer is likely no if you think about everything else you need.

A record keeping system could be:

- Computer software
- Breeding Wheel
- Breeding Calendar
- Chalk board in the office/milk house
- Health File Cards
- Three Ring Binder

Whichever record system you choose it should be:

- Practical
- Simple so any one can use it
- Easy to update
- Able to summarize herd events
- Able to pinpoint problem cows
- Dust resistant
- Cost effective

Counting The Events

How can you measure the reproductive health of the herd?

One way would be to count the number of problems that crop up during a time period, one year for example, and compare this to all those animals that could have developed the problem.

For example: In our herd of 40 cows, 2 cows developed metritis. 32 cows were lactating, and therefore could have developed the disease.

To count the events, we take the number of problems that arose (2), and divide this by the number of cows that could have developed metritis (32).

$$2 \text{ cow out of } 32 = 2/32 = 0.06$$

$$0.06 * 100\% = 6\%$$

Farmers try to keep these percentages low, and often aim for a number common to breeders in their area. This is called the target level.

If the percentage jumps past this target level it reaches what is called an action level. When percentages increase and reach this action level it is time to call in the veterinarian to find out what is wrong with the reproductive health of your herd.

Parameter	Target Rate	Action Level
Displaced abomasum	<3%	≥6%
Milk Fever	<2%	≥5%
Retained Placenta	<8%	≥10%
Metritis and Ketosis	If the rate of displaced abomasums is over 6% it is likely that metritis and ketosis may also be a challenge in fresh cows. At this point ketosis should be investigated by chemical analysis.	
Stillborn – born dead or died within 24 hrs of birth	<10% of first lactation, heifer calves <6% multiparous cows, heifer calves	>12% of first lactation, heifer calves >7% of multiparous cows, heifer calves
Dead and sold	<8%	≥12%
Length of dry period: ≥ end of 2nd lactation	40-60 days	>20% less than 30 Days >20% greater than 80 days
Length of dry period: Between first and second lactation	50-60 days	>20% less than 40 Days >20% greater than 80 days

However, there are problems with this method:

- For smaller herd sizes it is difficult to establish what is happening month to month.
- This only shows what has happened in the past and what is happening currently, it does not help you predict what may happen in the future.
- By the time you figure out that you have a health problem with your herd, valuable time may already have been lost.
- Some herds may have different benchmarks based on previous performance!

Additional Measuring Methods

There are other methods to measure a herd's health (many of these were also outlined in the above chart):

- You can figure out the average number of days between calvings for cows in your herd. This is called the calving interval.
- You can determine on average how soon cows become pregnant again after they have calved. This is called the calving to conception interval.
- You can determine how many times your cows must mate before they become pregnant. This is called breedings per conception.
- In a herd with over 40 cows, these indicators could be calculated every month or every second month. By doing this you are watching the reproductive health of the herd.

If these numbers reach the action level, a herd diagnosis is needed. Cows that are causing the problem need to be pinpointed and treated. Management practices should be reviewed (think of this as a herd treatment).

Meeting 5 - Conception And Pregnancies

Setting Objectives:

To discuss the aspects of parturition that impact animal health.

Suggested Learning Outcomes:

- To outline the potential trouble birth positions.
- To outline the importance of the C-Section procedure.
- To discuss the importance of the time after parturition, diseases and colostrum.

Suggested Roll Call Questions:

- Name a disease associated with parturition.
- Name a component of colostrum.

SAMPLE MEETING AGENDA


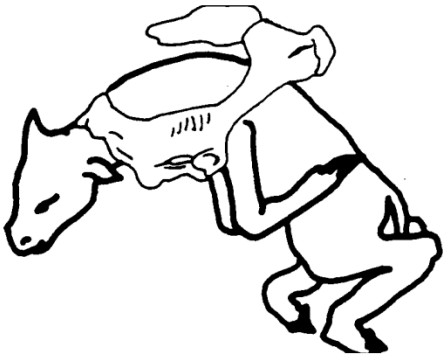
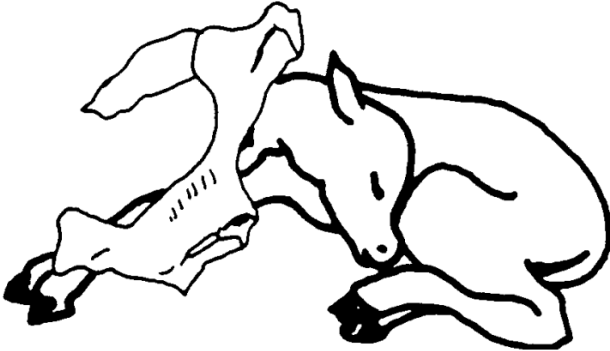
Time: 2 hours 10 minutes

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	15-20 minutes
Topic Information, Discussion	A Difficult Situation: Dystocia	15 minutes
Activities Related To Topic	Activity #1 - A Difficult Situation	30 minutes
Topic Information, Discussion	Diseases Of Parturition	10 minutes
Topic Information, Discussion	The Liquid Of Life	10 minutes
Activities Related To Topic	Activity #2 - Ensuring Quality	20 minutes
Wrap Up, Social time And Adjournment		10 minutes

A Difficult Situation: Dystocia

Not every calving goes as planned. There are several reasons that difficult births, also called Dystocia, can occur but the result is that the fetus cannot come through the birth canal easily. Most commonly, a fetus that is too large or is in an abnormal position will cause dystocia. Dystocia can result in sick cows and/or weak or stillborn fetus.

Generally, there are three different types of dystocia:

	Backwards with one leg back.
	Frontwards with the legs back.
	Head Back

C-Section

In some cases, dystocia cannot be remedied naturally, and surgery is needed. Caesarean delivery (C-section) is a surgical procedure used to deliver a baby through incisions in the abdomen and uterus. It is conducted on all types of animals and is sometimes a necessary surgery for some breeds of dogs (Boston terrier, bulldog). The reason for the later is because of the size of the hips versus the size of head and frame of the offspring.

Activity #1 - A Difficult Situation

Do	<p>Time: 30 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• None <p>Instructions:</p> <p>This activity provides a good place to either cover the process of a C-Section or discuss dystocia. Ask a veterinarian to come in to discuss.</p>
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to provide members with a hands-on experience to discuss dystocia and C-Sections.</p>
Apply	

Diseases Of Parturition

The following is a list of some of the diseases around parturition:

Retained Placenta: If the placenta does not pass from the uterus within a normal amount of time, then it is called a retained placenta. Dystocia often leads to retained placentas and metritis.

Metritis: This is the general word for an infection of the uterus. It can cause death in horses and small animals, but commonly causes delayed onset of the estrus cycle especially in cattle.

Prolapsed Uterus: The uterus passes through the birth canal, turning inside out. It hangs from the vulva. This condition can be caused by a difficult birth or a low calcium level in cows after calving.

Nerve/Muscle Damage: Nerve and/or muscle damage in the hind legs may follow dystocia or injury from slipping. This damage may occur in all mammals but is seen occasionally in cattle. Another condition, “milk fever,” is due to low calcium levels in blood and muscle tissues. This leads to weak muscles and inability to rise and stand.

To hopefully prevent all the above problems, there are four steps to follow:

1. **Close Observation:** Know the expected due date(s) of your animal and its expected behaviour during the birth process. Then you will know when it is time to call for assistance. Assisting too early can cause harm. Timely assistance may save both the dam and the offspring.
2. **Clean Birth Area:** This is sometimes difficult to achieve when animals give birth to their young when and where they feel most comfortable. The birth area should be free from animal waste, dry and provide good footing for large animals (a calving pen is best). This prevents exposure of the newborn to bacteria that could cause scours or a navel infection.
3. **Gentle Assistance:** If assistance is required, be gentle! The uterus is a muscular organ, but it can be ruptured easily by an offspring’s foot.
4. **Selective Breeding:** Some sires, rams etc. produce offspring that are easy to deliver. We can select and use these for our mating programs. Most dystocia’s are caused because the fetus is too large. So this form of “prevention” makes sense. For example, an Angus sire mated to heifers almost guarantees easy calving.

The Liquid of Life

Colostrum is the first milk produced by the mother that the newborn drinks almost immediately after birth. Colostrum provides the newborn with the maternal antibodies it needs to protect it from infection in the first few weeks of life. Alternatively, birds receive the maternal antibodies they need from the yolk of the egg from which they develop in.

What is Colostrum?

Defined as the first milk produced by a mammal after the birth of the young. Contains many beneficial nutrients as described below!

Once colostrum is consumed the antibodies are absorbed through the small intestine and into the blood stream. Failure of passive transfer of immunity (FPT) is the term given to a newborn animal that has not received adequate immunity from the colostrum consumed. Ability to absorb antibodies begins to decline 30 minutes after birth. FPT can also be caused by poor quality colostrum.

Since the young have a high risk of infection and disease, colostrum is very important to the newborn. It is for this reason that all newborns should stand and nurse within an hour of birth. They may need help to do this.

You should also take care to paint the newborn’s umbilical stump with iodine soon after the cord has been cut to prevent infection.

Activity #2 - Ensuring Quality

Do	<p>Time: 20 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Colostrum• Brix refractometer <p>Instructions: IgG is seen as the most reliable indicator of successful immunity transfer for the offspring.</p> <p>To test colostrum for IgG colostrum, we can use a Brix refractometer to examine the total protein level in the colostrum. This total protein level can be related to the total colostrum in the sample.</p> <p>To use the Brix refractometer, you can first pre-calibrate the Brix with distilled water. You can then dump that water out and place a small drop of colostrum on the prism and lower the sample cover. Make sure there are no bubbles in the refractometer. You can then read the IgG content by holding it up to a light source and reading the scale through the eyepiece. Good quality colostrum will bend the light more, so it rises higher on the scale (white line and blue line meet). If it is above 22% on the Brix scale, then it is good quality and depending on the total volume, you may be able to freeze it for future kids!</p> <p>You can get a veterinarian or knowledgeable producer to help you to read colostrum IgG values.</p>
Reflect	<p>Learning Outcomes: This activity aims to quantify colostrum quality to give goats the best chance of a good start in life.</p>
Apply	<p>Discuss The Following Prompts As A Group:</p> <ul style="list-style-type: none">• How might an animal's conditions affect colostrum quality? Poor health, poor diet?• How can we promote good health for our young offspring?• How can tools like these be used to improve on-farm operations?

Meeting 6 - What's In Your Genes!?

Setting Objectives:

To outline the different components of genetics that are important for members to understand.

Suggested Learning Outcomes:

- To outline the basics of genetics.
- To discuss inheritance through an example.
- To provide examples of genetic diseases.

Suggested Roll Call Questions:

- What do you consider when breeding or selecting an animal?
- What structures are important in the animals that you care or would like to care for (feet and legs)?

SAMPLE MEETING AGENDA

Time: 1 hour 45 minutes

Welcome, Call to Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes and Business	15-20 minutes
Topic Information, Discussion	The Basics!	20 minutes
Activities Related to Topic	Activity #1 - Breeding For Resistance	30 minutes
Topic Information, Discussion	A Misread Message	10 minutes
Wrap Up, Social Time And Adjournment		10 minutes

The Basics!

Why does my 4-H calf resemble her parents? Why does my puppy look more like his mother than he does like his father? You can find answers to your questions about the passing and inheritance of genes (or traits) when you learn about genetics...

What is it all about? Genetics is about storing and passing on information. Genetic messages are stored in DNA, which can be found in almost every cell of an animal's body. In order to keep the body working well, DNA tells cells what they're supposed to do, when, where and how.

Each living thing has a unique genetic code. Only identical twins have the same DNA.

DNA is the acronym for deoxyribonucleic acid (de-oxy-ribo-nuclayic).

The nuclei of most body cells contain a specific number of paired chromosomes. Chromosomes are threadlike "packages" of genes and other DNA in the nucleus of a cell. Different kinds of organisms have different numbers of chromosomes.

Each parent contributes one chromosome to each pair, so their offspring receive half of their chromosomes from their mothers and half from their fathers. Located on these chromosomes are genes, whose purpose is to carry information (DNA) that tells the cell how to make specific proteins. These genes can tell the cells to make red hair or black, curly or straight.

DNA stores the instructions for making specific proteins, but before it can be "read," it must be transcribed (think of it as translating a foreign language into English). In the process of transcription, the two strands that make up DNA are pulled apart and a complementary strand of RNA is formed.

DID YOU KNOW?

