



VETERINARY



The mission of 4-H Ontario:

“4-H Ontario is dedicated to the personal development of youth while providing a positive impact on volunteers and communities in Ontario.”

The 4-H Motto:

“Learn to do by Doing”

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, and my
country.”*



This Veterinary Project was created by:

Lacey Frizzell, Resource Assistant, 4-H Ontario
Jessica Currie, Resource Assistant, 4-H Ontario
Jen Lichy Resource Assistant, 4-H Ontario
Marie Winter, Program Manager, 4-H Ontario
Darlene Lyons, Resource & Program Assistant 4-H Ontario

For More Information:

4-H Ontario

5653 Hwy 6 N RR 5
Guelph Ontario N1H 6J2
Phone: (877) 410-6748
Fax: (519) 824-875
www.4-hontario.ca

Canadian 4-H Council

Central Experimental Farm
930 Carling Ave., Bldg. 26
Ottawa, Ontario K1A 0C6
Phone: (613) 234-4448
Fax: (613) 234-1112
www.4-h-canada.ca

Or contact you local 4-H Association!

TABLE OF CONTENTS

SECTION	SECTION NUMBER
Introduction	
Nervous System	1
Muscles	2
Bones	3
Antlers, Horns, Hooves	4
Reproductive System	5
Digestive System	6
Respiratory System	7
Teeth	8
Circulatory System	9
Genetics	10
Bio-security	11
Toxicology	12
Body Conditioning	13

INTRODUCTION

PURPOSE OF THE 4-H PROGRAM

The mission of the 4-H program is the personal development of youth while providing a positive impact on volunteers and communities in Ontario.

In 4-H, members will be:

- encouraged to develop self-confidence, a sense of responsibility, and a positive self-image;
- helped to develop their skills in communications, leadership, problem solving, and goal setting; and
- Offered the opportunity to learn about the food production, processing, and marketing systems and the heritage and culture of Ontario through projects such as livestock and crop production, financial management, food preparation, nutrition, recreational activities, and career development.

WELCOME TO 4-H

The 4-H Club Leaders' Handbook says that, "Volunteer 4-H leaders are a blend of friend, teacher and parent." What a big order to fill! But you will discover that you have many talents as a 4-H leader. Having an interest in young people and their development and being willing to take up the challenge of 4-H leadership is the first step to success.

This material covered in this manual is geared towards senior and intermediate members. However, the development of members as individuals is your real goal. You may wish to keep senior members interested by encouraging them to become youth leaders. You will get to know the club members and where their interests lie very well. Use this knowledge, your own expertise and imagination to plan a fun, interesting and challenging club program for your members. And enjoy being a 4-H leader!

WHAT ARE MY RESPONSIBILITIES AS A 4-H LEADER?

Before your club begins:

1. Attend a leader training session;
2. Advertise the project and organize a club which will have a minimum of six members; and
3. Review available resources and begin planning the club program.

During the club:

1. Attend each meeting and the Achievement Program;
2. Assist members in planning and presenting the club program;
3. Provide a FUN, learning atmosphere;
4. Have members complete the club membership list and forward to the Ontario 4-H office by the end of the second meeting;
5. Help each member to set and reach goals for personal development;
6. Encourage members to work together as a group;
7. Provide guidance in choosing and completing an Achievement Program; and
8. Evaluate the club program.

4-H CLUB PROGRAM PLANNING

WHY DO I NEED TO PLAN THE CLUB PROGRAM?

A successful 4-H club doesn't just happen! Careful planning is necessary and very important. As a 4-H leader, you have a responsibility to do the best job you can in providing a fun, learning experience for the 4-H members. Planning will make this a reality. Some other benefits of planning include:

- setting goals to strive for;
- sharing the workload;
- ensuring that club time will be productive;
- providing better communications;
- avoiding calendar conflicts;
- providing a role for each person;
- knowing who will be responsible for what part of the program;
- making the best use of available resources; and
- learning planning skills.

O.K. ... HOW SHOULD I PLAN?

You will want to make some initial plans before the club starts. Remember to involve members early in the planning process. Achieve this by one or more of the following:

- hold a general meeting and have the entire membership suggest ideas
- meet with the elected club officers
- form a planning committee of members and leaders (parents and sponsors could also be included)

It doesn't matter which approach you take but there are some basic steps to follow.

1. Look at the club's situation.
 - ages, interests and locations of members
 - successes and failures of past clubs
 - county/regional/district activities
 - available time
2. Identify the club's goals.
 - base these on the club's situation
3. List possible activities.
 - how goals can be met
 - brainstorming is a good technique at this stage
4. Determine activities.
 - keep goals and the club's situation in mind
 - balance business, learning and social recreation
5. Prepare the Club Program Plan.
 - when will activities take place, where will they be held, what will they be, who will do them
 - share and discuss the plan with the entire membership

HOW CAN I MAKE THE BEST USE OF RESOURCES?

There are many resources available to 4-H leaders. Awareness of these resources and how to use them will help in planning the club program.

1. 4-H MEMBERS' Materials and Leaders Guide

The Members' Material, which is on white paper, has been developed as a reference for information that can be covered during the 4-H meetings. **IT IS NOT NECESSARY TO COVER ALL OF THE INFORMATION THAT IS IN THE MANUAL.** Remember your club's situation and select topics that will be of greatest interest. This project is designed to allow flexibility; that is, choose the meeting topics that appeal most to you and the members. Only use the information that is at the right level for your members and suits your geographic location. The key here is to **BE FLEXIBLE** and meet the needs of your members.

The Leaders' Section, which is on yellow paper, suggests possible activities, presentation ideas, and discussion questions for meetings. Use this as an aid in planning the club program. Again, **USE ONLY THE ACTIVITIES YOU HAVE TIME FOR AND THOSE THAT FIT YOUR PROGRAM PLANS.** You will have ideas from the members and ideas of your own to use too.

USE READING ALOUD (by you or a member) **SPARINGLY** as a method of sharing information. Daydreaming, fidgeting, whispering, and perhaps even snoring are sure to follow this type of presentation.

When selecting activities and methods keep this chart in mind.

Method	Retention	Examples
Reading	Members will retain 10% of what they read.	Members' supplement
Hearing	Members will retain 20% of what they hear.	Lectures, speakers, being read to
Seeing	Members will retain 30% of what they see.	Exhibits, posters, illustrations
Hearing and Seeing	Members will retain 50% of what they see and hear.	Observe videos, demonstrations, films, slides, tours
Saying	Members will retain 70% of what they personally explain.	Discussion groups, judging, expression ideas
Saying and Doing	Members will retain 90% of what they are personally involved in saying and doing.	Practice, explore, demonstrate, build

2. CLUB MEMBERS

The ages of the members in your club probably cover a span of several years. This means that your members will have many different needs, strengths and abilities. Although it is important for the club members to learn to work together you must also recognize individual differences.

Senior Members - When the younger members need some undivided attention, have the seniors plan and/or carry out an activity on their own. For times when the whole club must be together, encourage senior members to share their skills and experience with juniors by guiding them through an activity.

Youth Leader - If there is a senior member in the club who has completed several projects this may be the challenge he/she is looking for. You can help this member put leadership skills into action by having him/her assist with delivery of the club program.

Club Executive - Make sure this group is aware of its responsibilities and then LET THE MEMBERS LEARN BY DOING. The executive is responsible for the business portion of the meeting; chairing, taking roll, and recording minutes, etc. The club might consider pairing a junior and senior member together for some of these positions.

OBJECTIVES

The 4-H members will:

1. Be encouraged to have fun while learning.
2. Become familiar with the field of veterinary medicine.
3. Be introduced to common diseases of food-producing and companion animals.
4. Develop leadership and cooperation skills through participation in club activities.
5. Develop judging skills through participation in meeting activities.

3. PARENTS AND SPONSORS

Members will learn and enjoy more if their parents are interested in what they are doing. Likewise, sponsors will be more willing to continue their support if they can see the value of the 4-H program.

INFORM - Many parents and sponsors don't know what the goal of the 4-H program is or how it benefits the members. Talk to them about 4-H at every opportunity.

INVITE - Parents and sponsors should be invited to a 4-H meeting to see the club in action.

INVOLVE - Once parents and sponsors are more aware of the 4-H program they are more likely to accept your requests for help (hosting a meeting, being a guest speaker, arranging for a tour). Recognize parents and sponsors for their support with thank you notes, newspaper articles, etc.

4. OTHER LEADERS AND THE 4-H ASSOCIATION

Don't feel that you are walking this road alone. Other 4-H leaders and the 4-H Association are willing to lend an ear for your ideas or offer suggestions.

5. GUEST SPEAKERS

Be sure to give speakers lots of notice. Be specific about what you would like discuss and how much time he/she will have. As with your club program planning, the guest should be aware of the club situation, ages of members, attention span and interests. Encourage the guest to involve the members in hands-on activity rather than just lecturing to them. If the number of possible speakers is limited, consider holding joint meetings with other clubs to make efficient use of the speaker's time.

6. SOCIAL RECREATION

4-H should be FUN! Using a variety of social recreation activities at each meeting adds enthusiasm and enjoyment. The age, sex and size of the group determine the kinds of activities. Possibilities include games, relays, active sports, picnics, singing, puzzles and refreshments. Involve members in planning and carrying out the activities.

These are just some of the resources available to you. Become familiar with your community and what it has to offer. The possibilities are endless.

PARLIAMENTARY PROCEDURE WITHOUT THE BORE

TIPS & IDEAS

1. SQUEEZE TOY

This is a great tool for teaching parliamentary procedure. The squeeze toy or ball can be passed to the person who is moving a motion. Only the person with the squeeze toy can speak. It can also be used to control meetings and ensure everyone gets a chance to speak. It helps keep the discussion on track and on schedule. Stuffed toy club mascots also work well.

2. ALARM CLOCK

An effective time management tool. Set the alarm at the beginning of the meeting, advising the club members that there is "X" amount of time to get through the business material. This can be used for any session or activity.

3. SNOWBALL FIGHT - CAN BE USED AS A BREAK DURING THE BUSINESS PORTION OF MEETINGS

Divide the group into two sides. Each person is given a full sheet of newspaper. At a signal, each uses just one hand to try to crumple the paper into the smallest possible wad. These are the “snowballs”. At another signal, both sides start throwing the “snowballs” at each other. When the signal is given to quit, each side counts the “snowballs” on its side. The side with the fewest “snowballs” wins. To save time the “snowballs” could be made ahead of time and distributed evenly between the two sides.

4. Since the business portion of the meeting can seem boring to members, try incorporating some of the material into social time or a social recreation activity.
5. Keep the business portion of your meeting to 15-20 minutes. Keep it to the point.
6. Let the officers fulfill their responsibilities.
7. Let officers and committee chairs do their assigned duties.
8. A volunteer leader is there for guidance only.

MOTIONS

1. ADDRESS THE CHAIRPERSON (I.E. RAISE YOUR HAND)

Chairperson should have a “fun gavel”
Instead of raising their hands, perhaps the club could come up with a move that appeals to them or is based on the current project.

2. WAIT FOR THE CHAIRPERSON TO ACKNOWLEDGE YOU

The chairperson could pass/toss/hand a stuffed toy, ball etc. to the person wishing to speak.

3. MAKE THE MOTION: “I MOVE THAT....”

Straightforward. However the motion should be stated clearly so that the recorder/secretary can get it down.

4. ANOTHER PERSON SECONDS THE MOTION: “I SECOND THE MOTION.”

The ball, squeeze toy, etc. should be passed to this person before they second. This will ensure that people are getting a chance to speak and are heard.