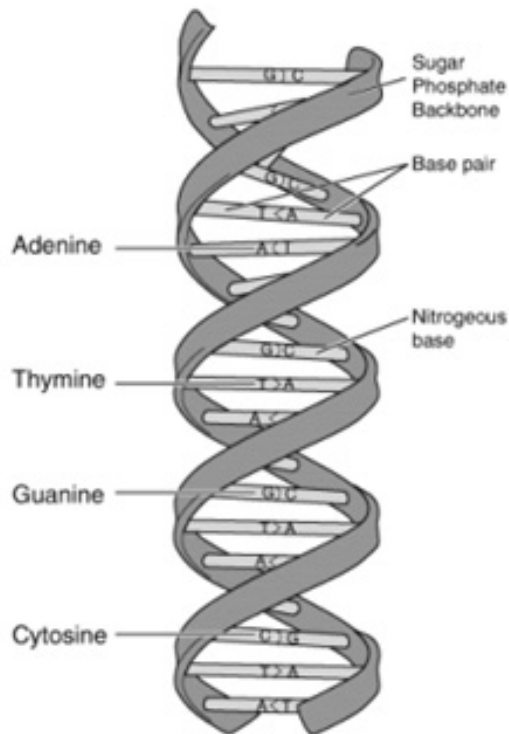


Goldfish have more than twice the total number of chromosomes that humans have! Humans have 46, dogs have 78, and goldfish have a whopping 96!

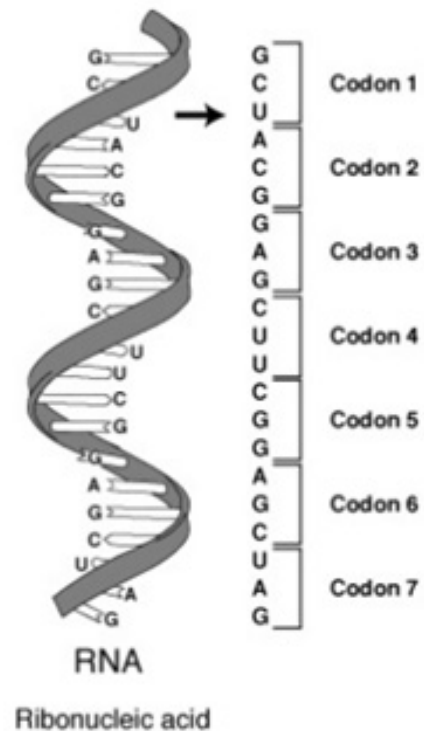
What Exactly Is DNA Made Of?

Each DNA molecule consists of a phosphate molecule, a deoxyribose sugar, and base pairs. The numerous possible combinations of adenine, cytosine, guanine and thymine (the base pairs) allow the DNA in everyone to be unique. When three base pairs are strung together, they form a codon. As the name suggests, each codon codes for a specific amino acid (keep in mind that amino acids are the "building blocks" for protein). Proteins are synthesized when chains of amino acids are formed.

DNA (note the double helix structure)



Codon (note the single helix structure of the RNA).



DID YOU KNOW?



The Nucleic bases are made up of 2 purines and 3 pyrimidines:

- Adenine: a purine base that is a constituent of DNA and RNA and an important energy transport and storage component in cellular metabolism.
- Cytosine: a pyrimidine base that is an essential constituent of RNA and DNA.
- Guanine: a purine base that is an essential constituent of both RNA and DNA.
- Thymine: a pyrimidine base that is an essential constituent of DNA.
- Uracile: a pyrimidine base that is an essential constituent of RNA. This takes the place of thymine in RNA.

A pairs with T and G pairs with C.

Passing And Inheriting Genes

Because complex animals like cows, pigs, sheep, and even you, come from two parents, they have two genes for each trait, one gene from each parent.

Why do some animals have black hair while others have red or white – isn't there only one gene for hair colour?

Different forms of genes are called alleles. Geneticists have found that some alleles are dominant, while others are recessive. That means that dominant alleles “take over” and are expressed (visible), while others are recessive (they are not expressed). This allows a variety of hair colours and also explains why some individuals tend to resemble one parent more than the other.

My calf's hair is red and curly, while both of her parents have straight, black hair. How could that happen?

No, your calf was not adopted!

As you just learned, the genes for traits like hair colour and type (curly or straight) are passed down from parents to their offspring. For example, if both parents have straight, black hair, then it is likely that their offspring will have straight, black hair. Once in awhile, though, this doesn't happen and parents with one hair colour and type will have offspring with another. As you know, the calf inherited two alleles for its hair colour and two alleles that determine whether the hair is curly or straight - one from its mother and the other from its father. Assume that the allele for black and straight hair is dominant and the allele for red and curly hair is recessive in your calf's breed.

For your calf to express the recessive alleles (red, curly) for hair, it must have inherited recessive alleles from both parents. Geneticists use something called a Punnett's square to organize this information and predict the genotypes (the genetic identity of an individual) and phenotypes (the observable traits or characteristics of an organism) of two individuals' offspring. They use an upper-case letter to indicate a dominant allele and a lower-case letter for recessive alleles.

B (black) b (red) C (straight) c (curly)	Mother → Father ↓				
		BC	Bc	bC	bc
	BC	BBCC	BBCc	BbCC	BbCc
	Bc	BBCc	BBcc	BbCc	Bbcc
	bC	BbCC	BbCc	bbCC	bbCc
bc	BbCc	Bbcc	bbCc	bbcc	

As you can see, your calf's parents must have a dominant and recessive allele in their genotype. Both their sex cells (egg, sperm) that resulted in your calf's conception contained recessive alleles. In this situation, statistically, there is a 1/16 or 6 ¼% chance that your calf's parents will produce red and curly-haired offspring.

The calf's genotype: bbcc.

It's phenotype: red and curly hair.

When your calf grows up, you may wish to predict what colour and type of hair its offspring will have. You choose to breed her to a bull with straight, black hair. There are four different possible genotypes that the bull with black, straight hair may have.

You find out that most of the bull's other offspring have straight hair, while only some have curly hair. They have all had black hair. You guess that his genotype is probably BBCc (you would have to do some more research to know this for sure).

You set up a Punnett's square:

B (black) b (red) C (straight) c (curly)	Mother → Father ↓		bc
		BC	BbCc
		Bc	Bbcc

You can predict that all offspring will have black hair. 50% will have curly hair and 50% will have straight hair.

How is SEX determined?

There are two kinds of sex chromosomes; X and Y. Females have two X chromosomes.

All eggs have an X chromosome. Males have an X chromosome and a Y chromosome, so sperm may contain either an X or a Y chromosome. If the sperm that fertilizes an egg carries a Y sex chromosome, the offspring will be male. If the sperm that fertilizes an egg carries an X sex chromosome, the offspring will be female. A baby's gender is always determined by the sex chromosome carried by the sperm. Male or Female?

B (black) b (red) C (straight) c (curly)	Mother → Father ↓	X
	X	XX
	Y	XY

A girl's genotype for sex will **always and only** be XX.

A boy's genotype for sex will **always and only** be XY.

If the Y chromosome is present, the offspring will be a male, regardless of the presence of an X chromosome. A female can only be born when the male sperm contains an X chromosome.

Applications of Genetics:

Selective Breeding As you have learned, genes are responsible for the passing and inheritance of traits. Our understanding of this is commonly used in successful breeding programs. Breeders may choose to mate two animals so that when they are combined, they will produce offspring with desirable traits. By choosing two animals based on certain characteristic strengths, it is possible to offset some of the weaker qualities of both parents. Whenever possible, a parent will be chosen because it has strength where the other may have a weakness.



DID YOU KNOW?



"Dolly", the famous cloned sheep, had three mothers – one who supplied the genetic information, one who supplied a dividing cell, and one who carried "Dolly" until she was born!

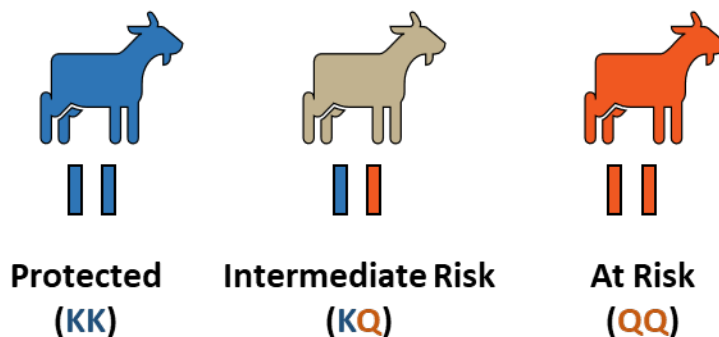
Activity #1 - Breeding For Resistance

Do	<p>Time: 30 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Worksheet on next page <p>Instructions:</p> <p>This activity on the next few pages was developed by Erin Massender (Acting Small Ruminant Specialist, OMAFRA; Ph.D. Candidate in Goat Genetics, University of Guelph) and was included in the updates to the Goat Project.</p> <p>The activity outlines a good example of how genetics can be used to solve a problem. Therefore, it seems appropriate that the activity is used in this club to discuss a genetics overview.</p> <p>You can go through the activity as a group!</p>
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to provide a tangible example of how members can use genetics to solve problems, all while introducing punnet squares.</p>
Apply	<p>Discuss The Following Prompts As A Group:</p> <ul style="list-style-type: none">• How might you use a punnet square in the future? <p>Some genetics do not follow simple inheritance as defined in the activity and are influenced by multiple factors. How might we use selection indexes and genomics to breed for those traits?</p>

Breeding for Scrapie Resistance

Background:

- Scrapie is a serious disease in small ruminants that cannot be cured, so it's very important that we reduce the risk of goats getting sick from this disease
- The risk of goats being infected with Scrapie is controlled by variations (alleles) in the Prion Protein gene (*PrP*). Scientists have found that the **K** allele is a resistance allele that protects goats from Scrapie, while the **Q** allele puts them at risk of Scrapie. So, one way to reduce the risk of Scrapie in the herd, is to breed for this trait.
- Goats have two copies of every gene, one from their sire and one from their dam.
 - The allele they receive from a parent is random, like a flip of a coin!
 - Some goats will have the same version of a gene from both parents (e.g., **KK** or **QQ**) these animals are known as *homozygotes*. Others will have different versions from each parent, these animals are *heterozygotes* (e.g., **KQ**).
- The combinations of letters in the animal's genetic code (genotype) determine how protected they are from becoming sick from Scrapie (phenotype). The possible genotypes (letters) and phenotypes (risk of Scrapie) are shown below.
- We can use a tool called a **Punnett Square** to figure out how likely an offspring is to be protected from Scrapie, if we know the genotypes of the parents we would like to mate.



The Challenge:

- A neighbour would like to breed for scrapie resistance in their goat herd. They have done genetic testing on their does and know that half are At Risk of Scrapie (**QQ**), and, luckily, half are at an Intermediate Risk (**KQ**).
- The neighbour has the option between purchasing two bucks:
 1. **Buck A** – Protected from Scrapie (**KK**), but very expensive.
 2. **Buck B** – Intermediate protection from Scrapie (**KQ**), but less expensive.
- Use the Punnett Square tool on the following pages to determine the expected phenotypes of offspring from the two bucks and answer these questions:
 1. Would the choice of buck impact the expected protection from Scrapie of offspring?
 2. Which buck would you recommend to the neighbour? Would your answer change if the herd only had does At Risk does?

Created by: Erin Massender, Acting Small Ruminant Specialist, OMAFRA; Ph.D. Candidate in Goat Genetics, University of Guelph

How to Use a Punnett Square

1. Pick the parents you would like to breed and write the parents' alleles (the letters of their genotype) for the trait on the outside (shaded) boxes of the square.
2. Match up the sire and dam alleles for each of the four blank boxes of the square and write the offspring genotype. **Note:** the order of the letters doesn't matter, KQ and QK genotypes are the same.
3. Use what you know about Scrapie genotypes to determine how likely the offspring is to be protected from Scrapie. Write the phenotype below the genotype in the box.
4. Add up all the identical boxes to determine the proportion of offspring with a given phenotype. **Hint:** each box represents a 1 in 4 (25%) chance of a given phenotype.

Sire Genotype: **KQ**

Dam Genotype: **KQ**

Possible Offspring Genotypes:
 25% **KK**: 50% **KQ**: 25% **QQ**

Possible Offspring Phenotypes:
 25% **Protected**: 50% **Intermediate**:
 25% **At Risk**

		<i>Sire Allele 1</i>	<i>Sire Allele 2</i>
		<u> K </u>	<u> Q </u>
<i>Dam Allele 1</i>	<u> K </u>	KK Protected	QK Intermediate
<i>Dam Allele 2</i>	<u> Q </u>	KQ Intermediate	QQ At Risk

Did You Know?

- Research has shown that the frequency of the protective alleles for Scrapie vary by country and breed, as we can see in this table.
- The percentage of the population protected from Scrapie is high in some breeds (like Boer) and low in many dairy breeds.
- *What impact would this have on selection as a strategy to protect animals from Scrapie in different breeds?*

Breed	Frequency of Genotypes		
	KK	KQ	QQ
Alpine	<1%	12-14%	88-86%
Saanen	<1%	2-8%	92-98%
Toggenburg	0-9%	4-42%	50-96%
Boer	6-10%	37-43%	48-57%

Source: Migliore, S., R. Puleio, and G.R. Loria. (2020) Scrapie Control in EU Goat Population: Has the Last Gap Been Overcome? Front Vet Sci. <https://doi.org/10.3389/fvets.2020.581969>

Scrapie Punnett Square Activity

Buck A (KK)

	Sire Allele 1 <u>K</u>	Sire Allele 2 <u>K</u>
Dam Allele 1 <u>K</u>		
Dam Allele 2 <u>Q</u>		

	Sire Allele 1 <u>K</u>	Sire Allele 2 <u>K</u>
Dam Allele 1 <u>Q</u>		
Dam Allele 2 <u>Q</u>		

Buck A - Offspring Genotypes & Phenotypes:

KQ Dams

QQ Dams

Buck B (KQ)

	Sire Allele 1 <u>K</u>	Sire Allele 2 <u>Q</u>
Dam Allele 1 <u>K</u>		
Dam Allele 2 <u>Q</u>		

	Sire Allele 1 <u>K</u>	Sire Allele 2 <u>Q</u>
Dam Allele 1 <u>Q</u>		
Dam Allele 2 <u>Q</u>		

Buck B - Offspring Genotypes & Phenotypes:

KQ Dams

QQ Dams

Punnett Square Answer Key

Buck A (KK)

	Sire Allele 1 <u>K</u>	Sire Allele 2 <u>K</u>
Dam Allele 1 <u>K</u>	KK Protected	KK Protected
Dam Allele 2 <u>Q</u>	KQ Intermediate	KQ Intermediate

Buck B (KQ)

	Sire Allele 1 <u>K</u>	Sire Allele 2 <u>Q</u>
Dam Allele 1 <u>K</u>	KK Protected	QK Intermediate
Dam Allele 2 <u>Q</u>	KQ Intermediate	QQ At Risk

	Sire Allele 1 <u>K</u>	Sire Allele 2 <u>K</u>
Dam Allele 1 <u>Q</u>	KQ Intermediate	KQ Intermediate
Dam Allele 2 <u>Q</u>	KQ Intermediate	KQ Intermediate

	Sire Allele 1 <u>K</u>	Sire Allele 2 <u>Q</u>
Dam Allele 1 <u>Q</u>	KQ Intermediate	QQ At Risk
Dam Allele 2 <u>Q</u>	KQ Intermediate	QQ At Risk

Buck A - Offspring Genotypes & Phenotypes:

KQ Dams 50% KK: 50% KQ
 50% Protected: 50% Intermediate

QQ Dams 100% KQ
 100% Intermediate

Buck B - Offspring Genotypes & Phenotypes:

KQ Dams 25% KK: 50% KQ: 25% QQ
 25% Protected: 50% Intermediate: 25% At Risk

QQ Dams 50% KQ: 50% QQ
 50% Intermediate: 50% At Risk

A Misread Message

The following list of diseases breaks down some of the common genetic diseases of animals and their prognosis. You can use this list as a guide to go through discussions. Members can also use this list as a reference for their own information.

Disease	Details
Glycogen branching enzyme deficiency (GBED)	<ul style="list-style-type: none"> • Causes abortion, stillbirths and foal deaths in affected Quarter Horses. • In one study at the Equine Center at the University of Minnesota, all foals with GBED died or were euthanized due to weakness. • The disease is inherited as a non-sex linked recessive trait which means that an affected horse received a copy of the defective gene from each parent
Severe Combined Immunodeficiency (SCID)	<ul style="list-style-type: none"> • A disease seen in Arabian horses. • It is a non-sex linked recessive disorder in which affected horses can't produce immune responses to protect against infectious diseases. • Affected foals don't produce antibodies after infection or immunization. • Affected foals rarely live beyond five months of age unless the condition is corrected through bone marrow transplant. • Since 1997 breeders have been able to use DNA testing to identify carriers of the SCID producing gene
Hemophilia	<ul style="list-style-type: none"> • It is a bleeding disorder that varies in severity and has no cure. • It is due to a deficiency in specific clotting factors • Is one of the few sex-linked traits in dogs. • The disease is carried by females but affects mostly males. • It occurs in many different breeds of dogs and in mixed breeds as well but German Shepherds are most commonly affected. • Dogs with mild forms may show few or no signs and may never require treatment. • Periodic transfusions may be given when bleeding occurs. • Dogs with severe forms often die or are euthanized because of uncontrollable bleeding problems • Bleeding under the skin or into the muscle may occur after vaccinations or severe bleeding may occur after routine surgery such as neutering. • Other less common problems include respiratory difficulties due to bleeding into the chest, weakness, paralysis or even sudden death due to bleeding into the brain or spinal cord.

Disease	Details
Glaucoma	<ul style="list-style-type: none"> • This disease is a leading cause of blindness. • It is the result of increased fluid pressure within the eye. • If the pressure cannot be reduced, there will be permanent damage to the retina and optic nerve resulting in visual impairment. • Complete blindness can occur in dogs within 24 hours or can occur slowly over weeks or months • It is usually very painful and your dog may paw at his red eye or rub his head along the floor • The eye may look cloudy due to swelling of the cornea and your dog will be very sensitive to light - The disease may be primary (inherited) or secondary to a number of other eye disorders • Ultimately most forms of the disease require surgery
Cataracts	<ul style="list-style-type: none"> • Are any opacity or loss of transparency of the lens of the eye. • - The opacity may be confined to a small area of the lens or it may affect the whole structure. • - There may be a discoloration of the pupil. • - A complete cataract affecting both eyes results in blindness. • - Small non-progressive cataracts will not interfere with vision. • - Most are hereditary and can be removed surgically. • - Many breeds of dogs are affected by inherited cataracts
Canine Acne	<ul style="list-style-type: none"> • Occurs in young adult English bulldogs, Boxers, Dobermans and Great Danes. • Affected animals have bumps, scabs and blackheads on their lips, chin and muzzle. • The dog's general health is not affected. • The mode of inheritance is unknown but it is preferable not to breed affected dogs. • It cannot be cured but can be controlled. • Mild cases need no treatment. • More severe cases or reoccurring infections may require the use of acne cleaning products or mild anti-seborrheic shampoos.
Porcine Stress Syndrome (PSS) Also known as Malignant Hyperthermia	<ul style="list-style-type: none"> • It is an inherited defect in muscle metabolism that can be life threatening to the pig • Affected pigs have a defect in the transport channel that moves calcium into their muscle cells. • Calcium is required for a muscle to contract and when the level of calcium is not correct lactic acid may build up in the muscle. • Along with this acid there will be a build up of heat and this combination can be severe enough to cause death. • Transportation, high environmental temperatures, exercise, mating and fighting can trigger a PSS episode
Tibial Hemmelia	<ul style="list-style-type: none"> • Affects Shorthorn cattle. • It is lethal. • Affected calves are missing part of their rear legs, have large umbilical hernias and skull deformity. • Calves can't stand to nurse and must be euthanized. • It is caused by an abnormal recessive gene.
	<p style="text-align: center;">4-H Ontario Veterinary Project - Reproductive System 299</p>

Disease	Details
Hip Dysplasia	<ul style="list-style-type: none"> • The number one cause of hind limb lameness in dogs. • Results in an arthritic condition of the hip joint which is initially caused by looseness in the hip joint itself. • This laxity involves the tendons, ligaments, connective tissue and muscle which surround the hip joint. • This in turn leads to bony abnormalities of the ball and socket (joint) • The instability of the joint causes abnormal wear and tear on the cartilage lining of the joint resulting in arthritis as the dog ages. • The disease is thought to be genetically determined in part but environmental factors such as nutrition and rapid growth may play a role in its development
Thyroid Disease	<ul style="list-style-type: none"> • Many breeds of dogs such as the Boxer seem to genetically inherit hypothyroidism. • The thyroid gland has low thyroid hormone levels. • The body for unknown reasons, forms antibodies against its own thyroid gland. • This results in partial or complete destruction of the gland and the inability to produce adequate thyroid hormone. • Affected animals may be listless, develop coarse hair coats, have hair loss. • They gain weight, experience infertility and show neurologic problems.
Equine Hyperelastosis Cutis	<ul style="list-style-type: none"> • Affects Quarter Horses. • Skin layers are not attached normally. • Creates loose areas of skin that are easily stretched away from the body • This makes the skin very susceptible to trauma • Usually diagnosed when the horse goes into training • Is subject to saddle pressure



Other Topics

Meeting 1 - The World Through A One Health Lens

Setting Objectives:

To discuss the importance of a One Health approach.

Suggested Learning Outcomes:

- To identify the pillars of One Health and understand how they are linked.
- To discuss vector-borne diseases and how these transfer between the different pillars

Suggested Roll Call Questions:

- Name a pillar of One Health and discuss something that would fall under that pillar.
- Give an example of how one or more pillars cross and the implications of examining the problem from a One Health approach

SAMPLE MEETING AGENDA

Time: 2 hours

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	20-25 minutes
Topic Information, Discussion	The World Through A One Health Lens	15 minutes
Activities Related To Topic	Activity #1 - One Brainstorm!	20 minutes
Topic Information, Discussion	Vector-borne Diseases	15 minutes
Activities Related To Topic	Activity #2 - Ouch That Hurts!	15 minutes
Wrap Up, Social Time And Adjournment		10 minutes

The World Through A One Health Lens

One Health

The world is more interconnected than ever. There are many complicated issues facing our generation that need a multi-disciplinary approach to be able to solve them. This is where One Health comes into play! One Health is the collaborative joining of forces or disciplines that combine animal health, human health and environmental health to achieve optimal health. Due to the strong interconnection between these three disciplines, the One Health approach helps to tackle multi-faceted problems that may not have been able to be solved by a single discipline approach.

The Three Pillars

The health of people, animals and our shared environment has become a highlighted focus in recent year. This is due to a multitude of factors including:

- Increase in human population resulting in people living close to animals (both wild and domestic). This provides an opportunity for transfer of diseases between humans and animals.
- Climate change and increase in land us (i.e. deforestation) has disrupted ecosystems and caused new ways for diseases to be passed by animals. This has also negatively impacted the health and stability of the environment.
- International travel and trade have also made the world more connected than ever, allowing diseases to spread quickly around the world.

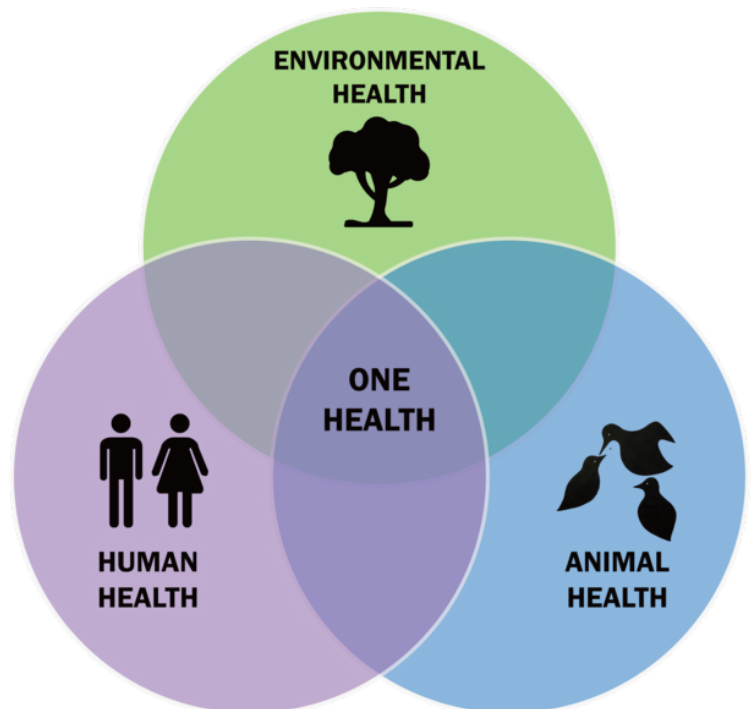


Image From: <https://commons.wikimedia.org/wiki/File:One-Health-Triad-en.png>

Watch this short informational video to learn more about One Health!

<https://www.youtube.com/watch?v=kfluP-tFC2k>



Activity #1 - One Brainstorm!

Do	<p>Time: 20 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Large Chart paper or White Board• Markers <p>Instructions:</p> <p>The goal of this activity is to think of the ways that environmental, human and animal health intersect. Individually, think of ways that these pillars interact with each other and come up with a list.</p> <p>For example: A wild animal may be infected with rabies, then infect a human through a bite (this would be an intersection between human and animal health).</p> <p>Think of as many as you can individually for 5 minutes by writing them down.</p> <p>Next pair younger and older members together and get them to add to their list. The goal is to think of as many unique crossovers as possible. Give the pair 5 minutes to do this and then come together as a group.</p> <p>Get each pair to say how many things they have on their list. Start with the person with the highest number and add to the chart paper. It is not meant to be a competition but a way to brainstorm ideas. Therefore, you are looking for unique ideas from each group.</p>
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to get members of thinking from a One Health perspective to identify and map problems.</p>
Apply	<p>Discuss The Following Prompts As A Group:</p> <ul style="list-style-type: none">• Was there any one pillar that you found difficult to connect?• How do you think that thinking about problems through this lens would lead to greater collaboration and problem solving?