5. MOTIONS SHOULD BE MADE STANDING UP!

6. CHAIRPERSON STATES THE MOTION

If using a speaker –indicating tool (ball or squeeze toy etc.) make sure the chairperson has it at this time.

7. CHAIRPERSON CALL FOR DISCUSSION OF THE MOTION

Remember to pass the indicator around to those who want to speak.

8. CHAIRPERSON CALLS THE VOTE: “ALL IN FAVOUR? OPPOSED”

At the first meeting of the club, an idea could be to create a method of voting either Favour or Opposed for the remainder of the club meetings.

9. CHAIRPERSON ANNOUNCES THE RESULT OF THE VOTE

Motion “carried” or “defeated”

10. THE CHAIRPERSON SHOULD REFRAIN FROM PARTICIPATING IN A DEBATE WHILE PRESIDING

If the chairperson/president wishes to participate, they should ask another member of the executive to assume the “chairperson” role while they take part in the discussion.

ELECTING THE CLUB EXECUTIVE

Use the information in this section to help your club set up an executive. The following are the positions and roles for an executive.

THE PRESIDENT

Traditionally the president acts as the meeting’s chairperson, works with the club volunteers to complete any club business and keeps the meeting running smoothly. The president also works with the volunteer leader to develop an agenda for each meeting.

THE VICE-PRESIDENT

Basically, the vice-president is the assistant to the President and also helps to keep meetings running smoothly. They will introduce any guests or lead the meeting if the President is absent.

SECRETARY

The secretary’s job is to keep written notes on all club activities, write summaries of each meeting (called ‘Minutes of Meeting’) and read them aloud at the next meeting. The secretary may also be asked to write letters of thanks or requests.

CLUB PRESS REPORTER

This position involves letting the public know what activities and events are going on within the club. They do this by writing small reports and sending them to the local media. This is a very important public relations position.

TREASURER

If the club has a bank account the treasurer will keep accurate accounts of all of the money that is collected and spent by the club. They will report the balance of the bank account at each meeting.

TIPS

1. Have members “campaign” for their position, they can practice creativity and public speaking!
2. Elections can be chaired by a volunteer, youth leader or senior member. The person chairing the elections is not eligible for any positions.
3. All positions are declared vacant by the chairperson, who indicates this by saying "I'd like to declare all positions vacant."
4. If possible ask a person who previously held each position to give a short explanation of the responsibilities involved. Ask them in advance to find a “fun” way of promoting the position. Examples are costumes, poems and props.
5. Your group needs to decide on the way you want to vote (i.e. show of hands, ballot, standing or anything you can think of, the possibilities are endless!)
6. Beginning with the position of President, the chairperson accepts nominations from members for the position.
7. Nominations do not require a seconder when taken from the floor. Written nominations do require a seconder.
8. Nominations are closed by a motion or declaration by the chairperson.
9. Give the acting chairperson a ball or toy or speaking stick they can use to pass and indicate who wants to nominate someone.
10. Have a recorder to list the nominations on chart paper at the front of the room so it is easier to keep track
11. Each member nominated is asked if she/he will stand for the position. Ask each nominee to give a short explanation of his/her interest in the position.
12. Members who decline are crossed off by the recorder.

13. If only one name is left then that member is acclaimed to the position. No vote is needed.

WHAT IS AN ACHIEVEMENT PROGRAM?

- An opportunity for members to share the knowledge and skills they have gained during this 4-H project
- Each member should be involved in some way
- Informs the public about the purpose and goals of the 4-H program

Be as creative as you can when planning your Achievement Program. Involve club members in selecting a suitable idea and making the necessary preparations. To help you get started here are some ideas.

1. At a public place, have the members talk about what they have learned during the club meetings. They could put emphasis on their own before the next meeting or special activities. This could be done with other 4-H clubs making the evening a 4-H public education night.
2. Develop a number of displays on topics relating to the field of veterinary medicine for showing at a local fair. **This is a great way to raise money for your club!**
3. Organize a poster session in a public place (fair, shopping centre, plowing match, Agri-Food Week program) demonstrating the typical 4-H Veterinary Club with a poster describing each meeting. Alternately, a poster session could focus on one topic of interest to the members that would be informative to the public.
4. Enter a float in a local parade. Decorate your float to illustrate the goals of 4-H and recent 4-H achievements in your community. Members could hand out flyers about 4-H to the people watching the parade.
5. Organize an information evening for parents of veterinary club members. Emphasize the communication of topics relating to veterinary medicine. For a more relaxed evening, prepare a quiz, pitting members against parents, and let the members shine!

HAS THE 4-H CLUB PROGRAM BEEN A SUCCESS?

Taking time to evaluate your 4-H club program is just as important as the initial planning. Ask everyone who was involved (members, other leaders, parents, sponsors and guests) for comments and suggestions. Their ideas will be very helpful in planning the program for your next club.

Here is a check list that may stimulate your thinking as you try to measure the success of the club program.

1. Did members and leaders enjoy coming to meetings?
2. Did each member have a chance to actively participate?
3. Did each member receive praise or encouragement in some way?
4. Did I plan for the differences in age level, abilities and interests of the members?
5. Did I give each member a chance to assume responsibility when it was appropriate?
6. Did members learn at least one new thing at each meeting?
7. Did all members feel they were "a part of" or "belonged to" the group?
8. Did I involve the parents and sponsors in some way?
9. Did all members and leaders have fun?

Always	Sometimes	Never
1.	1.	1.

Some of the material in this section on "4-H Club Program Planning" was adapted from, "Managing a 4-H Club" and "Managing a 4-H Project" from the Manitoba 4-H program, and "Home Study 4-H Advisor Course" from Ohio Cooperative Extension Service.

4-H CLUB PROGRAM PLANNING CHART

MEETING OR EVENT	DATE	TOPIC ACTIVITY OR TASK	PEOPLE WHO COULD HELP	PRESENTATION IDEAS TO CONSIDER

4-H CLUB PROGRAM PLANNING CHART

MEETING OR EVENT	DATE	TOPIC ACTIVITY OR TASK	PEOPLE WHO COULD HELP	PRESENTATION IDEAS TO CONSIDER

SPECIAL NOTES FOR THIS PROJECT

1. Because of the complicated physiological information, the Veterinary project is recommended for intermediate and senior members.
2. Any white pages are for both the leader and member. All yellow pages designed specifically for the leader. Lastly all green pages are glossary pages.
3. The Members' Manual has been designed as a reference source. Hopefully, the members can leave their manuals closed for most of the meeting, allowing them to observe, learn and take part in the discussion and other activities. It is not necessary — and usually not possible — to cover all the information given in the Members' Manual during the meeting.
4. The Members' Manual is designed to allow flexibility. Feel free to choose from sections that are of particular interest to you and your club.
5. If you plan to invite a veterinarian as a guest speaker, or there will be a large number of members wishing to spend a day with the veterinarian, you should approach more than one veterinarian for assistance.
6. You may wish to appoint one or two members to act as liaisons with the veterinarians in your area. They can help co-ordinate guest speaker appearances, and can approach the vets for help in answering difficult questions that may arise during this project.
7. As with all veterinary projects, it has been found that members learn and remember best if they are provided with actual specimens. A local veterinary clinic, agricultural college, abattoir or animal research station should be able to help you locate such visual demonstrations. A field trip to any of these establishments is also strongly recommended.
8. A whiteboard or flipchart is often useful for activities and discussion.
9. Throughout the manual you will see Roll Calls. The roll call is used as a way of introducing members and encouraging them to participate in the discussions at each meeting. Timid members in particular should be given the opportunity to speak during roll call. Not all the roll calls have to be completed and you may wish to use different ones. The roll calls in this manual are just a few examples which you may use but do not feel that you have to. As a volunteer you can choose one for them to do, or have them choose what they are comfortable with.
10. In the leaders section in each unit, you should come across a portion called “Learn to Do by Doing.” These activities are designed to reinforce

material covered in the Veterinary project, while allowing members to be creative, have fun, develop personal skill, and make new friends. Senior members can run the activities as well as the leader. Each activity may vary in time depending upon the size of the club. The more hands on activities there are, the better the member will learn.

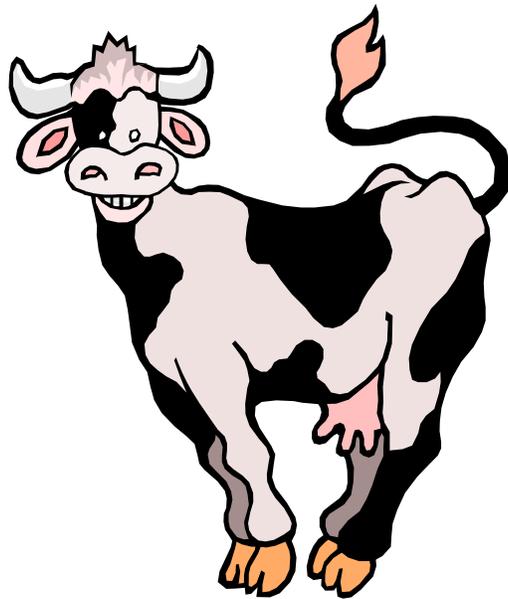
11. Case studies are present in most units. This allows members to try to be a vet and diagnose some of the cases provided. The leader section contains the correct answers. This allows the members to know whether or not they made a mistake or if they were correct.
12. In the member's section there is a part called "The Disease Guide." This is designed to lay out all the diseases present in each unit so that the members know what affects what part of the body. This is strictly information about diseases.
13. Please feel free to go over and beyond this manual. This manual is designed as a guideline to help you lead your club. Be creative and have fun.

GOOD LUCK!

BIBLIOGRAPHY

1. "Beef Cattle Foot Rot"
<http://www.beef-cattle.com/beef-cattle-foot-rot.htm>
visited on July 14, 2005
2. "Nuflor-BRD and Footrot"
<http://www.nuflor.com/diseases/fr-frp.html>
visited on July 14, 2005
3. "Hoof Diseases"
<http://www.horse-diseases.com/clubfoot.html>
visited on July 14, 2005
4. www.paulnoll.com/oregon/Birds/Avian-Respiratory.jpg
5. www.Dictionary.com
6. www.4-hontario.ca
7. www.healthopedia.com/cardiovascular.html
8. www.upei.ca/~cidd/intro.htm
9. www.vth.vt.edu/clientsvisitors/sa-factsheets
10. www.americanboxerclub.org/genetic_diseases.html
11. www.azgaitedhorses.com/gen_disease.htm
12. www.vmdb.org/july99.html
13. www.duchessfund.org/disease.htm#pss_ptl
14. www.uoguelph.ca/zoology
15. www.mic-d.com/gallery/brightfield
16. <http://users.rcn.com/jkimball.ma.ultranet/Biology>

ANTLERS, HORNS & HOOVES





ANTLER, HORNS, AND HOOVES

ROLL CALL

- | |
|--|
| <ul style="list-style-type: none">➤ <i>Name an animal that grow antlers or horns.</i>➤ <i>Have you ever seen an animal being dehorned? How was it done?</i> |
|--|

"Learn to do by Doing"

ACTIVITIES

- 1) Find samples of hooves and identify them. Collect samples from local farmers, meat packing plants, or pet stores have them for dog treats.
- 2) Go to a farm where examining animals' hooves are accessible to look at.
- 3) View different sets of antlers, and discuss what they could be from.
- 4) Demo of hoof trimming, nail cutting or dehorning would be a great way of presenting material
- 5) Ferrier could be asked to speak for hoof section



ANTLERS, HORNS, HOOVES: DISEASE GUIDE – Case Studies

Problem# 1:

Hi my name is Martin. I am a four year old Aberdeen Black Angus bull. Lately my feet have been very sore. The skin between my claws has become inflamed and it hurts to walk. There are also little sores above my coronary band. Do you know what is wrong with me?
Is it curable?