Vector-borne Diseases

A challenging problem in human and animal health is controlling something known as vector-borne disease. Vector-borne diseases are responsible for close to 1.4 million deaths annually. A vector is something that transmits a disease or parasite from one animal or plant to another. In history there has been plenty of cases of zoonotic diseases. A zoonotic disease is something that can transfer between animals and humans. The Bubonic Plague was thought to be transferred from rats to humans and the COVID-19 infection was thought to start as a bat coronavirus. Despite these other vector-borne disease, infection is typically transmitted by arthropod vectors.

Within the classification of arthropods, two are the most common vectors. Insects (such as mosquitos and gnats) and ticks. Typically, arthropod vector-borne diseases manifest through a typical pathway. One species serves as a reservoir for the infection, then an insect vector transfers that infection to a species that is more susceptible to the disease, harbours and replicates the disease with the potential of the vector transferring the disease to others. Through this pathway the disease can stay under the radar as the reservoir species can always spread the disease unless transfer is controlled between the vector, the reservoir and the host.

The table on the next page will be outline some of the diseases associated with vectors, their reservoir species (if any), the clinical signs and signs, any background on the disease and prevention or treatment of the disease (those with a Canadian history will appear in grey).

What Is An Arthropod?

Arthropods are the largest group of animals within the animal kingdom and includes lobsters, crabs, spiders, ticks, mites, insects, centipedes, and millipedes.

Disease	Vector	Reservoir	Clinical signs	Prevention/Treatment
West Nile Virus (WNV)	Culex Mosquito	Birds	Most people infected with WNV do not show clinical signs. Others can get fever, head and body aches, fatigue, rash, meningitis or encephalitis.	Exposure to WNV can be prevented by reducing mosquito development sites (i.e., standing water) and using personal protection against mosquitoes. Treatment involves consulting a doctor as no vaccine or specific medicine is currently available. In severe cases IV fluids, pain medication and nursing care may be needed.
Lyme Disease	Black Legged Tick	Ground dwelling birds and small mammals	Early clinical signs may include fever, headache, muscle and joint pain, fatigue and an expanding red rash (bull's-eye).	Avoid tick bites by wearing insect repellent, proper clothing, removing ticks as soon as possible and removing tick habitats from your place of residence (long grass). Treatment for confirmed Lyme cases involves continued testing and antibiotics. As the disease can be difficult to treat, longer courses of antibiotics may be needed, and these programs need to be closely followed.
Malaria	Mosquito	Humans	Fever, headache, chills and diarrhea	The disease is caused by a parasite that is transferred by mosquito from one reservoir (human) to another. The best prevention is to prevent mosquito bites. This disease is not common in Ontario and infections are acquired when visiting other countries. Treatment for malaria is drug based (either ACT or Chloroquine phosphate) and must be treated by a doctor.
Rabies	Bats, skunks, foxes, and can be found in raccoons and other mammals	None	Causes inflammation of the brain and spinal cord, which is almost always fatal	Prevention involves ensuring pets are vaccinated and that those working with wild animals are also vaccinated. Following exposure to a potential rabid animal, individuals should thoroughly wash the wound and seek immediate medical attention to assess the need for post exposure vaccination.
Yellow Fever	Monkeys	Aedes mosquito	Sudden onset of fever, chills, severe headache, back pain, general aches, nausea and vomiting, fatigue, and weakness	Found in the tropical and subtropical areas of Africa and Central and South America mainly. Not found in Canada as mosquito vector and reservoir are not native and all cases are travel related. A vaccine is available to prevent the disease. Mosquito prevention can also be used. No medicine to cure, treatment is like WNV.

Activity #2 - Ouch That Hurts!

Do	<p>Time: 15 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Tick key or tweezers• Fact sheet on the next page <p>Instructions:</p> <p>Removing a tick is an important skill to learn for both pet owners and your own health. Ticks carry diseases that cross the boundary between environmental and human and animal health such as Lyme's disease. Instruct members how to remove ticks using the tick key or tweezers based on the fact sheet on the next page. Members can add this fact sheet to their reference materials.</p>
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to discuss the importance of removing ticks in a safe manner</p>
Apply	<p>Discuss The Following Prompts As A Group:</p> <ul style="list-style-type: none">• Why is it important that you remove the tick AND ensure you remove the head?• Why do you think that tick keys are designed in this way?• Why should you keep a tick that you removed from your dog or yourself?• What should you do if you have clinical signs of a tick-borne disease?

EARLY DETECTION IS KEY

The identification of Lyme disease in its early stages is very important. In most cases, if caught early, Lyme disease can be treated effectively with antibiotics.

Symptoms typically occur 3 to 30 days after you've been bitten. They can differ from person to person and **could include any** of the following:

- ▶ Rash (sometimes shaped like a bull's eye)
- ▶ Fatigue
- ▶ Aching muscles and joints
- ▶ Fever
- ▶ Swollen lymph nodes
- ▶ Chills
- ▶ Headache

More severe symptoms (experienced weeks to months after a tick bite, if untreated) could include but are not limited to:

- ▶ Severe headaches
- ▶ Facial paralysis (such as Bell's palsy)
- ▶ Joint pain
- ▶ Irregular heart beat
- ▶ Nervous system disorders (such as dizziness, mental confusion or inability to think clearly, and memory loss; nerve pain, numbness or tingling in the hands or feet)

Contact your health care provider if you're not feeling well or are concerned after being bitten by a tick.

PETS AND LYME DISEASE

Although pets can't spread Lyme disease directly to humans, they can carry infected ticks into your home or yard. Regular tick checks and prompt tick removal are just as important for pets as for people.



Sore muscles and joints are the most common symptom of Lyme disease in pets. Some animals may develop a fever or fatigue. Talk to your veterinarian about tick prevention or if you think your pet has Lyme disease.

For more information, visit

Canada.ca/LymeDisease

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ENJOY THE OUTDOORS, WITHOUT A TICK

LYME DISEASE IS IN CANADA. PREVENTION IS IMPORTANT.

LEARN HOW YOU CAN REDUCE YOUR RISK

Lyme disease is spread by the bite of infected blacklegged ticks. These ticks are often found in and near areas with trees, shrubs, tall grass or piles of leaves. It can cause serious health issues if untreated, but you can take action to reduce your risk.

CAN YOU IDENTIFY A BLACKLEGGED TICK?



Source of tick pictures: URI TickEncounter Resource Center

Generally, people are infected through the bite of immature ticks called nymphs that are about the size of a poppy seed. Adult ticks (about the size of a sesame seed) can also transmit Lyme disease. Ticks are very small and their bites are usually painless, so you may not know you've been bitten.

PREVENTION TIPS!



The best way to prevent Lyme disease is to avoid being bitten by a tick. Follow these tips when heading outside in areas where ticks can be found:

PREVENT

- ✓ Wear light coloured long-sleeved shirts and pants.
- ✓ Tuck your shirt into your pants, and pull your socks over your pant legs.
- ✓ Wear closed-toe shoes.
- ✓ Use bug spray with DEET or Icaridin (always follow label directions).
- ✓ Walk on cleared paths or walkways.
- ✓ You can also wear permethrin-treated clothing, now available in Canada (always follow label directions).

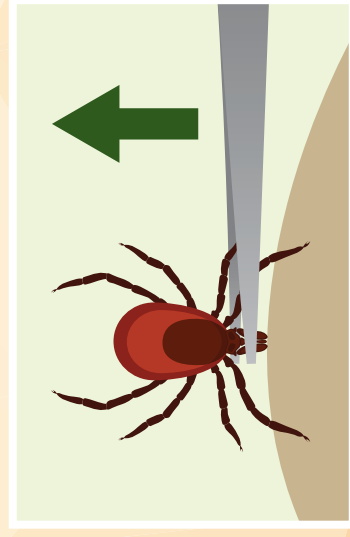
WHAT SHOULD YOU DO IF YOU'RE BITTEN?

TAKE ACTION

- ✓ Use clean fine-point tweezers to immediately remove attached ticks:
 - ▶ Grasp the tick's head as close to your skin as possible.
 - ▶ Slowly pull it straight out. Try not to twist or squeeze the tick.
 - ▶ If parts of the tick's mouth break off and remain in your skin, remove them with the tweezers.
 - ▶ If you can't remove the mouthparts, leave them alone, and let your skin heal.
- ✓ Wash the bite area with soap and water or alcohol-based sanitizer.
- ✓ Keep the tick in a closed container and bring it with you if you go see your health care provider.
- ✓ Contact your health care provider if you're not feeling well or if you are concerned after being bitten by a tick.

CHECK

- ✓ Shower or bathe as soon as possible after being outdoors.
- ✓ Do a daily full body tick check on yourself, your children, your pets and your gear.
- ✓ Put your clothes in a dryer on high heat for at least 10 minutes.



Meeting 2 - Animal Wellbeing

Setting Objectives:

To identify the importance of the animal wellbeing and the statutes and laws that protect it.

Suggested Learning Outcomes:

- To identify the components that make up the human animal bond.
- To outline the importance of minimizing fear and handling animals in a safe way.
- To discuss the codes, laws and regulations surrounding animal welfare for a variety of species

Suggested Roll Call Questions:

- Name one regulation, law or code governing animal wellbeing.
- What does the human animal bond mean to you?

SAMPLE MEETING AGENDA

Time: 1 hour 40 minutes

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	15-20 minutes
Topic Information, Discussion	Building A Bond	5 minutes
Activities Related To Topic	Activity #1 - Documenting The Connection	15 minutes
Topic Information, Discussion	Laws, Codes And Regulations	20 minutes
Activities Related To Topic	Activity #2 - Proper Restraint	20 minutes
Wrap up, Social time And Adjournment		10 minutes

Building A Bond

The human-animal bond is the relationship between animals and people that promotes the wellbeing and the health of both. The human-animal bond has existed for generations and has heavily influenced today's society and how we have animals as pets. The human-animal bond is vital to veterinary medicine, prioritizing the psychological and emotional needs of people and animals, and One Health interactions. It is up to veterinarians to strengthen the human-animal bond and maximize the relationship as much as possible.



Activity #1 - Documenting The Connection

Do	<p>Time: 15 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Photo of an animal or pet <p>Instructions:</p> <p>Ask members to bring in a picture of them with their animal. Get members to look at the photo and think about all the ways they bound with their pet/animal.</p> <p>Members can then write on the back with the words or phrases that they thought about when they were looking at the photo.</p> <p>Ask members if they would like to share their responses with the group.</p>
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to think about all of the connections that members have with their pets.</p>
Apply	<p>Discuss The Following Prompts As A Group:</p> <ul style="list-style-type: none">• What were some of the words you came up with?• Do you resonate with any of the words that other people came up with?

Laws, Codes And Regulations

In order to protect the wellbeing of both agricultural and companion animals, governments and other organizations have put forward legislation and codes. The topic information contained in this section will break down some of the laws, codes and regulations that govern Ontario.

Laws

There are both federal and provincial laws governing animal cruelty:

FEDERAL

The Criminal Code of Canada outlines the legal requirements for the care of animals in section 445.1. It states:

1. Everyone commits an offence who
 - a. willfully causes or, being the owner, willfully permits to be caused unnecessary pain, suffering or injury to an animal or a bird;
 - b. in any manner encourages, aids, promotes, arranges, assists at, receives money for or takes part in
 - » the fighting or baiting of animals or birds, or
 - » the training, transporting or breeding of animals or birds for the purposes of subparagraph (i);
 - c. willfully, without reasonable excuse, administers a poisonous or an injurious drug or substance to a domestic animal or bird or an animal or a bird wild by nature that is kept in captivity or, being the owner of such an animal or a bird, willfully permits a poisonous or an injurious drug or substance to be administered to it;

This Act of Federal Parliament sets up the requirements for animal welfare but requires a high burden of proof to get conviction under the act.

PROVINCIAL

As of January 1, 2020, the Provincial Animal Welfare Services (PAWS) Act replaced the Ontario Society for the Prevention of Cruelty to Animals (OSPCA) Act. The PAWS Act presents the strongest penalties in Canada against Animal Cruelty. The PAWS Act covers offences, including:

- causing or permitting distress to an animal
- causing harm or attempting to cause harm to a law enforcement or service animal
- promoting, arranging or receiving a financial benefit from animal fighting events
- training animals to fight other animals
- owning or possessing equipment or structures used in animal fighting
- failing to follow any applicable standards of care
- obstructing an inspector or agent

Codes and Regulations

NATIONAL FARM ANIMAL CARE COUNCIL (NFACC)

The Canadian Agri-Food Research Council (CARC) produced Codes of Practice starting in 1980. Today the NFACC (which followed CARC) has 16 species codes, either current or under revision (as of 2020). The Codes serve as our national understanding of animal care requirements and recommended practices. These codes undergo review every 5 years to ensure that they meet the current research within the field. This review can institute nothing, an addendum or a full review.