Solution:

Martin suffers from Foot Rot or Strawberry Foot. It is caused by the bacteria *Fusiformis Necrophorus*. Lameness may set in if not treated right away. This disorder is treatable. It can be treated with injectable antibiotics and by covering open lesions with creams from the vet. To prevent this from spreading, the farmer could put foot baths of copper sulfate at the doors where the cattle walk into the barn. Also the farmer could keep barnyard and barn clean and dry.

Problem# 2:

Hi my name is Dakota. I am a fifteen year old gelding quarter horse. All my life I have been a trail horse. I am never normally tired or sore after the trails I travel, but the other day I was forced into riding down a gravel road. After I was done my feet were really sore and it hurts to walk on them
Is my condition reversible?

Solution:

Dakota may suffer from a spongy hoof. This means that the horn is soft and non-resistant and after traveling a far distance on a hard gravel road his horn would have become hot and tender. If Dakota is not careful lameness may set in. If he takes it easy for a week or so his condition should improve. He should make sure that his hooves are clean from debris and that he is staying on soft surfaces.

Problem# 3:

Hi my name is Betsy-Lou. I am a thirteen year old Welsh pony. My owner recently removed me from my muddy paddock to my dry stable. I have noticed that my hooves are starting to crack and I do not know what to do.
Am I in trouble?

Solution:

Betsy-Lou suffers from Brittle or Cracked Hoof. In her case, her condition is caused by her relocation. The hoof suffers from an abnormally dry state. This condition is not too severe because she caught it right away. A Farrier should be contacted because her hooves should be trimmed regularly. Also Betsy-Lou should with her owners help try to find an area where there is a balance of moisture so that her hooves do not crack anymore.



ANTLER, HORNS, AND HOOVES

ROLL CALL

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

ANTLERS

Animals with antlers include deer, elk, caribou, moose and reindeer. Found only on males, antlers are used for self-defense 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-defense 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 herdmates can be severely injured by cattle who use their horns in the struggle to be dominant. Humans can also be injured by horned animals.

Some breeds/strains of breeds 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.

METHODS OF DE-HORNING

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.

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. Veterinarians often administer a local anesthetic when using this method.

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 is recommended.



HOOVES

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.



Horse Hoof



Cow Hoof



Pig 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.



ANTLER, HORNS, AND HOOVES

“Disease Guide”

HOOF DISEASES

DISORDER	CAUSE	EFFECT	TREATMENT/ RECOVERY
Foot Rot (Strawberry Foot)	Bacteria- <i>Fusiformis</i> <i>Necrophorus</i> -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 to its limits.



<p>Ringed or Ribbed Hoof (Grass Rings)</p>	<p>Anything tending to an alternate increase and decrease in the secretion of horn from the coronet. (i.e. Alternating between wet and dry pastures)</p>	<p>The wall becomes marked with a series of well-defined ridges in the horn, each ridge running parallel with the coronary margin.</p>	<p>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, then the animal needs to be looked at by a professional.</p>
<p>Brittle Hoof (Cracked Hoof)</p>	<p>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.</p>	<p>The horn of the animal suffers from an abnormally dry state. May appear as being baked hard and stony. The hoof may start cracking.</p>	<p>Have a balance if wet and dry areas. Make sure that the animals feet are tended to regularly.</p>



ANTLERS, HORNS, HOOVES: DISEASE GUIDE

Case Studies

PROBLEM # 1

Hi my name is Martin. I am a four year old Aberdeen Black Angus bull. Lately my feet have been sore. The skin between my claws has become inflamed and it hurts to walk. There are also little sores above my coronary band.

Do you know what is wrong with me?
Is it curable?

PROBLEM # 2

Hi my name is Dakota. I am a fifteen year old gelding quarter horse. All my life I have been a trail horse. I am never normally tired or sore after the trails I travel, but the other day I was forced into riding down a gravel road. After the ride my feet were really sore and it hurts to walk on them.

Is my condition reversible?

PROBLEM # 3

Hi my name is Betsy-Lou. I am a thirteen year old Welsh pony. My owner recently removed me from my muddy paddock to my dry stable. I have noticed that my hooves are starting to crack and I do not know what to do.

Am I in trouble?



ANTLER, HORNS, AND HOOVES

Glossary

ANTLERS	: one of the paired, deciduous, solid, boney outgrowths on the head.
BLOOD VESSEL	: any tubular canal in which the blood circulates.
DEHORNING	: the action of removing horns from an animal.
FOOT ROT	: a bacterial infection of the foot that causes swelling and inflammation of the foot.
HOOF	: the horny sheath encasing the ends of the foot.
HORN	: a permanent bonelike growth projecting from the head of various hoofed animals.
OSTEOMYELITIS	: an inflammation of the bone marrow.
TOE NAIL	: the nail growing on a toe.

BIOSECURITY



BIO-SECURITY AND THE FIGHT AGAINST DISEASE

ROLL CALL

- *Do you have any farm procedures in place for preventing diseases? If so what are they?*
- *How would an outbreak of a disease effect your farming operations?*

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 bio-security?

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

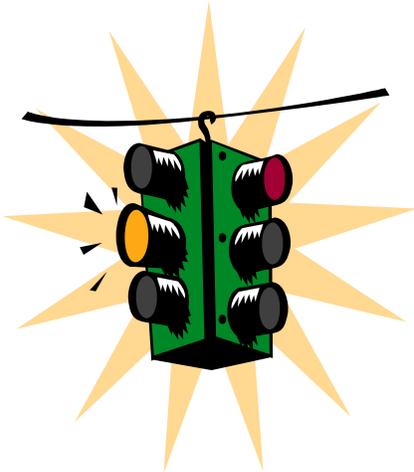
Farmers also lose valuable time caring for sick animals.

Protecting the Herd

As you have already learned, contagious diseases can have devastating effects on the well-being of a herd. 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 farm's overall bio-security by identifying the changes that need to be made on your farm.

How can I protect my herd?

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 the herd of origin?
- Control populations of flies, birds, rats, and mice that move from farm to farm. They can carry diseases and contaminate feed and water.
 - Eliminate nesting sites
 - Destroy existing populations by poisoning or trapping
 - Seal off openings into silo roofs
- Wash and disinfect equipment shared between animals and neighbours: halters, pails, machinery, hoof trimmers, and dehorner.
- Use separate boots, forks, and shovels when handling feed and manure. This is an easy way to reduce the risk of contaminating feed!

2. Isolate! For 21-30 days



- All animals that have been newly purchased or returning from livestock shows
- All animals that show symptoms of disease.
 - This allows you to observe these animals for symptoms of disease. If they remain disease-free during their isolation period, they can be (re)introduced to the rest of the herd.

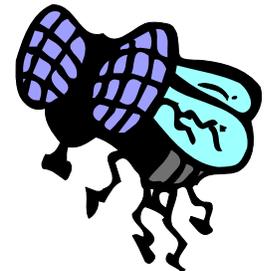
3. Vaccinate!
 - Vaccines, if administered properly, can protect animals and humans against some diseases.
 - Be sure to vaccinate farm dogs and cats.

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.
 - Remove all manure after use and disinfect after use.
 - Use a designated maternity pen for freshening animals only.
 - Remove all manure after use and disinfect after use.

5. Sanitation!
 - Dispose of dead animals immediately, by burial or by dead stock removal. Animals must be buried at least two feet deep. Remember to wear protective clothing while handling.
 - If you must bury, include contaminated bedding, milk, manure, or feed.
 - Clean and disinfect area after carcass removal.
 - Maintain a clean living area for livestock.
 - Control populations of parasites and flies that contaminate feed and water and live in manure piles.
 - Store manure so it is inaccessible to cattle, especially calves.
 - When choosing disinfectants, consider the following:
 - Does it work against bacteria, fungi or viruses?
 - Will it be effective if used in hard water?
 - Will it be effective if used in extreme temperatures (hot and cold)?
 - Is it compatible with soaps?
 - Will it continue to work for a period of time after application?
 - Can it be used on feeding equipment?
 - Does it give off irritating fumes?



What is STRESS?

Stress can decrease an animal's ability to fight off disease. There are many forms of stress, including:

- Environmental Stress
 - Humidity
 - Drafts
 - Dust
 - Manure gases (hydrogen sulphide, carbon dioxide, carbon monoxide, methane gas, and ammonia)
 - Temperature changes
 - Airborne bacteria, viruses, fungi, etc.
- Behavioral Stress
 - Overcrowding
 - Mixing animals from different sources (e.g. feeder pigs)
- Nutrition
 - Imbalance or deficiency of nutrients
- Production Stress
 - Heavy production (i.e. dairy cattle)

Any combination of these stresses can suppress an animal's immune system. If an animal is exposed to a disease-causing agent (bacteria, virus) at a time when its immune system is not able to function at its best, it is likely to be infected with the disease and become very sick. Its body may take longer fighting the disease, meaning that the animal takes longer to recover. Keep stress to a minimum!!

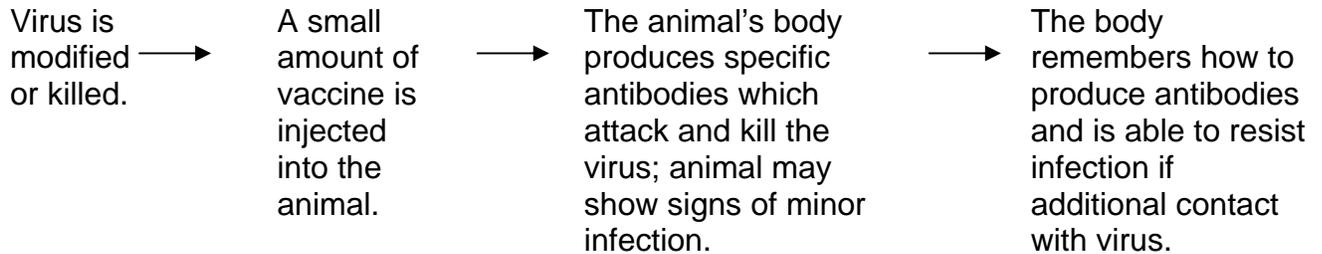
Good ventilation can eliminate many of the stresses that aggravate an animal's respiratory system. While some farmers rely on natural ventilation (by opening windows and doors), others use automatic systems consisting of exhaust fans and controlled air inlets. There are methods of ventilation best suited for different types of animals living in various environments. Whatever the system, a good ventilation system should:

- Provide fresh air without causing drafts.
- Remove stale air.
- Control humidity.
- Control odour.
- Control temperature.

Vaccination

It was mentioned earlier that vaccination can protect humans and animals from diseases. Now you will learn how vaccines work and how you can establish an effective vaccination program.

A vaccination is a planned and controlled infection that prevents disease.



Vaccination Timeline:

Birth: newborn receives antibodies from colostrum, does not need to be vaccinated.

6-8 Months: animal is vaccinated for the first time.

4-6 weeks later: animal is given a booster shot.

1 year later: animal is vaccinated again, repeated annually.