Within the Code of Practice, there are Requirements and Recommended Practices. NFACC defines these as:

Requirements are considered to reflect practices essential for the delivery or maintenance of responsible care and handling. Requirements are often animal-based. These are most directly linked to animal welfare and can be applied in a wide range of production systems. Since requirements often state necessary outcomes, producers have the flexibility to determine how the outcomes can be achieved using individual management and husbandry practices.

Recommended Practices encourage continuous improvement in animal care and are intended to support Code requirements (though failure to implement Recommended Practices does not imply that acceptable standards of animal care are not being met).

PROACTION

The ProAction program was created with the help of dairy farmers, researchers and industry partners to show how farmers could responsibly produce milk. The ProAction framework is made up of six modules that “demonstrate responsible stewardship of their animals and the environment, sustainably producing high-quality, safe, and nutritious food for consumers” (DFC).

Activity #1 - Documenting The Connection

Do	<p>Time: 20 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Prop or Animal model• Fact Sheet <p>Instructions:</p> <p>Review the fact sheet on the next page on proper restraint techniques and see if you can demonstrate on either a live or imitation model.</p> <p>Source: http://www.ruralareavet.org/PDF/Animal_Handling-Physical_Restraint.pdf</p>
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to discuss proper restraint techniques and how you can minimize fear.</p>
Apply	<p>Discuss The Following Prompts As A Group:</p> <ul style="list-style-type: none">• What were some key steps in ensuring proper animal restraint?• What should you do if the animal looks uncomfortable?

PHYSICAL RESTRAINT OF DOGS AND CATS



Restraint with dog in sitting position

RESTRAINT OF DOG IN SITTING POSITION

Place one arm under the dog's neck so that the forearm holds the dog's head securely against the restrainer's body.

Place the other arm around the hindquarters to prevent the dog from standing or lying down during the procedure.

Pulling the dog close to the chest allows more control if the animal attempts to move.

RESTRAINT OF DOG IN STANDING POSITION

Place one arm under the dog's neck so that the forearm holds the dog's head securely. The head should be positioned so that it is impossible for the dog to bite either the holder or the person performing the procedure.

Place the other arm under the abdomen to prevent the dog from sitting or lying down during the procedure.

Pulling the dog close to your body allows more control if the animal attempts to move.



Restraint with dog in standing position

RESTRAINT OF DOG IN LATERAL RECUMBENCY

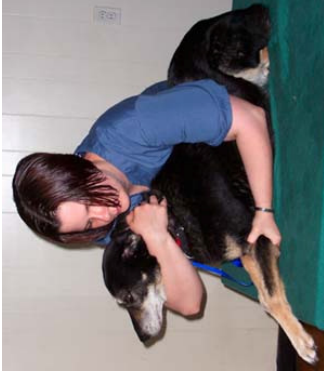
With the dog in standing position, reach across the dog's back and take hold of the foreleg and hindleg closest to you.

Gradually lift the dog's legs off the table (or floor), and allow her body to slide slowly against your body until she is lying on her side with feet pointing away from the handler.

Use your forearm to exert pressure on the side of the dog's head, thus immobilizing the head.



Restraint with dog in lateral recumbency



Restraint of dog for cephalic veinpuncture

RESTRAINT AND POSITIONING FOR CEPHALIC VEINPUNCTURE

Place the animal in sitting position or sternal recumbency.

Extend the animal's front leg by placing the palm of one hand behind the animal's elbow.

Compress the cephalic vein with the thumb, and stabilize the vein by rolling the skin laterally.

For IV injection, slowly lift the thumb off the vein, leaving the hand in position behind the elbow to prevent the animal from withdrawing the leg.

RESTRAINT OF CAT FOR FEMORAL VEINPUNCTURE

Take the scruff of the cat's neck in one hand, grasping as much of the loose skin as possible along the neck. Grasp high up between the ears, or the cat may be able to turn her head and bite.

Wrap the fingers of the other hand around and through the cat's hind legs.

Gently stretch the cat out by separating your hands. Brace the cat's back and neck firmly against your forearm.

The hand holding the hind legs can then be used to hold the top leg and tail out of the way, while the person performing the veinpuncture pulls out on the leg closer to the table.

Pressure placed vertically on the inner thigh will occlude and raise the femoral vein.



Restraint of cat for femoral veinpuncture

Meeting 3 - Biosecurity And Reporting

Setting Objectives:

To outline the importance of maintaining proper biosecurity and the requirement to report certain diseases.

Suggested Learning Outcomes:

- To outline some of the best practices for biosecurity for both kennels and farms.
- To discuss provincially and federally reportable diseases.

Suggested Roll Call Questions:

- Can you think of any ways you can promote biosecurity for kennels or farms? If so, what are they?
- How would an outbreak of a disease effect a farming operation?

SAMPLE MEETING AGENDA

Time: 2 hour

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	15-20 minutes
Topic Information, Discussion	Importance Of Biosecurity	20 minutes
Activities Related To Topic	Activity #1 - Contain The Epidemic	30 minutes
Topic Information, Discussion	Reporting Requirements	15 minutes
Wrap up, Social Time And Adjournment		10 minutes

Importance Of Biosecurity

Everyone involved with the production of livestock, especially farmers, aim to protect animals' health and productivity against disease. Everyone should learn about health management practices that they can use on their farm to help:

- Prevent the introduction of diseases into your herd
- Decrease the spread of disease between animals, farms, and countries

BIO-SECURITY IS THE PRACTICE OF PREVENTING OR REDUCING THE SPREAD AND INFECTION OF DISEASE.

Why Should I Learn About Biosecurity?

You have probably heard people talking about Bovine Spongiform Encephalopathy (mad cow) and "Foot and Mouth Disease." Contagious diseases such as these are transmitted from infected animal to uninfected animals. The diseases are transmitted through saliva, bodily fluids or ingestion of an infected animal.

When these diseases infect animals, they can have devastating economical effects. Every year farmers lose money because of:

- Decreased meat, milk, and/or offspring production in infected animals
- increased vet bills, use of medicines
- Higher rate of abortions
- Higher mortality rate

Farmers also lose valuable time caring for sick animals.

Protecting The Herd

As you have already learned, contagious diseases can have devastating effects on the well-being of a group of animals. Because the threat of spread and infection of disease exists, management practices have been established. By learning about these practices, you will be able to increase your operation's overall biosecurity by identifying the changes that need to be made.

How Can I Protect My Animals?

- 1. Be a "Traffic Cop".** Control the Traffic on Your Farm. Control the number of visitors to your farm. If you must have visitors, supply them with clean clothes and disinfected footwear. Designate a specific visitor area to minimize contact with livestock or feed sources. Insist herd workers wash their hands after handling sick animals and before milking. Control the movement of cats and dogs between farms. Post "DO NOT ENTER" signs. Know the source of purchased animals. Have they been vaccinated? What is the current health status of all animals? Control populations of flies, birds, rats, and mice. They can carry diseases and contaminate feed and water.
- 2. Isolate! For 21-30 days.** All animals that have been newly purchased or returning from shows should be quarantined if the health status is suspected or unknown. All animals that show clinical signs of disease may be infected. This allows you to observe these animals for prolonged clinical signs of disease. If they remain disease-free, they can be introduced to the animals. An animal doesn't have to have overt signs of disease to be shedding a bacteria or virus and to pass it on to other animals – diseases like strangles in horses can be passed on with no outward signs.

3. **Vaccinate!** Vaccines, if administered properly, can protect animals and humans against some diseases. Be sure to vaccinate and keep your animals up to date.
4. **Separate!** Young animals can become infected with contagious diseases when exposed to older infected or carrier animals before they are given time to develop immunity. Provide adequate pen, stall, or bedded area per animal. Provide adequate feed and water access per animal. Use a designated sick pen for sick animals only. Use a designated maternity pen for freshening animals only.
5. **Sanitation!** Dispose of dead animals immediately, by burial or by dead stock removal and disposal. Maintain a clean and dry living area for your animals. Control populations of parasites, fleas and flies. When choosing disinfectants, consider the following:
 - a. Does it work against bacteria, fungi or viruses?
 - b. Will it be effective if used in hard water?
 - c. Will it be effective if used in extreme temperatures (hot and cold)?
 - d. Is it compatible with soaps?
 - e. Will it continue to work for a period after application?
 - f. Can it be used on feeding equipment?
 - g. Does it give off irritating fumes?

Notes For Farm Biosecurity

There are three components or pillars to a good biosecurity program:

1. Bio-Exclusion: Stop infected individuals from entering the herd.
2. Bio-Management: Stopping infection from spreading within the herd or farm.
3. Biocontainment: Stop infected animals from leaving the herd.

Each of these components is key to a good biosecurity process. However, in the past ruminant industries have seen variable adherence to these strategies that would not be possible to avoid for pork or poultry producers. This is because of the ever-present potential for animal health and economic disaster that has occurred in these industries in the past. However, any of the diseases outlined already could impact the industry at any time.

Notes For Kennel Biosecurity

Good biosecurity can prevent diseases like parvovirus (a disease that lives on surface and soil for a very long time). Inform your visitors about the biosecurity practices, post signage and ensure contact is kept to a minimum at all time if the animals are young and have a very naïve immune system.

Activity #1 - Contain The Epidemic

Do

Time: 30 minutes

Materials:

- Dice
- Game board

Instructions:

This activity introduces a game that can be applied to many different levels of outbreak control. Specifically, the game will cover the different components of outbreak response and ensure good practices for each step of the process. This activity can also be done in a big field with pylons serving as the farms.

To start, split the group into two equal groups: one group will serve as the viral group. In contrast, the other will perform as the government emergency response personnel. The virus strikes first, so it automatically goes first.

On the board, there are 10 farms. The viral group will choose which farm they would like to start at and can move one to three spaces each turn depending on the roll of a dice:

1. A roll of 1-2 means you can move 1 space on the board.
2. A roll of 3-4 means you can move 2 spaces on the board.
3. A roll of 5-6 means you can move 3 spaces on the board.

Your goal as the viral team is to reach the next farm and make it to each farm on the board (to infect all of the farms).

To start the response, the response personnel must roll a 5 or 6. If they do not, they will have to give up their turn and let the other team go again (giving the virus more time to move to infect more farms).

If the response personnel do roll a 5 or 6, then they can roll again to see if they do anything to stop the viral progression:

1. A roll of 1 means you cannot do anything, and the viral team also gets to move one step.
2. A roll of 2-4 means you get to set up a roadblock. Roll again to determine the number of lines your roadblock can span (the line can go vertical and horizontal to try and block in the viral team from getting to other farms:
 - a. 1-2 means you get 2 lines
 - b. 3-4 means you get 3 lines
 - c. 4-5 means you get 4 lines
 - d. 6 means you get 5 lines
3. A roll of 5-6 means that nothing happens for that turn.

The game ends when the virus is surrounded by roadblocks or when the virus infects all 10 farms (this game is heavily skewed to the response personnel, but it is possible to get stuck at the first step of the game for a while).

This activity can be done in paint or PowerPoint if this is a virtual club. If the activity ends early, switch teams (the strategy used should be very different).

This activity can also be done in a large field/paved area. Pylons can be used to denote infected/non-infected farms and spraypaint/chalk can be used to denote the squares.

Activity #1 - Contain The Epidemic

Reflect	Learning Outcomes: This activity aims to identify how emergency response works in terms of reporting and containment procedures.
Apply	Discuss The Following Prompts As A Group: <ul style="list-style-type: none">• How difficult was it for the personnel to start? How does that relate to how diseases can spread quickly if not reported?• How many farms did the virus infect before they were cordoned off? If each farm represented 100 animals, how many animals were affected? Could that have been less if your dice rolls were different?• How did the starting position of the viral infection affect the game? Did the second group change their strategy?• How can you apply this game to your life? (think COVID pandemic).

Contain the Epidemic Game Board

							F		
	F								
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Reporting Requirements

Becoming an animal owner creates a duty of care to their animals and a legal requirement to report all suspected cases of certain diseases.

The reporting requirements are laid out in federal (the Health of Animals Act) and provincial (the Animal Health Act) statutes. The diseases identified in these statutes represent diseases that can spread rapidly and may not be in Canada currently. As you will read, the best defence against all of these diseases is to stop the spread and control the affected area. Although the diseases listed have awful human and animal health implications, they can be prevented and controlled.

Discuss It!

What is encompassed by the term duty of care?