Why use

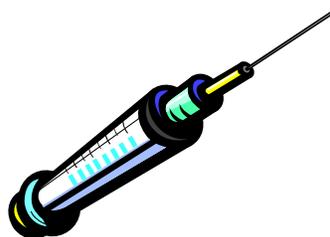
Live (modified) Virus?

- relatively inexpensive
- longest duration of protection from disease

Killed Virus?

- easier to store
- cannot cause disease
- less risk of contamination
- can be given to pregnant animals

YOUR VETERINARIAN CAN HELP YOU CHOOSE THE BEST VACCINE FOR YOUR ANIMALS.



FOOT AND MOUTH DISEASE (FMD)

You have learned that contagious diseases can be transmitted from an infected animal to a non-infected animal. One such disease is Foot and Mouth Disease (FMD).

Foot and Mouth Disease:

- Is a highly contagious, viral disease.
- In 2001 an outbreak had resulted in the slaughtering of 4,190,000 sheep, cattle, pigs, goats, and deer.
- It affects cloven-hoofed animals including cattle, sheep, pigs, goats, deer, elk, and buffalo; very rarely does it affect humans.
- Infected animals may develop blisters in the mouth (snout), on the feet, in teats and udder.
- Most commonly spread by direct contact between animals, but can be spread by indirect contact.
 - Direct: blisters, nasal discharge, saliva, milk, semen, manure, and urine.
 - Indirect: contaminated vehicles, people, frozen semen, contaminated feed, and drinking water.

KEEPING FMD OUT!

Vaccines exist, but only to protect animals for a relatively short period of time. They would only be used in an emergency.

Instead we must use what we have learned about bio-security to protect Canadian farms from FMD.

What should I do?

- Control traffic!
 - No visitors who have been in countries affected by FMD in the last 14 days.
 - Do not use semen or embryos from imported from FMD-positive countries.
- Isolate!
 - Animals showing symptoms of FMD from the rest of the herd.
- Separate!
 - Young and old animals to prevent spreading.
- Report any suspected cases of FMD to your veterinarian.

What is Canada doing?

Canada's strict border policy has kept the country free from FMD since 1952:

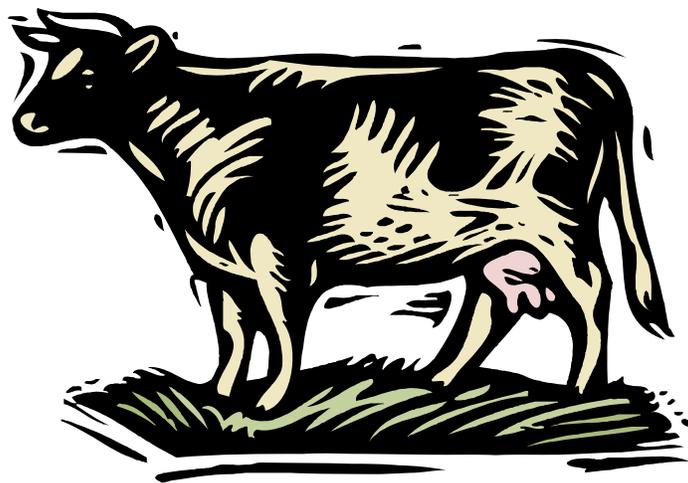
- Used farm equipment and all live ruminant animals (cows, sheep, etc) and their products cannot be imported into Canada.
- Travelers are educated about the spread of the disease and are advised not to visit Canadian farms within 14 days of being in a country with FMD.
- Disinfectant is provided for travelers' shoes.
- Beagles are used to "sniff out" food products carried by travelers.

Who can help me protect the bio-security of my farm?

Using common sense and your increased knowledge of bio-security and disease prevention, you can identify factors that threaten the health and well-being of your herd. Making small changes now can save you a lot of money, time, and stress later on.

Veterinarians can also help you implement new strategies on your farm to protect you and your operation from disease and its devastating effects.

BODY CONDITIONING



BODY CONDITIONING 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.

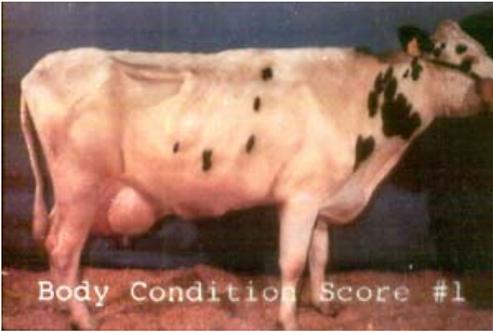
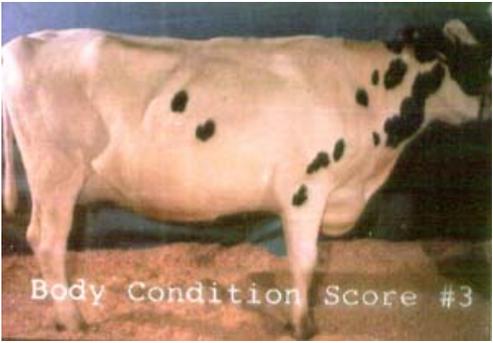
BEEF CATTLE

Body Score		Description	
1	Thin	<ul style="list-style-type: none"> • Emaciated; all skeletal structures are visible. • No muscle tissue is evident. • No external fat present. • Little chance of survival in stressful conditions. • Approximately 120 kilograms (260 pounds) underweight. • Starving and weak. 	
2		<ul style="list-style-type: none"> • Very thin; skeletal structures are visible. • Muscle tissue is evident, but scarce. • No external fat present. • Approximately 90 kilograms (200 pounds) underweight. 	
3		<ul style="list-style-type: none"> • Thin; upper skeleton is prominent (vertebra, hips, pin bones). • Muscle tissue is more abundant. • Body fat is not obvious. • Approximately 65 kilograms (140 pounds) underweight. 	
4		<ul style="list-style-type: none"> • Hooks and pins becoming less obvious. • Muscle tissue is abundant. • Fat is beginning to cover ribs. • Approximately 35 kilograms (75 pounds) underweight. 	
	Ideal		

5		<ul style="list-style-type: none"> • Ideal flesh at weaning. • Ribcage is only slightly visible. • Hooks and pins are visible but not obvious. • Muscle tissue is nearing maximum. • Fat deposit behind shoulder is noticeable. • Ribs are covered slightly. 	
6		<ul style="list-style-type: none"> • Ideal flesh at calving. • Ribcage is only barely visible. • Hooks and pins are becoming less prominent. • Muscle tissue volume is at a maximum. • Fat deposit behind shoulder is obvious. • Ribs are covered completely with fat beginning to cover rump. • Approximately 35 kilograms (80 pounds) overweight. 	
7	Fat	<ul style="list-style-type: none"> • Slightly over-conditioned. • Skeletal structures are becoming difficult to identify. • Fat deposits behind shoulder and at tailhead are obvious. • Approximately 80 kilograms (170 pounds) overweight. 	
8		<ul style="list-style-type: none"> • Over-conditioned, • Skeletal structures are invisible. • Fat deposits are flattening rump. • Fat is filling brisket and over shoulder. • Mobility may begin to be restricted. • Approximately 120 kilograms (260 pounds) overweight. 	

9		<ul style="list-style-type: none">• Obese.• Flat appearance dominates.• Brisket is heavy.• Fat deposited in udder limits effective lactation.• Approximately 160 kilograms (350 pounds) overweight.	
---	--	---	---

DAIRY CATTLE

Body Score	Description	
1	<ul style="list-style-type: none"> ▪ Rump Area: Deep cavity around tailhead. No fatty tissue felt between pins. Pelvic bone easily felt. ▪ Loin Area: Ends of short ribs sharp to touch. Upper surfaces can be felt easily. Deep depression in loin. ▪ Typical in cows with a severely displaced abomasum. 	 <p>Body Condition Score #1</p>
2	<ul style="list-style-type: none"> ▪ Rump Area: Shallow cavity lined with fatty tissue at tailhead. Some fatty tissue felt under pin bone. Pelvis easily felt. ▪ Loin Area: Ends of short ribs feel rounded. Upper surface felt with slight pressure. Depression visible in loin. ▪ High-producing, early lactation cows should score 2. 	 <p>Body Condition Score #2</p>
3	<ul style="list-style-type: none"> ▪ Rump Area: No visible cavity around tailhead. Fatty tissue is easily felt over whole rump. Skin appears smooth. Pelvis is felt with slight pressure. ▪ Loin Area: Ends of short ribs can be felt with pressure. There is a thick layer of tissue on top. There is only a slight depression in the loin. 	 <p>Body Condition Score #3</p>
4		

5	<ul style="list-style-type: none"> ▪ Rump Area: Folds of fatty tissue are visible around tailhead. Patches of fat are present around the pin bones. Pelvis is felt only with firm pressure. ▪ Loin Area: Short ribs cannot be felt even with firm pressure. No depression is visible in loin between backbone and hip bone. 	
	<ul style="list-style-type: none"> ▪ Rump Area: Tailhead is buried in fatty tissue. No part of pelvis can be felt even with firm pressure. ▪ Loin Area: Folds of fatty tissue over short ribs. Bone structures cannot be felt. ▪ These cows are good candidates for fat cow syndrome. 	

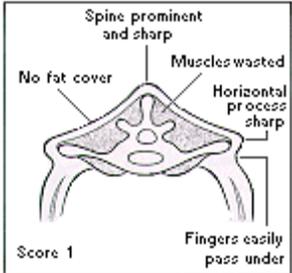
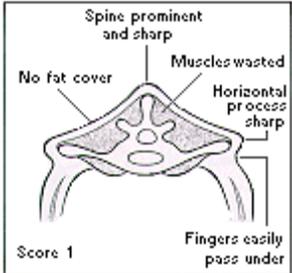
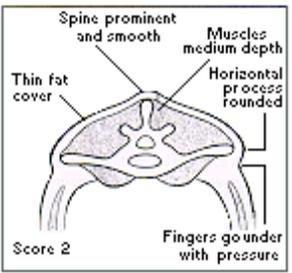
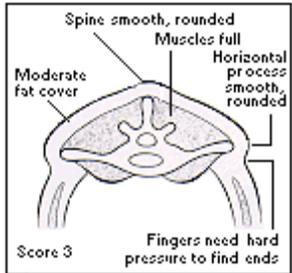
HORSES

Body Score	Description	
1	<p>Emaciated</p> <ul style="list-style-type: none"> ▪ Processes (the tops of the vertebrae), ribs, tailhead, point of the hip, and point of buttock, project prominently. ▪ Bone structure of withers, shoulders, and neck easily noticeable. ▪ No fatty tissue can be felt. 	
2	<p>Very Thin</p> <ul style="list-style-type: none"> ▪ Slight fat covering over base of spine. ▪ Transverse processes (part of the bone projecting sideways from the lumbar vertebrae) of lumbar vertebrae feel rounded. ▪ Spine, ribs, tailhead, hip, and buttocks prominent. ▪ Withers, shoulders, and neck structure faintly visible. 	
3	<p>Thin</p> <ul style="list-style-type: none"> ▪ Transverse processes cannot be felt. ▪ Slight fat cover over ribs. ▪ Spine and ribs visible. ▪ Tailhead prominent but individual vertebrae cannot be identified visually. ▪ Point of hips appear rounded but visible. ▪ Point of buttocks not distinguishable. ▪ Withers, shoulders, and neck accentuated. 	