The Canadian Food Inspection Agency (CFIA) enforces the reportability guidelines. To ensure compliance, the CFIA will often cover the cost of disposal of the infected animals. For example, for an outbreak of Scrapie, all the animals exposed to the same birthing environment are deemed at risk of developing the disease and are ordered destroyed. Producers are compensated for the loss of their animals. The maximum amount of compensation paid for goats ordered destroyed under the Health of Animals Act is \$600 for non-registered animals and \$1000 for registered animals. Sheep or goats known to be infected with Scrapie are humanely destroyed. Their carcasses are burned or buried under CFIA supervision (Scrapie Canada).

These diseases are serious, so the federally reportable diseases are explained below:

Federally Reportable Diseases

- 1. Anaplasmosis:** This disease is also called gall sickness and is primarily caused by ticks that carry the bacterium *Anaplasma phagocytophilum*. This bacterium invades the blood cells leading to anemia (due to a breakdown of the blood cells). Anemia refers to any condition in which there is a lack of healthy red blood cells that carry oxygen to the body's tissues. The clinical signs are hard to spot upon the first infection but lead to fevers, muscle weakness and irregular heartbeats. In general, an infected goat will appear like it does not have energy. This goat should be separated from the rest of the herd, and the incident should be reported to the authorities. This is an economically significant disease, especially if there are biting flies present, which can further spread the disease. With the increase in global temperature, tick populations are moving further north with the many diseases that would not be experienced normally by the goat industry.
- 2. Anthrax:** This disease results from infection by the bacterium *Bacillus anthracis*. This disease is a concern for producers as it can survive in two forms. Its first form is vegetative (easy to kill). The other is a sporulated/spore form, which is highly resistant to temperatures, drying or disinfectants. Anthrax is usually contracted by livestock when they eat the bacillus spores on plants in pastures. Sudden death is the typical sign; however, fever, staggering, excitement, depression, incoordination, trembling and difficulty breathing can also be clinical signs. If an infection is suspected, contact a veterinarian immediately, and they will advise on next steps. Due to the way that the bacterium incubates, this can only spread the spores more. Additionally, spores can remain dormant in the soil or animal by-products meaning that they can spread up to 10 years later. This is a nasty and reportable disease.
- 3. Besnoitiosis:** This refers to Caprine besnoitiosis caused by the cyst-forming protozoal apicomplexan *Besnoitia caprae*. The disease is endemic (regularly found in a certain area) of Kenya, Nigerian and Iran. Still, it has also been identified in other parts of the world as well. The disease has a generally high infection rate but low mortality. The parasites cause lesions on the skin, nasal cavity and larynx. This disease is reportable as it is economically important in other ruminant and equine species. Not a lot is known regarding its transmission or pathogenesis.

4. **Bluetongue:** A severe viral disease that is caused by orbivirus transmitted by the genus *Culicoides* (biting gnats). The disease is isolated based on the range of these gnats, but as temperatures have warmed, the disease has spread North in Europe. Disease spread occurs mainly in the late summer and early fall and is self-limiting primarily (resolves without treatment) but is economically significant for sheep and wild species
5. **Brucellosis:** This disease is caused by infection from a species of *Brucella*. *Brucella melitensis* is the most important species in sheep and goats. The disease can lead to abortion, retained placenta, and swelling of the testicles (leading to infertility). Additionally, this disease can be spread to humans and goats through any of the goat's bodily fluids. The ability for this disease to spread makes it a reportable disease.
6. **Cysticercosis:** This disease is caused by the larval stage of *Taenia ovis* (also known as tapeworms). The parasite leads to cysts occurring in the muscles, brain, liver or peritoneal cavity leading to death. The parasite is on the list due to the risk for dogs and other sheep and goats.
7. **Foot-and-Mouth Disease (FMD):** This viral disease is considered one of the most economically significant diseases for livestock caused by Aphthovirus. The virus infects many species of agricultural importance. It leads to vesicular lesions (blisters) on the infected individual's feet and mouth, leading to reluctant gait and eating. The only way to control this disease is to cull, as infected individuals can quickly spread the illness.
8. **Peste Des Petits Ruminants:** This disease carries a French name due to its discovery in Cote d'Ivoire (The Ivory Coast, a country in Africa) in 1942. The disease is characterized by fever, necrotic stomatitis (gut pain making eating or drinking difficult), gastroenteritis (diarrhea, vomiting and abdominal pain), pneumonia (respiratory infection), and sometimes death. Transmission occurs by close contact. Although it does not affect humans, it can spread very quickly to other goats or ruminants.
9. **Rift Valley Fever (RVF):** This zoonotic viral disease (it can also infect humans) originated in Kenya's Rift Valley. It is commonly caused by close contact with the blood or organs of infected animals. Still, the disease can also be caused by bites from infected mosquitoes. The disease is normally confined to Africa, but a preventative vaccine makes this a preventable and reportable disease in Canada.
10. **Scrapie:** a fatal, degenerative disease caused by a prion (a type of protein that can trigger normal proteins in the brain to fold abnormally). These known prions make up the transmissible spongiform encephalitis (TSEs) that occur in cattle (BSE or mad cow disease; bovine spongiform encephalopathy) and humans (Creutzfeldt-Jakob disease). Although there are no current associations supporting scrapie transfer into humans, BSE is a true problem for transmission, and it needs to be kept out of the food chain. The disease can transfer from dam to kid and to other kids in that same environment. There is no treatment for this disease, and it is to be kept out of the country through strict control.

DID YOU KNOW?



Although the disease is referred to as bluetongue, it rarely leads to cyanotic (blue=lack of oxygen) tongue. It instead mainly manifests in sheep as fever, swelling of the face, and nasal discharge. Again, the disease often does not show clinical signs in goats.

Research It!

Look up one of the diseases not previously identified in the national reporting guidelines and give its mode of action, treatment, infection risks and reasons for showing up on the list.

Provincially Immediately Notifiable Diseases

The following list of diseases from the regulations relating to goats is being reported:

- | | | | |
|-------------------------|---------------------------|--------------------------------|--|
| 1. Aino Virus Infection | Pleuropneumonia | 14. Nipah Virus | 20. Rabies |
| 2. Akabane Disease | 8. Coxiellosis (Q Fever) | 15. Peste Des Petits Ruminants | 21. Toxic Substances that may cause a threat to animal or human health |
| 3. Besnoitiosis | 9. Heartwater | 16. Salmonellosis | |
| 4. Borna Disease | 10. Influenza | 17. Screwworm | |
| 5. Botulism | 11. Japanese Encephalitis | 18. Sheep and Goat Pox | |
| 6. Contagious Agalactia | 12. Listeriosis | 19. Tick-Born Fever | |
| 7. Contagious Caprine | 13. Louping Ill | | |

Meeting 4 - Toxicology

Setting Objectives:

To outline the importance of identifying and controlling toxic substances for your animals.

Suggested Learning Outcomes:

- To identify common toxic agents for animals.
- To outline the categories of poisons for animals.
- To identify what to do in a poisoning situation.

Suggested Roll Call Questions:

- • Have your animals ever eaten poison? If so, what did you do?
- • How would you prevent animals from ingesting toxins?

SAMPLE MEETING AGENDA

Time: 1 hour 40 minutes

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	15-20 minutes
Topic Information, Discussion	All About Poisoning	20 minutes
Activities Related To Topic	Activity #1 - A Poor Match	15 minutes
Topic Information, Discussion	Classification Of Poisons	10 minutes
Wrap up, Social Time And Adjournment		10 minutes

All About Poisoning

Poisoning

Poisons are toxic substances that can be eaten, absorbed through the skin, and inhaled. Poisoning is sometimes misdiagnosed because its clinical signs exhibit other disease or disorders, making it especially dangerous. Some poisons act immediately, while others take days to appear; this also makes diagnosis difficult.

Common Clinical Signs Of Poisoning:

- Muscle tremors or seizures
- Vomiting and or diarrhea, sometimes with blood
- Excessive salivation - drooling or foaming
- Redness of skin, ears, eyes
- Bleeding (common when rat poison is ingested)
- Formation of ulcers or blisters of the mouth or skin
- Excessive licking
- Swelling of a limb or face, (common with bites and stings)
- Changes in body temperature (unusually high temperature usually due to increased muscle activity as a result of tremors or seizures)

What Should I Do If I Suspect Poisoning?

1. If you suspect poisoning, call your veterinarian or veterinary emergency clinic immediately. If it is possible, have the following information ready:
 - a. Name of toxin ingested, inhaled, or absorbed.
 - b. Approximately how much of the toxin was ingested.
 - c. How long ago you suspect the poison was ingested.
 - d. Approximate weight of your pet.
 - e. What clinical signs are being exhibited -- vomiting, tremors, salivation; and general observations - such as color of the gums, respiratory rate, heart rate, and if possible, body temperature

Be Aware Of The Following Common Household Poisons:

- Antifreeze (Ethylene glycol)
- Cannabis
- Slug/Snail bait
- Prescription medications
- Mouse and rat poison
- Lawn fertilizers, weed killers
- Household cleaners and chemicals
- Some plants (indoor and outdoor) including azalea, oleander, mistletoe, and Easter lilies; shrubs, and trees
- Grapes and certain types of fruit

Check with your veterinarian for help in finding information on native plants in your area that are toxic to pets. Identifying plants as poisonous or non-poisonous is difficult for many reasons:

- What may be poisonous to some species is harmless to others
- Poisonous content varies of plants may vary in different stages (early growth to maturity)
- Some plants, such as buttercups, contain poisons when fresh but not when dried
- Only certain parts of the plant may contain poisons (rhubarb – only leaves are poisonous)
- Certain species are more susceptible to certain poisons than others
- Young animals are more susceptible than older animals (animals may build up resistance)
- Hungry animals are more prone to ingesting poisonous plants.

Activity #1 - A Poor Match

Do	<p>Time: 15 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Matching Game Work Sheet <p>Instructions:</p> <p>On the worksheet attached, match the product to the animal that experience toxicity when ingested.</p> <p>Some toxins might match with more than one animal.</p>
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is for members to learn some of the common toxic agents for animals.</p>
Apply	<p>Discuss The Following Prompts As A Group:</p> <ul style="list-style-type: none">• If your pet is poisoned, you should collect:<ol style="list-style-type: none">a. Name of toxin ingested, inhaled, or absorbed.b. Approximately how much of the toxin was ingested.c. How long ago you suspect the poison was ingested.d. Approximate weight of your pet.e. What clinical signs are being exhibited -- vomiting, tremors, salivation; and general observations -- such as color of the gums, respiratory rate, heart rate, and if possible, body temperature.• Why do you think each of these are important?• Were there any poisons that surprised you?

A Poor Match Worksheet

Product			Toxic or Not?
Apple		→	
Acetaminophen		→	
Chocolate		→	
Avocado		→	
Salmon		→	
Macadamia nuts		→	
Grapes		→	
Onion		→	
Spinach		→	
Xylitol		→	
Cheese		→	

A Poor Match Worksheet - ANSWER KEY

Product			Toxic or Not?
Apple		→	NO
Acetaminophen		→	YES
Chocolate		→	YES
Avocado		→	YES
Salmon		→	NO
Macadamia nuts		→	YES
Grapes		→	YES
Onion		→	YES
Spinach		→	NO
Xylitol		→	YES
Cheese		→	NO

Classification Of Poisons

Type of Poison	Properties	Clinical signs	Watch out for these plants
Alkaloids (examples include morphine, atropine, nicotine, quinine, and strychnine)	Basic organic substances with a bitter taste	Irritates the gastrointestinal tract, causing nausea, colic and diarrhea Affects the nervous system, causing blindness, weakness, convulsions, and death.	<ul style="list-style-type: none"> • Lupines • Buttercups • Marsh marigolds • Purple night-shade
Glycosides (natural plant products containing the sugar glucose):			
Cyanogenic glycosides	In the presence of certain enzymes, hydrocyanic acid, (a toxic substance) is produced Conditions such as climate, soil, and exposure to sunlight cause variations in content of cyanogenic glucosides in plants.	Interferes with oxygen exchange from the lungs to the body tissues, causing muscle tremors, difficult respiration, and convulsions Often clinical signs are not seen because death occurs quickly	<ul style="list-style-type: none"> • Sorghum • Sudan grass • Marsh-arrow grass • Wild cherries
Saponin glycosides	Produces gastroenteritis causing vomiting, diarrhea and colic If absorbed into bloodstream, causes a break down of red blood cells Injury to the central nervous system causes convulsions and paralysis.		<ul style="list-style-type: none"> • Purple cockle • Cow cockle • Pokeweed
Mustard oil glucosides	Severe gastroenteritis causes severe colic and purging.		Found in plants belonging to the Mustard family
Nitrates	Poisoning occurs when nitrate is converted to nitrite in the gastrointestinal tract	Acute poisoning: <ul style="list-style-type: none"> • Trembling and staggering, rapid breathing, death Chronic poisoning: <ul style="list-style-type: none"> • Poor growth, Poor milk production, Abortions, Affects vitamin A storage in cattle 	Weeds: pigweed, thistle, hemlock, wild Morning Glory Crops: oats, rye, wheat, barley, corn, sorghum, sugar beets, turnip (Drought and low light intensity may cause nitrates and nitrites to accumulate in stem and leaves of crop plants)

Classification Of Poisons

Type of Poison	Properties	Clinical signs	Watch out for these plants
Selenium	<p>Element needed for normal metabolism</p> <p>Poisoning occurs when quantities are taken in exceeding what is normally needed</p>	<ul style="list-style-type: none"> • Stiffness of joints • Lameness • Loss of hair • Hoof deformities 	In most plants, the level of selenium is related to levels in the soil.
Mycotoxins	<p>Produced by fungi</p> <p>Produced only in the right environmental conditions</p> <p>Mycotoxin production may occur while crop is standing or after it is harvested.</p> <p>Two main types of toxins; vomitoxin and zearalenone. There are countless</p>	<p>Multifactorial. Some may cause an animal to vomit and may transfer to their final product.</p> <p>Zearalenone: a female estrogen; females show signs of irregular estrus and reduced litter sizes.</p>	Crops infected by fungi including corn and cereals.
Photosensitization	<p>Certain plants contain toxic agents which cause animals to become sensitive to strong sunlight when eaten.</p>	<ul style="list-style-type: none"> • May cause sunburning and swelling of sensitive areas, the formation of ulcers, and gangrene. • May cause blindness. • In some cases it may cause liver damage 	<p>St. John's wort</p> <p>Spring parsley</p> <p>Buckwheat</p> <p>Blue-green algae</p>

Providing A Poison-Proof Environment

The following are key when providing a poison proof environment.