4	Moderately Thin		
	<ul style="list-style-type: none"> ▪ Slight ridge along back. ▪ Faint outline of ribs visible. ▪ Tailhead prominence depends on conformation, fat can be felt around it. ▪ Withers, shoulders, and neck not obviously thin. 		
5	Moderate		
	<ul style="list-style-type: none"> ▪ Back is flat (no crease or ridge). ▪ Ribs not visually distinguishable but easily felt. ▪ Fat around tailhead beginning to feel spongy ▪ Withers appear rounded over spine. ▪ Shoulders and neck blend smoothly into body. 		
6	Moderately Fleshy		
	<ul style="list-style-type: none"> ▪ May have slight crease down back. ▪ Fat over ribs spongy. ▪ Fat around tailhead soft. ▪ Fat beginning to be deposited along the side of withers, behind shoulders, and along sides of neck. 		
7	Fleshy		
	<ul style="list-style-type: none"> ▪ May have crease down back. ▪ Individual ribs can be felt but noticeable filling between ribs with fat. ▪ Fat around tailhead soft. ▪ Fat deposited along withers, behind shoulders, and along neck. 		
8	Fat		
	<ul style="list-style-type: none"> ▪ Crease down back. ▪ Difficult to feel ribs. ▪ Fat around tailhead very soft. ▪ Area along withers filled with fat. ▪ Area behind shoulder filled with fat. ▪ Noticeable thickening of neck. ▪ Fat deposited along inner thighs. 		
	Extremely Fat		

9	Extremely Fat	
	<ul style="list-style-type: none"> ▪ Obvious crease down back. ▪ Patchy fat appearing over ribs. ▪ Bulging fat around tailhead, along withers, behind shoulders, and along neck. ▪ Fat along inner thighs may rub together. ▪ Flank filled with fat. 	

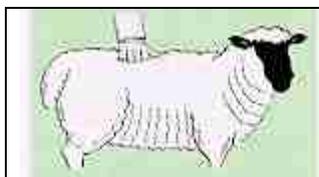
SHEEP (Ewes)

Body Score	Description	
0	Extremely Emaciated	
	<ul style="list-style-type: none"> ▪ Applies only in very severe cases (ewes is at the point of death) ▪ It is not possible to feel any muscle or fatty tissue between skin and bone. 	
1	Extremely Underweight	
	<ul style="list-style-type: none"> ▪ The vertical and horizontal processes are prominent and sharp. ▪ The loin muscle is thin and with no fat cover. 	
2	Underweight	
	<ul style="list-style-type: none"> ▪ The vertical processes are prominent but smooth. ▪ The horizontal processes are smooth and rounded, but it is still possible to press the fingers under. ▪ The loin muscle is of moderate depth but with little fat cover. 	
3	Ideal	
	<ul style="list-style-type: none"> ▪ The vertical processes are smooth and rounded; the bone is only felt with pressure. ▪ The horizontal processes are also smooth and well covered; hard pressure with the fingers is needed to find the ends. ▪ The loin muscle is full, with a moderate fat cover. 	
	Overweight	

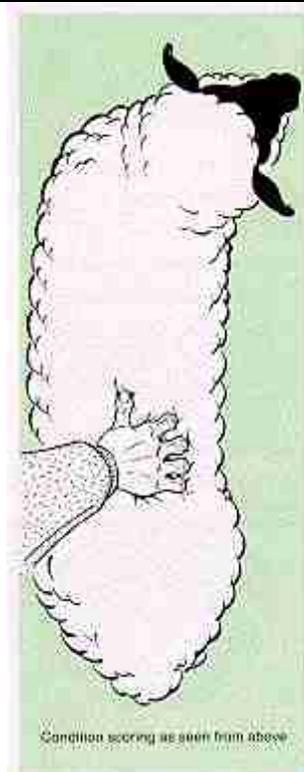
4	Overweight	<ul style="list-style-type: none"> ▪ The vertical processes are only detectable as a line. ▪ The ends of the horizontal processes cannot be felt. ▪ The loin muscles are full and have a thick covering of fat. 	
	Obese		

Notes:

- To assess body condition accurately, handle ewe over and round the backbone, in the area of the loin behind the last rib.
- Using the fingertips:
 - First feel the degree of sharpness or roundness of the lumbar vertebrae.
 - Secondly, feel and assess the prominence and degree of cover over the horizontal processes.
 - Then assess by feel the amount of muscle and fat under the ends of these bones.
 - Finally, assess the eye muscle and its fat cover, by pressing the fingers into the area between the vertical and horizontal processes.



Condition scoring from the side and top.



Condition scoring as seen from above

4	Obese	<ul style="list-style-type: none"> ▪ The vertical processes cannot be detected even with pressure; there is a dimple in the fat layers where the processes should be. ▪ The horizontal processes cannot be detected. ▪ The loin muscles are very full and covered with very thick fat. 	
---	-------	---	--

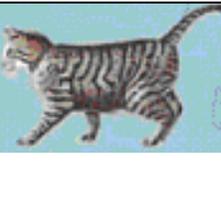
PIGS (SOWS)

Description			
Body Score 1		Body Score 2	
<p>Emaciated/ Very Thin</p> <ul style="list-style-type: none"> ▪ The sow is visually thin. ▪ Hips and backbone very prominent ▪ No fat cover over hips and backbone. 		<p>Thin</p> <ul style="list-style-type: none"> ▪ The hip bones and backbone are easily felt without any pressure on the palms. 	
Body Score 3		Body Score 4	
<p>Ideal</p> <ul style="list-style-type: none"> ▪ It takes firm pressure with the palm to feel the hipbones and backbone. 		<p>Heavy/ Overweight</p> <ul style="list-style-type: none"> ▪ It is impossible to feel the bones at all, even with pressure on the palms of the hands. 	
Body Score			
		<p>Grossly Obese</p> <ul style="list-style-type: none"> ▪ The sow is carrying so much fat that it is impossible to feel the hipbones and backbone even by pushing down with a single finger. 	

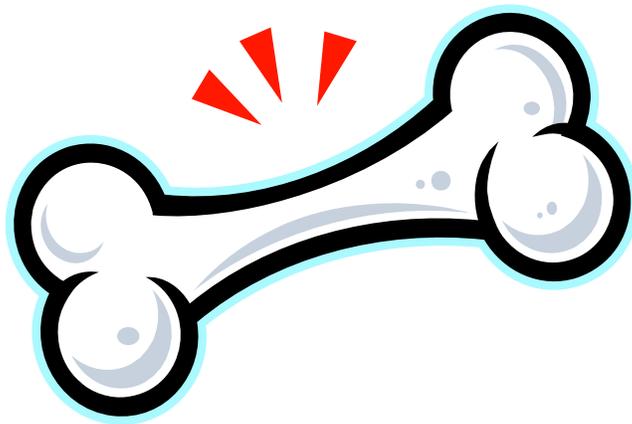
DOGS

Body Score	Description
1	<p>Emaciated</p> <ul style="list-style-type: none"> • Ribs, backbone and pelvic bones easily seen, even from a distance • No body fat • Obvious loss of muscle mass
2	<p>Underweight</p> <ul style="list-style-type: none"> • Ribs can be seen and easily felt • Pelvic bones are prominent • Obvious waist and abdominal tuck
3	<p>Ideal</p> <ul style="list-style-type: none"> • Ribs can be felt • Waist obvious when viewed from above • Abdominal tuck evident
4	<p>Overweight</p> <ul style="list-style-type: none"> • Ribs hard to feel, covered by fat • Noticeable fat deposits over back and base of tail • Waist and abdominal tuck barely discernible
5	<p>Obese</p> <ul style="list-style-type: none"> • Ribs can not be felt, under heavy fat covering • Massive fat deposits over back and base of tail

CATS

Body Score	Description	
1	Emaciated/ Very Thin <ul style="list-style-type: none"> ▪ Ribs are visible ▪ No palpable fat 	
2	Thin/ Underweight <ul style="list-style-type: none"> ▪ Ribs are easily palpable with little fat cover ▪ Lumbar vertebrae obvious ▪ Minimal abdominal fat 	
3	Ideal <ul style="list-style-type: none"> ▪ Well proportioned ▪ Slight fat covering over ribs ▪ Minimal abdominal fat ▪ Observable waist behind ribs 	
4	Heavy/ Overweight <ul style="list-style-type: none"> ▪ Moderate fat covering over ribs ▪ Obvious rounding of abdomen; moderate abdominal fat 	
5	Grossly Obese <ul style="list-style-type: none"> ▪ Heavy fat cover over ribs ▪ Heavy fat deposits over lumbar area, face and limbs ▪ No discernible waist ▪ Extensive abdominal fat deposits 	

BONES



THE BONES

ROLL CALL

- Name a bone and describe its location.
 - Long -legs
 - Flat –ribs, sternum, scapula
 - Short – knee, stifle
 - Irregular vertebrae, clavicle, skull
- Have you ever seen an animal with a broken bone? What was the treatment?
- Name a bone disease or disorder and describe its effect on the animals.
 - See disease guide

"Learn to do by Doing"

ACTIVITIES

A) Hollow Strength

Required Materials: Paper, tape, scissors, paper plates, measuring cups, weights (blocks – small)

Leader:

Provide members with a sheet of paper (8 ½" x 11") and ask them to cut it horizontally into three equal pieces.

Member:

- 1) roll each sheet into a cylinder (1 inch or 2.5 centimeters in diameter) and fasten it with tape
- 2) Stand the rolls on their ends, placing a paper plate on top of the bones.
- 3) Begin to add weights (wooden blocks) to the plate.
- 4) Count how many blocks the plate can hold before it collapses.
- 5) Roll 3 more sheets of paper as tightly as they can (no hollow space in center)
- 6) Stand these "bones" on their ends as before placing the same plate on top of them.
- 7) Load bricks onto the plate until the bones collapse.

Leader

Members should notice that the hollow bones were able to support more weight before collapsing. Explain that the large bones in animals' bodies (including humans) are hollow bones that are strong and designed to carry a lot of weight. As well, hollow bones are lighter than solid bones, requiring less energy to move them.

Get a Backbone

Required Materials: Empty spools of thread (assorted sizes), pencils, strings, scissors, tape, balloons, ruler, and a hole punch

Leader: Provide members with a large, a medium, and a small empty thread spool, one pencil, scissors, ruler, hole punch, string, and tape. Members may work individually or in groups.

Members:

- 1) Trace the base of the medium and large spool twice and the small spool once onto the cardboard.
- 2) Cut out the cardboard circles and punch holes through the centers.
- 3) Using a piece of string (45 cm or 18 in), thread the spools together beginning with the largest spool, taping the string to the bottom of the largest spool.
- 4) Blow up a balloon and place it on top of the model –this represents the animal's head.
- 5) Stand the column of spools on the table (largest on the bottom) and push the top spools about 2 inches (5cm) to each side.

Leaders:

Explain that the small spools at the top represent the cervical vertebrae, the medium spool represents the thoracic vertebrae and the larger bottom spools represent the lumbar vertebrae. Explain that the vertebra, like the spool, are not permanently attached together, allowing the body to bend and lean in different directions. Between each pair of vertebrae is a disk of cartilage that acts as a shock absorber, just as the cardboard circle between the spools keeps them from knocking together. Without this flexible disc the vertebrae would grind together and the body would not be able to twist, turn, or bend without pain and damage.

Make the Bones

Required Materials: foam, fasteners, skeleton picture of animal

Leader: Provide members with foam and fasteners and a picture of a skeleton (horse). Allow them to work in groups or as a club. They should put together all the foam bones together, creating a fastener where the bones should bend.

Sampling

Have samples of bones. You can get these from butchers, and vet centers. Be sure to sterilize them first. This will give the members of the club the opportunity to see what actual animal bones look like.

BONES: DISEASE GUIDE- Case Studies

Problem# 1

My name is Princess Patsy. I am a two-month-old gilt from champion stock. I sneeze and cough sometimes and my herd mates are starting to chuckle behind my back. My nose is sore and twisted.

Do I have a cold, or something more serious?

Solution:

Patsy has atrophic rhinitis. There is no cure, but her farmer could have used a vaccine to prevent this disease. The farmer could also improve sanitation and keep the pigs warm and dry.

Problem# 2

My name is Crazy Cow. I was in the field with other cattle that had swollen jaw bones, and I appeared to get the same thing. My jaw oozes yellow discharge.

Am I sick or have I just hurt my jaw while eating something?

Solution:

Crazy Cow has Lumpy jaw. Separate all the healthy cattle from the sick cattle. There is an antibiotic treatment that can be used on the sick animals. This is an infectious problem. If the treatment is not successful the animals may have to be sent to market.

Problem# 3

My name is Heavy Horse. I have been working the fields since I was big enough to participate in the team. I work many hours and days in a row. My legs are very painful.

Am I just old, or is there something wrong with me?

Solution:

Heavy Horse has Ringbone. The extensive wear and tear increased the number of calcium deposits in the leg making it very painful. There is no treatment although corrective shoes could help.

THE BONES

ROLL CALL

- Name a bone and describe its location.
- Have you ever seen an animal with a broken bone? What was the treatment?
- Name a bone disease or disorder and describe its effect on the animals.

Bones:

- are living and always changing
- can die if severely injured
- provide a support framework for the body
- protect the stomach, lungs, heart, etc.

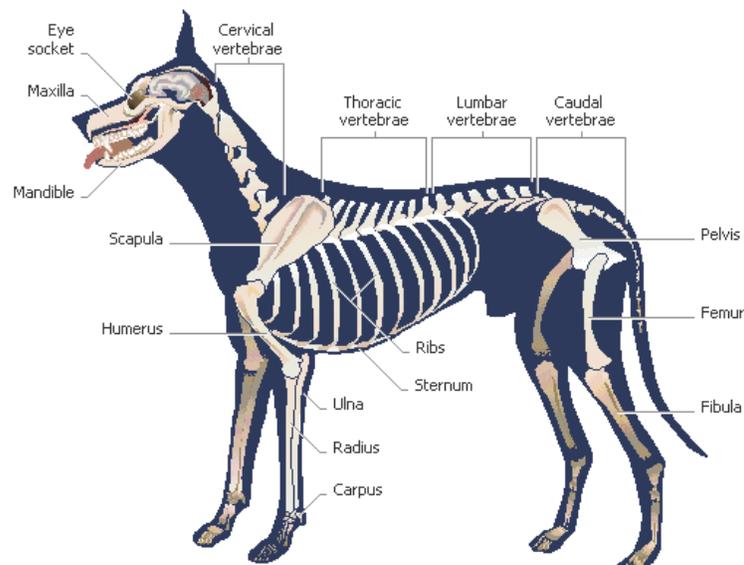
A Body's Frame- The Skeleton

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:

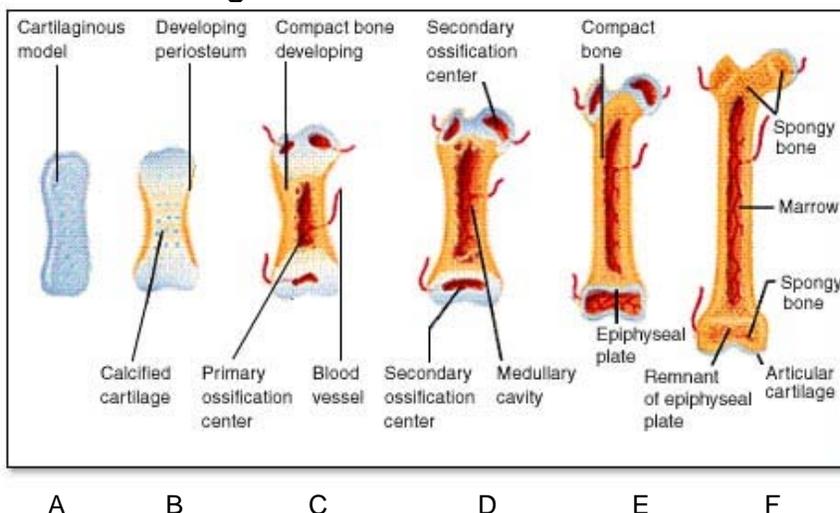
- Long
- Flat
- Short
- Irregular



TYPES OF BONES

Type of Bone	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
	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																
Flat	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Found in the vertebrae, clavicle and skull 																

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

f) 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:

1. Immovable joints, such as those in the skull;
2. Movable joints, for example the elbow and knee joints; and
3. 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.



Hip Joint



Knee 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.

Bird



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.

The study of bones is termed **Osteology**, from the Latin, “:oste” meaning bones and “ology” meaning the study of.

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 the 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 -more sense to send the animal to market
- 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-e-litis)	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.

JOINT INJURY AND DISEASE

DISORDER	CAUSE	EFFECT	TREATMENT	RECOVERY
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.	Pain killers - decrease exercise.	Nil - euthanasia in severe cases.
Infectious Arthritis	Can be caused by a penetrating wound, infected navel - where bacteria, fungi, mycoplasma or virus enters the blood-stream. 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.

BONES: DISEASE GUIDE

Case Studies

PROBLEM # 1

My name is Princess Patsy. I am a two-month-old gilt from champion stock. I sneeze and cough sometimes and my herd mates are staring to chuckle behind my back. My nose is sore and twisted.

Do I have a cold, or something more serious?

PROBLEM # 2

My name is Crazy Cow. I was in the field with other cattle that had swollen jaw bones, and I appeared to be getting the same thing. My jaw oozes yellow discharge.

Am I sick or have I just hurt my jaw while eating something?

PROBLEM # 3

My name is heavy horse. I have been working the fields since I was big enough to participate in the team. I work many hours and days in a row. My legs are very painful.

Am I just old, or is there something wrong with me?

THE BONES

Glossary

ARTHRITIS	: inflammation of a joint or joints.
ARTICULAR CARTILAGE	: joint cartilage.
BONES	: the hard tissue of which a skeleton is composed.
BONE MARROW	: a soft vascular tissue found in the central cavities of most bones.
CARPAL	: the wrist bone.
CARPUS	: the wrist
CARTILAGE	: a tough, elastic supporting tissue in animals.
CERVICAL VERTEBRAE	: neck vertebrae.
CLAVICLE	: the bone connecting the shoulder blade and the breastbone.
CLOACA	: the common cavity in which the urinary, genital, and intestinal tract lead.
DIGIT	: a finger or toe.
FEMUR	: the long bone that forms the chief support of the thigh; thighbone.
FIBULA	: the smaller of the two bones between the human knee and ankle.
HUMERUS	: the bone of the upper arm or forelimb.
JOINT	: the place, point, or line where two or more things are joined together.

LIGAMENTS	: a band of tough tissue binding together bones.
MANDIBLE	: the lower jaw.
MAXILLA	: the upper jawbone in vertebrates.
METACARPUS	: the five bones of the hand between the wrist and finger bones.
METATARSUS	: the bones between the ankle and the toes.
OSTEOLOGY	: the study of the functions and structure of bones.
PATELLA	: the flat, movable, oval bone at the front of the human knee joint.
PELVIS	: the part of the skeleton that forms a bony girdle, joining the lower or hind limbs to the body.
PERIOSTEUM	: a tough, fibrous membrane covering the bones.
RADIUS	: the shorter of the two bones of the forearm.
RIB	: one of the series of curved bones attached to the spine of most vertebrates.
SCAPULA	: either of the two large, flat bones of the upper back; shoulder blade.
SPLINT	: to confine, support, or brace, as a fractured limb, with or as with splints.
SPRAINS	: a violent straining or twisting of the ligaments surrounding a joint.
STERNUM	: the structure of bone and cartilage that forms the ventral support of the ribs in vertebrates.
SYNOVRA	: the viscid, transparent, lubricating fluid secreted by a membrane in the interior of joints.
TARSAL	: situated near the ankle.
TARSUS	: the ankle.

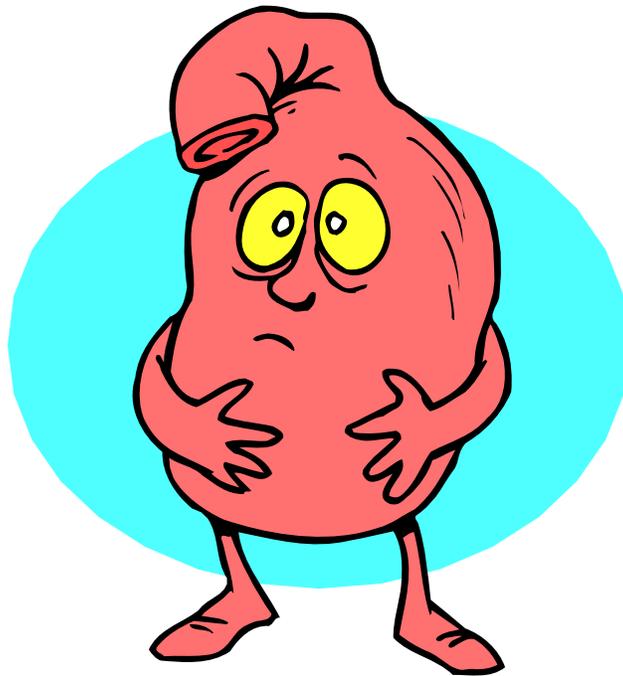
TIBIA

: the inner and larger of the two bones of the leg below the knee; the shinbone.

ULNA

: the larger of the two bones of the forearm on the same side as the little finger

CIRCULATORY SYSTEM



THE CIRCULATORY SYSTEM

ROLL CALL

- | |
|--|
| <ul style="list-style-type: none">➤ <i>Name a fact you know about the circulatory system.</i>➤ <i>Do you know anyone who has suffered from heart disease? How was it treated?</i>➤ <i>Suggest a tip for keeping a healthy heart.</i> |
|--|

"Learn to do by Doing"

ACTIVITIES

- 1) Visit a vet and get him/her to show you how to take the pulse of different animals, their temperatures, and maybe how to take their blood pressure.

- 2) Call an Abattoir. See if you can get a heart of either a pig or a cow. Then let the group examine it. Be sure to point out major structures like the aorta.

- 3) If the vet tests blood for certain diseases, see if he/she would walk the group through the process of drawing blood to the actual testing part. Also the vet could explain the results.

THE CIRCULATORY SYSTEM

ROLL CALL

- 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.

What is 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 containers 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. 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.
 - ▶ The muscle in the middle is elastic and very strong
 - ▶ The inner layer is very smooth so that the blood can flow easily with no obstacles in its path.
 - ▶ 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 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.

Arteries and veins run parallel throughout the body with a web-like network of capillaries, embedded in tissue, connecting them. The arteries pass their oxygen-rich blood to the capillaries, which allow the exchange of gases within the tissue. The capillaries then pass their waste-rich blood to the veins for transport back to the heart.

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.