- When using poisons such as ant, rat and mice baits, place the products in areas that are inaccessible to animals. Most baits contain sweet smelling ingredients which can be attractive to pets.
- Medications made for humans may have sugar coatings on them that are attractive to pets and may be toxic if ingested.
- Do not allow pets to chew on plants or trees that are poisonous. You can buy commercial sprays that can be safely applied to plants and discourage pets from chewing on plants.
- Spray bottles or cans that may contain a toxic substance may be seen by a pet as a toy. The contents may leak out if the container is punctured by the pet's teeth.
- Thoroughly read all directions for use of chemicals and follow directions carefully.
- When cleaning your house, never allow your pet access to the area where cleaning agents are used or stored.
- Never give your animal any medications unless under the direct of your veterinarian. Many medications that are used safely in humans can be deadly when used inappropriately. One extra strength acetaminophen (Tylenol) tablet (500mg) can kill a seven-pound cat.
- Keep all prescription and over the counter drugs out of your pets' reach, preferably in closed cabinets. Pain killers, cold medicines, anti-cancer drugs, antidepressants, vitamins, and diet pills are common examples of human medication that could be lethal even in small dosages. One regular strength ibuprofen (Motrin) tablet (200mg) could cause stomach ulcers in a ten-pound dog.
- Many common household items may be toxic to certain species. Items that are highly toxic even in small amounts include:
 - o Pennies (high concentration of zinc)
 - o Mothballs (contain toxic chemicals)
 - o Potpourri oils
 - o Fabric softener sheets
 - o Automatic dish detergents (can cause lesions)
 - o Batteries (contain acids which can cause lesions)
 - o Homemade play dough (contains high quantity of salt)
 - o Cigarettes
 - o Coffee grounds
 - o Alcoholic drinks

Meeting 5 - The Business of Veterinary Medicine

Setting Objectives:

To consider all the components that make up the business of veterinary medicine and what animals and veterinary care cost.

Suggested Learning Outcomes:

- To outline the jobs available in the veterinary industry.
- To discuss mental health and burnout in the industry.
- To discuss finances, and the costs you can expect with animal care.

Suggested Roll Call Questions:

- Name a career in the veterinary industry.
- How much do you think it costs to own a pet?

SAMPLE MEETING AGENDA

Time: 2 hours

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	15-20 minutes
Career Spotlight	Careers In The Veterinary Industry	20 minutes
Activities Related To Topic	Activity #1 - Documenting Gratitude	20 minutes
Topic Information, Discussion	Money, Money, Money	10 minutes
Activities Related To Topic	Activity #2 - True Costs Of Animal Ownership	20 minutes
Wrap up, Social Time And Adjournment		10 minutes

Careers In The Veterinary Industry

Veterinarian

If you are interested in working with animals and are fascinated with medicine, surgery you are fascinated by science, medicine, and surgery then a career in veterinary medicine may be right for you. A veterinarian is a Doctor of Animal Health who holds a Doctor of Veterinary Medicine (DVM) degree and who is licensed to provide medical and surgical care for animals. The DVM degree requires 7 years of schooling.

Veterinarians can also specialize into fields that include anesthesiology, cardiology, emergency and critical care, dentistry, dermatology, internal medicine, neurology, ophthalmology, radiology and surgery.

Additionally, not all veterinarians work in a clinic! Some work in regulatory roles, while others work with public or private companies. The opportunities are numerous with a DVM degree!

Registered Veterinary Technician (RVT)

RVT are formally educated and work with licensed veterinarians to aid in the care of animals. Some areas of their expertise include:

- Obtaining and processing diagnostic radiographs and ultrasound
- Administration and dispensation of medications and treatments as prescribed by the attending veterinarian
- Providing optimum husbandry, restraint and handling
- Anaesthetic delivery and monitoring
- Prevention and control of zoonotic diseases and biosecurity protocols
- Nutrition management
- Animal behaviour and welfare
- Breeding, reproduction, and neonatal care
- Professional practice administration, veterinary hospital management and client relations
- Diagnostic laboratory tests (hematology, clinical chemistry, cytology, and urinalysis)
- Routine, intensive and emergency care of animals
- Exotic animal medicine
- Extensive anatomy and physiology training
- Sanitation, sterilization and disinfection controls and procedures
- In depth knowledge of dental structures, conditions and lesions, causes and stages of diseases
- Surgical preparation and assistance
- Microbiology, immunology, bacteriology, parasitology, zoonoses, and virology

Receptionists

These members of the veterinary team greet clients, schedule days and are the front line of the clinic. These staff members need to have a high attention for detail and be organized.

Animal Care Attendants

These members of the veterinary team assist veterinarians and vet technicians by setting up procedures, animal restraint, equipment maintenance and other miscellaneous tasks. They help keep the veterinary clinic running smoothly.

Office Managers

This role oversees scheduling of staff, budgets and all other business-related components of the workplace. Depending on the size of the practice, this role may be filled by a veterinarian owner.

Lab Assistant/Technician/Scientist

While the role works outside of the traditional clinic environment, these individuals provide valuable insight to the veterinary team through their analytical work.

Researcher

These individuals work with industry groups and veterinarians to answer questions and develop products.

Mental Health And Burnout

Mental health is an important topic to discuss with members. Included with this meeting is a fact sheet from the Canadian Veterinary Medicine Association.

Experience It!

Contact your local mental health association and see if they would be interested in speaking to your club about mental health.



Burnout has been referred to as an “unintentional end point” for certain individuals who are exposed to chronic stress within their working environment.¹

These job-related stressors can leave people feeling overworked and can occur when there is conflict between co-workers, responsibilities and work demands exceed available resources and when there are feelings of having no control over the quality of services and work provided, loss of economic security or position, feelings of inequity or lack of respect, or a gap between one’s individual values and the organizational goals.^{2,3}

RECOGNIZING THE SIGNS OF

BURNOUT + COMPASSION FATIGUE



BURNOUT

From the research perspective, burnout is considered one of the elements of Compassion Fatigue.⁴ From the organizational and social work perspective, it is often distinguished as being different from compassion fatigue in that burnout arises from where one works, whereas compassion fatigue is associated with the work you do.² Here are three primary characteristics of burnout according to psychologists and social workers.^{2,4}

- **Feelings of hopelessness.** Burnout is associated with feelings of hopelessness and difficulties in dealing with your work or in doing your job effectively, and these negative feelings usually have a gradual onset. They can reflect feeling that your efforts do not make a difference or can be associated with a very high work load or a non-supportive work environment.
- **Exhaustion.** You may feel worn out, overwhelmed, drained, tired, and lacking adequate energy. Physical problems include stomach pains and digestion problems.
- **Alienation from job-related activities.** You may feel trapped by the work you do. You find your job increasingly negative and frustrating, and develop a cynical attitude toward your work and your colleagues. At the same time, you may distance yourself emotionally from your work.
- **Reduced performance.** Burnout mainly affects everyday tasks at work, at home or when caring for family members. People experiencing burnout tend to be negative about their activities, find it hard to concentrate, are listless and lack creativity.

You might be wondering how to assess your personal levels of compassion fatigue, compassion satisfaction, and burnout.

Here is a scientifically validated assessment tool called the Professional Quality of Life scale at www.proqol.org.

Click on *Proqol Measure* and *Tools* and look for Proqol Measure. It was written for caregivers in human medicine like paramedics, psychologists and social workers. However, it has been used in research studies and clinical work with veterinarians^{8,9} so when you complete the scale change the word “person” to client or patient. That will help give you better context to accurately answer the questions.

Careers in the Veterinary Industry

Compassion fatigue is defined as an overexposure to suffering and pain that can cause personal stress and a reduced ability to be empathetic.^{5,6}

For professional caregivers like veterinary professionals, this stress occurs from a wish to relieve suffering, but when work or personal stressors exceed the ability to cope, it can result in psychological and/or physical symptoms that can disrupt a person's ability to function at work or in one's personal life. In comparison to burnout, compassion fatigue results from caregivers who frequently have to deal with highly distressing situations involving their patients and in our case as veterinary professionals, animal owners, clients and producers (the people part of the veterinary work). It has been considered the "cost of caring".^{1,5,6}

COMPASSION FATIGUE

Some experts believe that compassion fatigue is a misnomer because it is not fatiguing to extend compassion to others.⁷ Empathy fatigue is a term that is popping up to describe the emotional exhaustion which caregivers, including veterinary professionals, experience. One of the reasons for this shift in terminology is recent neurobiological research that shows that the cerebral networks activated by acts of empathy are very different than the areas of the brain that are activated by acts of compassion. Compassion lights up the areas of the brain that release positive neurotransmitters such as oxytocin and vasopressin, making one feel revitalized.⁷ On the other hand, extending empathy activates brain areas that sense and perceive pain and feelings of stress resulting in a depletion of feel-good neurotransmitters.⁷



You may begin to see the term empathy fatigue replace compassion fatigue in the literature. Regardless of the term used, as veterinary professionals we experience fatigue when we get too attached to alleviate the suffering of our patients, take on the pain of what others, such as owners, clients, and producers are feeling, or overtax and exhaust our empathy reserves when we work too deeply in emotionally charged situations.

Watch this presentation by Dr. Brian DiGangi DVM, MS, DABVP, Senior Director, Shelter Medicine, ASPCA as he describes different definitions of compassion fatigue, signs and symptoms, and helpful strategies in an evidence-based way.

www.youtube.com/watch?v=9Vjv-645uaQ

Dr. Anna Baranowsky¹ has described a trajectory of the signs and symptoms of compassion fatigue. It is not a linear path as a person may have behaviours or thoughts at one time that align to a couple of the phases.