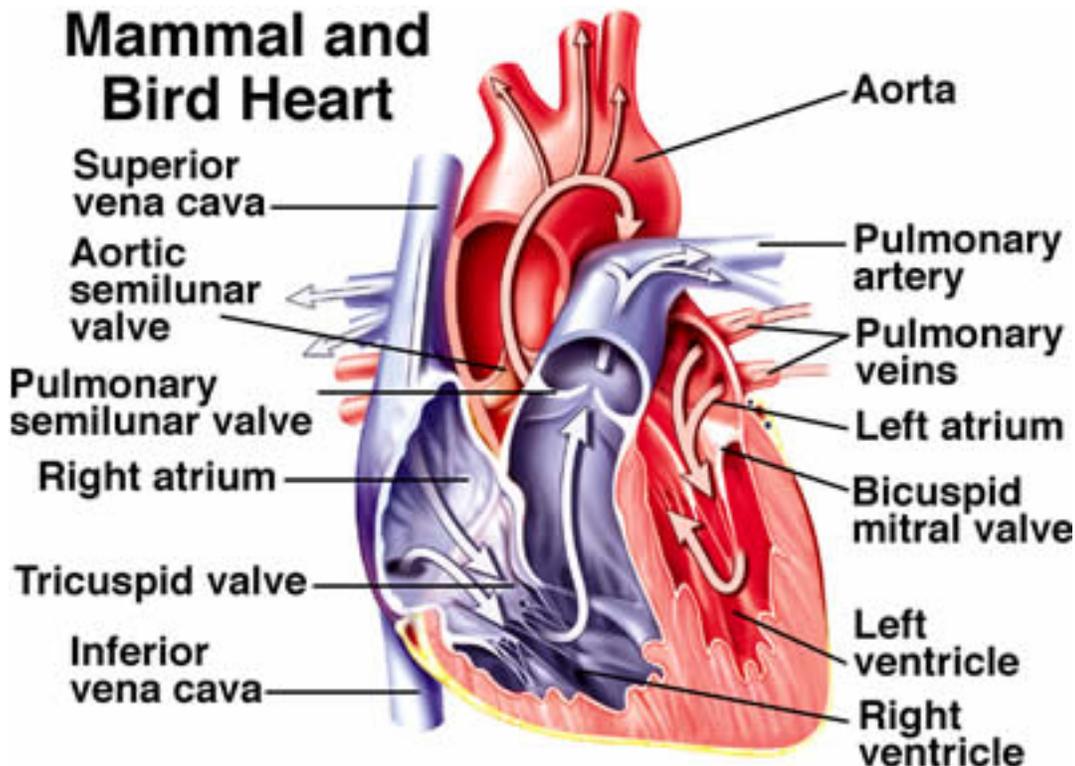
How is BLOOD PRESSURE measured?

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 the major part of the circulatory system, supplying blood to the rest of the body, with the exception of 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.

DID YOU KNOW

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.

THE CIRCULATORY SYSTEM

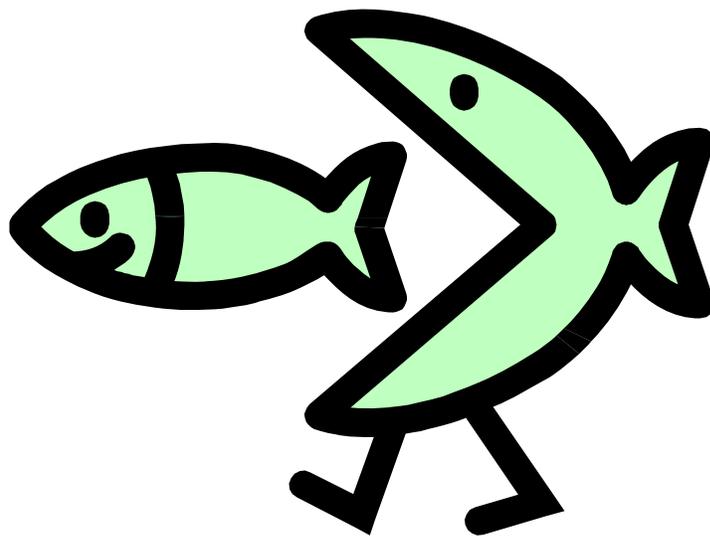
Glossary

AORTA	: the large trunk artery that carries blood from the left ventricle of the heart to branch arteries.
ARTERY	: any of the muscular elastic tubes that form a branching system and that carry blood away from the heart to the cells, tissues, and organs of the body.
ATRIUM	: a body cavity or chamber, especially either of the upper chambers of the heart that receives blood from the veins and forces it into a ventricle.
BLOOD	: the fluid consisting of plasma, blood cells, and platelets, which is circulated by the heart through the vertebrate vascular system, carrying oxygen and nutrients to and waste materials from all body tissues.
BLOOD PRESSURE	: the pressure exerted by the blood against the walls of the blood vessels, especially the arteries. It varies with the strength of the heartbeat, the elasticity of the arterial walls, the volume and viscosity of the blood, and a person's health, age, and physical condition.
CAPILLARIES	: one of the minute blood vessels that connect arterioles and venules. Those blood vessels form an intricate network throughout the body for the interchange of various substances, such as oxygen and carbon dioxide, between blood and tissue cells.
CIRCULATORY SYSTEM	: the bodily system consisting of the heart, blood vessels, and blood that circulates blood throughout the body, delivers nutrients and other essential materials to cells, and removes waste products.
DIASTOLIC PRESSURE	: the blood pressure after the heart contracts, while the chambers of the heart refill with blood.



HEART	: the chambered muscular organ in vertebrates that pumps blood received from the veins into the arteries, thereby maintaining the flow of blood through the entire circulatory system.
PULMONARY CIRCULATION	: the circulation of blood between the heart and the lungs.
PULSE	: the rhythmical throbbing of arteries produced by the regular contractions of the heart.
SYSTEMIC CIRCULATION	: the general circulation of blood through the body.
SYSTOLIC PRESSURE	: blood pressure within the arteries when the heart muscle is contracting.
VEINS	: any of the membranous tubes that form a branching system and carry blood to the heart.
VENA CAVA	: either of the two large veins that drain blood from the upper body and from the lower body and empty into the right atrium of the heart.
VENTRICLE	: a small cavity or chamber within a body or organ, especially the right or left ventricle of the heart or any of the interconnecting ventricles of the brain.

DIGESTIVE SYSTEM



THE DIGESTIVE SYSTEM

ROLL CALL - ANSWERS

- Name one type of food eater and describe what they eat.
 - Carnivores-protein (meat)
 - Herbivores –plants (complex system)
 - Omnivores –both meat and plants
 - Domesticated Birds -seeds
- Name one disease or disorder involving the digestive tract and state one symptom or method of treatment
 - Look at the disease guide for all the answers
- Name one of the four compartments of the ruminant stomach and one fact that you know about it. (for more information read in the members guide –RUMINANT STOMACH)
 - Rumen – first stomach –largest –fore stomach
 - Reticulum – second stomach – water bag –honey comb
 - Omasum – third stomach –many plies
 - Abomasum –forth stomach –true stomach –secretory stomach

"Learn to do by Doing"

ACTIVITIES

A) Enzyme Action

Required Materials: Starchy food samples, such as soda crackers or bread.

Leader:

- 1) Provide members with small pieces of bread or soda crackers.
- 2) Instruct them to chew the food, without swallowing, until they notice a change in taste.
- 3) Ask for their explanation of what is happening in their mouth.
- 4) Explain that the starch is beginning to be digested by enzymes in their saliva.

B) Belching

Purpose: This activity demonstrates that proper belching is a matter of life or death for ruminants.

Required Materials: Balloon, carbonated soda (cola)

Leader:

- 1) Pour pop into a balloon.
- 2) Close the balloon carefully and shake it up.
- 3) Ask the members to explain what happened.
- 4) Emphasize that this is what would happen to the animal's rumen if the gas was not released.

C) How Good are Villi?

Required Materials: Flour, water, paper towels

Leader:

- 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.

Member:

- 1) Designate each group member as 1, 2 or 3
- 2) 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.
- 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?

D) PH IN THE GUT

Required Materials: Flour, Vinegar, unsweetened red grape juice, baking soda, water, drinking glass

Leader:

- 1) 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? This past is chyme.

Member:

- 1) 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.)
- 2) 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? What reaction do you get? Are the contents of the glass now acidic or alkaline?

E) Make an Emulsion

Required Materials: eggs, oil, vinegar

Leader:

- 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.

Member:

- 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).

Leader:

1) Explain that bile acts as an emulsifier like the egg did in this recipe. Bile also helps retain the contents of the intestine fluid, and prevents the food from fermenting or going bad. Bile also gives feces its colour.

F) Jeopardy:

Post the paper of questions, and give each question a different pointing system depending upon how much time you spent on each section. Put the points awarded to each question on the back of the paper and stick the question side towards the wall so the points face outwards. (This also could be used as a quiz and completed in groups or individually.)

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) None of the above
- (e) All of the above

2. Another name for the gut is the

- | | |
|-----------------------|----------------------|
| (a) Digestive pathway | (c) Stomach |
| (b) 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) Lipids
 - (c) Cellulose
 - (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) Protease
 - (c) Lipase
 - (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) Mucus membrane
 - (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
- 20a. How many compartments are there in the ruminant stomach?
- 20b. Which compartment is the largest?
- ... is the driest?
 - ... is a water reservoir?
 - ... is also called the true stomach?
21. 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

22. Rumination takes longer if the food is
 (a) Soft (b) Coarse (c) Sweet (d) Fresh
23. Fermentation occurs in the (a) Rumen (c) Omasum
 (b) Abomasum (d) Esophagus
24. 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
25. Microorganisms are a good source of:
 (a) Cellulose (b) Fats (c) Proteins (d) Vitamins
26. A build-up of gas in the rumen is called:
 (a) Gastric impaction
 (b) Indigestion
 (c) Gastritis
 (d) Bloat
27. In severe cases of bloat, the gas must be removed by puncturing the rumen. The instrument used is a
 (a) Debloater
 (b) Trocar
 (c) Probang
 (d) Release valve
28. Hardware Disease occurs when metal objects penetrate the
 (a) Rumen
 (b) Reticulum
 (c) Abomasum
 (d) Omasum
29. Glands outside the gut that help in digestion are called
 (a) Sub-guttural glands
 (b) Accessory glands
 (c) Gastro-cecal glands
30. Which salivary gland is found on each side of the base of the tongue?
 (a) parotid
 (b) mandibular
 (c) sublingual
31. The drier the food, the thicker the saliva. True False

32. Which of these functions is NOT performed by saliva?
- (a) Lubricating the mouth and esophagus
 - (b) Softening and wetting food
 - (c) Partially digesting starches
 - (d) Dividing large molecules of lipids
33. The pancreas is located
- (a) Behind the stomach
 - (b) In the loop of the duodenum
 - (c) At the junction of the small and large intestines
 - (d) Behind the angle of the jaw
34. Pancreatic juice contains
- (a) sodium bicarbonate
 - (b) salt
 - (c) hydrochloric acid
 - (d) vitamins
35. Pancreatitis is a disease particular to
- (a) ruminants
 - (b) small animals
 - (c) domestic fowl
36. Pancreatitis is usually found in animals that are
- (a) young
 - (b) old
 - (c) overweight
 - (d) undernourished
37. Bile is produced by the
- (a) pancreas (b) gall bladder (c) stomach (d) liver
38. All domestic animals have a gall bladder except the
- (a) horse (b) cat (c) dog (d) cow (e) chicken (f) pig
39. The function of the gall bladder is to
- (a) Produce extra bile when needed
 - (b) Store and concentrate the bile
 - (c) Control the release of pancreatic juice and bile
 - (d) It does not function in digestion