Careers in the Veterinary Industry

COMPASSION FATIGUE

Zealot phase

1

- You have overflowing enthusiasm and go the extra mile without complaining or prompting, willing to stay late or put in extra hours and you feel that you are making a difference.
- You make excuses because you think you are superhuman. So you say things like, “I can deal with this stress because I am a veterinary professional.” Or “I’ve been doing this for ten years but I am OK, I can handle this.”
- At times it might feel like you are losing control, so you roll up your sleeves and work harder, becoming a workaholic because you think the work will make your stress or bad feelings go away.
- Stress starts to affect you and you may experience rapid heartrate, breathing difficulties, aches and pains, shock, sweating, and dizziness.⁵

Irritability phase

2

- Lose your sense of humour.
- Begin to cut corners at work.
- Daydream and get distracted when colleagues or clients are talking with you.
- Make mistakes or oversights.
- Become cynical and mocking others, talking about them unfairly and with criticism.
- Feel undervalued and under-resourced, like what you have is not enough to get the job done. You might blame others for not having the resources or putting up protocols or processes that seem like obstacles to getting your work done. You might feel ashamed, thinking that you should be able to handle it but beating yourself up because you can’t.
- This is in stark contrast to how you felt in the zealot phase or when you started the job, maybe at an earlier point you did feel under-appreciated or undervalued but you said to yourself, “That is OK, the animals need me, I need to care for the animals. I’m not in this for the people. I want to do this.” But then somewhere along the way you say, “That is not OK, I do not have enough or have what I need to succeed.” It is noteworthy that likely there was no change in the circumstances, situation or work tasks, rather there is a change in how you are responding.
- Become impatient, irritable, moody, angry.⁵

Withdrawal phase

3

- You are tired all the time. Your sleep patterns are altered, either you sleep all the time or you can’t get to sleep or you wake up in the middle of the night and you can’t fall back to sleep.
- You get colds, one cold after another, one cold runs into another. Your cough never clears up.
- You might fall into the trap of self-entitlement. Self-entitlement is a justification of your negative and maladaptive behaviours because of the positive things you stand for, sort of like a quid pro quo. It’s like wearing an invisible badge of honour on your sleeve. “I stayed up all night with this sick patient so I am a little cranky today and biting everyone’s head off but I’m sure you get it. Look at me I am a hero and so committed to my work.” “Or I worked overtime every single day this week, so I am getting wasted this weekend.” We begin to justify the negative behaviours because of the things we do and what we believe in.
- Complaints about you at work or in your personal life.
- Patients start to blur in your mind, the cases all run together. Difficulty concentrating, confusion, spaciness, whirling thoughts, blurring thoughts.
- You see patients and owners/clients/producers as irritants and not as individuals deserving of attention.
- You may start to neglect, withdraw and detach from patients, clients, family, co-workers and yourself.⁵
- Potential for thoughts of self-harm or harming others.⁵
- Potential for use of negative coping techniques (smoking, alcohol, or other substance abuse and misuse).⁵

Zombie phase

4

- On autopilot, just going through the motions.
- No longer are good on the job. Making mistakes.
- Feeling disconnected.
- Nothing left to give, depleted, emptied out, numb.
- Potential for thoughts of self-harm or harming others.⁵
- Potential for use of negative coping techniques (smoking, alcohol, or other substance abuse and misuse).⁵



Careers in the Veterinary Industry

If you are feeling any of these signs please get help.



It is possible to disembark from this trajectory with self-awareness and accessing support. If you are in crisis, have thoughts of self-harm, harming others or thoughts of suicide **go to your local emergency department or call 911 immediately.**

If you have thoughts of suicide you can also contact the **Canada Suicide Line** at **1-833-456-4566** or text **45645**. They can connect you to your local crisis centre.



See Appendix A for “Who ya’ gonna’ call list” for other support including a list of Employee Family Assistance Plans (EFAP) and phone numbers offered by your provincial veterinary association. EFAP provide telephone, online and in-person help to address a full range of mental health issues including but not limited to family and relationship issues, trauma, depression, anger management, stress management and more.

You may be wondering how to learn strategies to deal with compassion fatigue.

Check out this online course.

www.sheltermedicine.vetmed.ufl.edu/education/courses/compassion-fatigue-strategies/



REFERENCES

This checklist was written by Dr. Kathy Keil. Dr. Keil studied cognitive and neuropsychology in her undergraduate and graduate psychology degrees prior to attending veterinary school. She is not a licenced psychologist. She has training in Mental Health First Aid, safeTALK suicide awareness, ASIST suicide intervention and is licenced to teach safeTALK. She regularly teaches suicide awareness and basic intervention skills to veterinary professionals and ways for them to take care of their own mental well-being. She is a member of the ABVMA Member Wellness Committee and a technical services veterinarian with Merck Animal Health. She is the leading force behind the Merck-CVMA “It’s Time to Talk about Mental Health in Vet Med” Awareness Campaign.

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RESOURCES

Appendix A

Who ya’ gonna’ call list

This is a list of community resources that can offer mental health help and support including suicide intervention and crisis support. Make this list personal. Add phone numbers for help and support in your own local community.

If you are in crisis, please visit your local emergency department or call 911 immediately.

If you have thoughts of suicide or you are with someone who does call Canada Suicide Support 1-833-456-4566 or text 45645. This is a crisis line for immediate help when in crisis. It connects people to their local crisis centre.

Veterinary Provincial Employee Family Assistance Plan (EFAP) Providers—Check with your association to make sure that you have the most up-to-date information. As of June 25, 2019 the information is as follows:

BC, AB, MB Veterinary Medical Associations EFAP Provider is Homewood Health 1-800-663-1142. Press (1) for immediate crisis support, offered 24/7. www.homeweb.ca

Saskatchewan Veterinary Medical Association EFAP Provider is Professional Psychologists and Counsellors (PPC) 1-306-664-0000 or 1-888-425-7721. office@peopleproblems.ca. www.peopleproblems.ca Service available to all active general, life practicing and educational SVMA members (must have been licenced for 6 months). Four hours of complimentary services annually. Your licence number is required.

Ontario Veterinary Medical Association EFAP Provider is WorkHealthLife 1-844-880-9137. www.workhealthlife.com Available to OVMA members and their family. Professionals Health Program 1-800-851-6606 (available to veterinarians registered with College of Veterinarians of Ontario only).

Quebec AMVQ Association EFAP Provider is Morneau Shepell 1-800-361-2433. www.travaillantevie.com

New Brunswick Veterinary Medical Association EFAP Provider is Clinic of Applied Psychology 1-506-858-9180. www.cpamoncton.ca/fr (French) www.cpamoncton.ca/en/ (English). Service available to veterinarians registered with the New Brunswick Veterinary Medical Association. Three complimentary sessions with a psychologist (confidential). Bilingual appointments available in Moncton or with one of their partners across the province.

Nova Scotia Veterinary Medical Association EFAP Provider is the Professional Support Program 1-800-563-3427. Service available to veterinarians registered with the Nova Scotia Veterinary Medical Association.

Prince Edward Island No provincial EFAP Provider. Direct suicide support call 1-800-218-2885.

Newfoundland and Labrador No provincial EFAP Provider. Mental Health Crisis Centre (NL) 1-888-737-4668.

Northwest Territories/ Nunavut/ Yukon No EFAP Provider. Canadian association for suicide prevention NWT 1-800-661-0844. www.nwthelpline.ca and in Nunavut/ Nunavik 1-800-265-3333.

Find the number of your local distress centre and write it down on this list. Tip google these search terms—distress centre and the name of your local community

Write down other resources in your own community like counsellors, psychologists, social workers, chaplains.

The CVMA also has a list of support services categorized per province.

www.canadianveterinarians.net/documents/resources/vet-health-wellness-helplines-support-services



CANADIAN VETERINARY MEDICAL ASSOCIATION
L'ASSOCIATION CANADIENNE DES MEDECINS VETERINAIRES



MERCK
Animal Health

Activity #1 - Documenting Gratitude

Do	<p>Time: 20 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Notepad, notebook or other paper sourcePen or other writing instrument <p>Instructions:</p> <p>A tool that can be used to keep track of the good things in your life when things seems difficult. There are many ways to keep track of this information in journal form but this activity will introduce members to one way of doing it!</p> <p>It's extremely simple to start: simply write down (or type) the things you are grateful for on a daily basis.</p>
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is for members to learn about an important tool in recognizing things that they are grateful for which can positively affect their mental health.</p>
Apply	<p>Discuss The Following Prompts As A Group:</p> <ul style="list-style-type: none">• Can you think of anything else you might want to add to your journal?• Is there anything you might want to share with the group?

Money, Money, Money

There is always a duty of care requirement to owning an animal. The codes, regulations and laws are clear that adequate care must always be provided. Necessities like food, water, and shelter are not free. Neither is your time which you will use to care for the animal.

An additional cost that most people do not factor in is the cost of veterinary care. While you may know how much food is going to cost, or how much per month it is going to cost to house your animal, it can be difficult to predict when unforeseen medical bills are going to occur.

Food Animals

For food animals, the NFACC Codes of Practice present requirements and recommendations for standards of care that must be followed. There are usually fixed expenses (i.e., vaccinations) but there are also variable expenses (i.e. health related, proactive measures). By keeping a budget you can account for these expenses and ensure that you remain profitable.

Companion Animals

Remaining profitable is less of a concern for companion animals but you still have the same responsibility to your animals as do food animal producers. A visit to the vet will have a consult fee, cost for any medication and a cost for any procedures. You should always have reserves saved to handle these added costs as without it, the cost of ownership may exceed your savings.

Overall, you should only own animals that you can adequately provide care to!

Activity #2 - True Costs Of Animal Ownership

Do	<p>Time: 20 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Notepad, notebook or other paper sourcePen or other writing instrument <p>Instructions:</p> <p>Owning an animal (whether it be as small as a fish or as large as a steer) can be expensive. The financial investment should be considered when thinking about adopting a new companion. Ask the members to come up with one animal that they had considered owning one day. Using the internet either on a computer or phone, get the members to research how much the annual cost would be of owning that animal. Ensure they consider some of the following: food, veterinary care, licensing fees, adoption fee, crates/cages/boarding/shelter costs, bowls/dishes, training classes, grooming, pet accessories (leash, collar, outfits), toys, treats and more!</p> <p>After a period of time, ask the members to share with the group the animal they chose to adopt and the approximate annual costs of owning that animal.</p>
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to get members to consider and contemplate the cost of pet ownership.</p>
Apply	<p>Discuss The Following Prompts As A Group:</p> <ul style="list-style-type: none">• What was the most expensive part of owning a pet (this will vary based on what animal they chose)?• What were some of the costs you considered for your pet of choice?• What are some costs that may only occur the first year of owning an animal?

Meeting 6 - The Business Of Veterinary Medicine

Setting Objectives:

To outline some of the current emerging technologies and to allow members to think about the future of veterinary medicine.

Suggested Learning Outcomes:

- To discuss big data and 3-D printing to introduce the topic of emerging technologies.

Suggested Roll Call Questions:

- Research a type of emerging technology in veterinary medicine. What is it and what does it do?
- How might emerging technologies better improve the quality of care for animals?

SAMPLE MEETING AGENDA

Time: 2 hours

Welcome, Call To Order, Pledge		10 minutes
Roll Call		10 minutes
Parliamentary Procedure	Minutes And Business	15-20 minutes
Topic Information, Discussion	Big Data And 3-D Printing	15 minutes
Activities Related To Topic	Activity #1 - Research It!	20 minutes
Achievement Project Planning	Members can use this time to plan their achievement project	30 minutes
Wrap Up, Social Time And Adjournment		20 minutes

Big Data And 3D Printing

To round out the other topics section, it is important that emerging technologies are discussed. As these are emerging at the time of writing this manual, the thought was that the two below could start a discussion on the topic. By the time you as a club leader or member are reading this, it may be already outdated information, but it is still important to highlight regardless.

Big Data

In the world of the Internet and with the vast amount of processing power available to us, it is important to think of data as a resource that can be used to solve problems. The wealth of data has allowed us to look at questions and see if any associations or trends can be observed.

On dairy farms, we can now predict mastitis and other leading causes of somatic cell count based on a cow's milking and visit behavior in robotic milking systems. As we further collect data we can add to these algorithms and make them more robust. This can further improve animal welfare and promote positive outcomes for animals in our care.

Data is also being collected about companion animal (dog, cat and other pets) in relation to disease status. This data can be integrated from multiple locations and combined to provide more information for veterinarians to do their job.

As the industry works to collect more information and integrates this with computer algorithms, our predictive ability and accuracy will continue to improve.

3-D Printing

3-Dimensional printing is an evolving field in veterinary medicine. 3-D printing allows for the creation of a physical object created from medical imaging. Essentially, the combination of images from magnetic resonance imaging (MRI), computed tomography (CT) and other computer software creates an image that can go on to be transformed into a STL file that is then read by the printer to print the object.

The 3-D printer lays down many thin layers of the given media to construct the desired image. Some potential media include silicon, plastics, metals, wood and more! One of the most common uses for 3-D printing in the Veterinary landscape is the use of it for pre-surgical planning and for surgery. Printing a replicate of what they are performing the procedure on allows the surgeon the chance to plan their approach, try different methods or refine their technique ahead of a big procedure! Additionally, 3-D printing can create surgical implants that can be customizable to the individual animal! This allows veterinarians to correct structures affected by congenital defects, disease or trauma. This is an ever-evolving field in veterinary medicine!



Source From: <https://news.cornell.edu/stories/2020/09/passion-3d-printing-engineering-fuels-veterinary-startup>

Research It!

In the next activity you will have the chance to debate why your chosen technology is the best! Use all the tools you have available to research and brainstorm!

Activity #1 - Research It!

Do	<p>Time: 30 minutes</p> <p>Materials:</p> <ul style="list-style-type: none">• Notepad, notebook or other paper source• Pen or other writing instrument <p>Instructions:</p> <p>Ask the members to come up with one emerging technology that they had researched prior to the meeting. Using the internet either on a computer or phone, get the members to research how their technology is the best next invention for the field of veterinary medicine.</p> <p>After a period, ask the members to state the top two reasons that their innovation is the best! Write them down on a chart paper and then give everyone two votes for which technology they think is the coolest.</p> <p>You may wish to share this activity with members prior to the club meeting.</p>
Reflect	<p>Learning Outcomes:</p> <p>The objective of this activity is to let members debate and reason about why their chosen innovation is the best.</p>
Apply	