40. The duodenum is the first part of the small intestine. It is
 (a) Round
 (b) Oval
 (c) S-shaped
 (d) Contracted
41. The largest section of the small intestine is the
 (a) Duodenum
 (b) Jejunum
 (c) Ileum
42. Villi are found
 (a) At the junction between the stomach and intestine
 (b) In the lining of the intestine
 (c) At the ileo-cecal valve
 (d) In the pancreas
43. The role of the villi is to
 (a) Mix and churn food
 (b) Produce intestinal juice
 (c) Absorb nutrients
44. The first part of the large intestine is the
 (a) Colon
 (b) Rectum
 (c) Cecum
 (d) Duodenum
45. The cecum acts as a rumen in some
 (a) Herbivores
 (b) Carnivores
 (c) Ruminants
46. Which of these animals has a specialized, enlarged cecum?
 (a) dog (b) horse (c) cow (d) chicken
47. In general, most digestion is completed in the
 (a) Large intestine
 (b) Cecum
 (c) Small intestine
 (d) Ileo-cecal valve
48. Feces are stored in the
 (a) Cecum
 (b) Ileum
 (c) Anus
 (d) Rectum
49. The environment of the intestines is - acidic alkaline

50. Excess water is removed from waste food in the
 (a) Colon
 (b) Small intestine
 (c) Jejunum
 (d) Anus
51. Once digestion is finished, chyme becomes
 (a) Chiton
 (b) Bolus
 (c) Chymase
 (d) Chyle
52. Colic is most commonly found in
 (a) horses (b) cows (c) pigs (d) cats
53. The process by which nutrients are taken into the bloodstream is:
 (a) absorption (b) fermentation (c) digestion (d) assimilation
54. Where does most absorption occur?
 (a) Stomach
 (b) Small intestine
 (c) Large intestine
 (d) Throughout the gut
55. Water is important to absorption because:
 (a) It keeps the villi moist
 (b) It prevents food from drying out and sticking to the lining of the gut
 (c) It is the medium through which nutrients pass into the bloodstream
56. Assimilation is the process whereby
 (a) Food is broken down
 (b) Nutrients are taken up by the blood
 (c) Nutrients are used by the body
 (d) Digestive juices are mixed with food
57. Assimilation
 (a) Is a slow process
 (b) Occurs at intervals of 6 to 8 hours
 (c) Happens only when the gut is completely empty
58. The products of excretion are
 (a) chyle (b) gas (c) feces (d) fatty acids
59. Diarrhea is dangerous when it continues for more than
 (a) 5 days (b) 2 days (c) 1 day (d) 1 week (e) 1 month
60. The most serious effect of diarrhea is
 (a) Dehydration (b) Lack of appetite
 (c) Inflammation of rectum (d) Vomiting

ANSWERS:

- | | |
|--|-------------|
| 1) A | 29)B |
| 2) D | 30)C |
| 3) B | 31)False |
| 4) C | 32)D |
| 5) C | 33)B |
| 6) A | 34)A |
| 7) C | 35)B |
| 8) A | 36)C |
| 9) A | 37)D |
| 10)B | 38)A |
| 11)A | 39)B |
| 12)D | 40)C |
| 13)C | 41)B |
| 14)B | 42)B |
| 15) Hydrochloric acid, the enzyme pepsin, mucus | 43)C |
| 16)D | 44)C |
| 17)C | 45)A |
| 18)B | 46)B |
| 19)A | 47)C |
| 20)Four | 48)D |
| 22)B) | 49)Alkaline |
| Largest - rumen | 50)A |
| Driest- Omasum | 51)D |
| water reservoir- reticulum | 52)A |
| called the true stomach - | 53)A |
| abomasum | 54)B |
| 21)B | 55)C |
| 22)B | 56)C |
| 23)A | 57)A |
| 24)B | 58)C |
| 25)C | 59)B |
| 26)D | 60)A |
| 27)B | |
| 28)B | |

THE DIGESTIVE SYSTEM

ROLL CALL

- Name one type of food eater and what they eat.
- Name one disease or disorder involving the digestive tract and state one symptom or method of treatment
- Name one of the four compartments of the ruminant stomach and one fact that you know about it.

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.

TYPES OF EATERS



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.

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.

ENZYMES are naturally occurring substances that speed up or trigger a chemical reaction. They are called catalysts.

There are many digestive enzymes, and each one acts on a specific nutrient.

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).

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.

HOW FOOD IS DIGESTED: THE FERMENTATION PROCESS

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.

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.

PARTS OF THE RUMINANT (FOUR CHAMBERED) STOMACH

THE RUMEN (first stomach, paunch, forestomach)

The rumen is the largest of the four compartments, taking up 90% of the total area and occupying the whole left side of the abdomen. It has many small tongue-like projections called papillae that give it a soft fur-like appearance. This is where the billions of microorganisms are found that are essential to the digestion and fermentation of cellulose. Partially chewed, food is stored here until it can be rechewed by the animal.

RETICULUM (second stomach, waterbag, honeycomb)

The smallest of the four compartments, the reticulum looks like a honeycomb. Its main function is to act as a fluid tank for the stomach, sending liquid wherever it is needed for digestion.

The reticulum is also called the pacemaker because it coordinates the movements of the rumen. You can count the "movement waves" of the reticulum as food is moved through it. To do this place your hand on the right side of the animal's stomach, halfway between the last rib and the point of the hip bone, and feel the movements of the rumen as it works up and down. Dairy cattle are the best animal for this demonstration.

The opening between the reticulum and the third compartment is very small so only tiny or well digested particles of food will pass through.

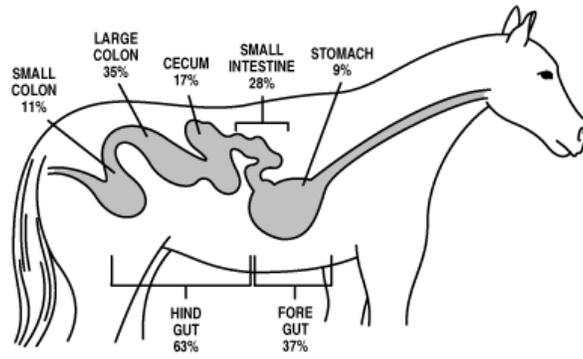
OMASUM (third stomach, manyplies)

The omasum has many leaves or laminae that feel and look like sandpaper. It is a very dry compartment, and food is always dry and tightly packed here. Its duty is to prepare food for digestion in the fourth stomach by grinding it down and removing any excess water. It also absorbs the bicarbonate from the saliva to keep the contents of the fourth stomach (abomasum) acidic.

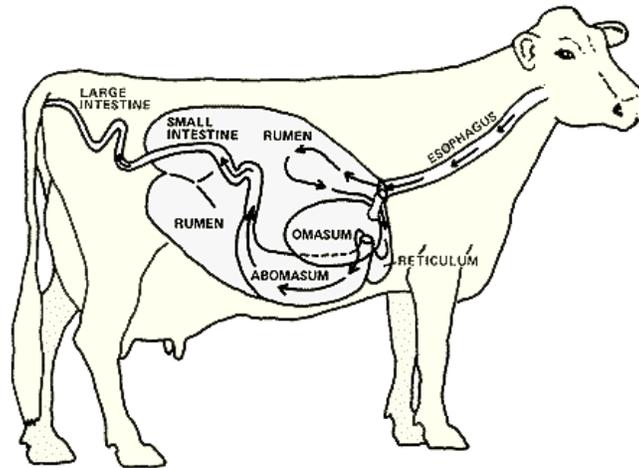
ABOMASUM (fourth stomach, true stomach, secretory stomach)

This compartment is like the simple stomach of non ruminants. In other words, this is where gastric juice is released to help with the chemical breakdown of food. It is the only part of the stomach with glands that release digestive juices.

For ruminant animals, the process of digestion is a little different. During rumination a bolus is regurgitated into the mouth, chewed 30 to 60 times, then it is re-swallowed. The whole process takes approximately 30 to 60 seconds, and then a second bolus is sent up. Rumination occurs at 6 to 8 hour intervals. The coarser the food and the larger the meal, the longer the cudging time. It usually starts half an hour after feeding has ended, and does not stop until all the coarse portions have been broken down, on average 2 hours later.



This diagram shows the digestive tract of a horse



This diagram shows the digestive tract of a cow.

Notice the difference between the cow and the horse. Their digestive systems are built in a similar fashion but there are specialized components in each.

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 the food towards 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 up 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 it 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"> 1) an inner MUCUS MEMBRANE, or lining with glands that secrete important digestive juices 2) A thick middle MUSCLE LAYER that makes movement possible 3) 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.

<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 holds 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% of the length. It is not clearly separated from either the duodenum or 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 enzyme 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 special cecums. ▶ 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 increase its surface area. ▶ Due to the villi, nutrients are more easily and more quickly absorbed. The villi move constantly. This helps them come in contact with all the digested food so that it can be completely absorbed. 	<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.
-------------------------	---	--	---

<p>Large Intestines (Colon)</p>	<p>▶ The large intestine differs from the small in that it is larger, lumpier and has a more fixed position. It is divided into the cecum and the colon.</p>	<p>▶ No digestion and very little absorption take place in the large intestine. Its job is:</p> <ul style="list-style-type: none"> ○ To remove excess water from the non-absorbed foods ○ To concentrate non-absorbed foods into feces. <p>1) CECUM: this is usually an off-shoot where the small and large intestine meet.</p> <p>▶ In humans and carnivores it is a small and simple affair, not much more than a holding tank for digested food that has had all its nutrients removed.</p> <p>▶ 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 a mucus membrane.</p> <p>2) COLON: the colon is a reservoir for excrement.</p> <p>▶ It empties into the RECTUM, which opens to the outside at the ANUS.</p> <p>▶ The anus is controlled by two sphincters.</p> <p>▶ In animals that have been trained, the external, voluntary sphincter allows feces to be held until it is convenient for voiding.</p>	<p>▶ Specialized cecums act like rumens. They have billions of micro-organisms that ferment and digest cellulose. Unlike rumens, little gas is produced.</p>
---------------------------------	--	--	--

THE DIGESTIVE SYSTEM

“Disease Guide”

STOMATITIS:

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

SYMPTOMS:

- 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 heat can also injure the mouth.

CHOKE:

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 will lead to choking.

SYMPTOMS:

- 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

REATMENT:

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 plub at one end). Make sure that the animal's head is raised to provide a straight channel down. It could also be gently snared with a wire loop and pulled out through the mouth. 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.

SYMPTOMS:

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. However it is a live virus, and the live virus can bring the disease onto your farm. The use of the vaccine is not always recommended unless an outbreak is to be controlled. 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.

ACUTE INFECTIOUS HEPATITIS

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

ABCESS 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.

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 accumulates 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.

SYMPTOMS:

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 much 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.

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.

SYMPTOMS:

- going off feed
- stops cudging
- 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.

JOHNE'S DISEASE:

Cattle are most susceptible to this disease, but sheep, deer and goats can also suffer. The disease is spread in the dung of infected animals and gets into the food and water supply. When the organism arrives in the intestines it attacks the walls and sets up such an infection that food can no longer be absorbed into the blood. Though young animals are usually attacked, death may not follow until years after the infection has set in.

SYMPTOMS:

- 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.

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.

SYMPTOMS:

- 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.

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, growth on the salivary glands, and nervous disturbances such as hysteria can all lead to ptyalism.

SYMPTOMS:

- 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 does however, paralyze 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.

APTYALISM:

The opposite of ptyalism, aptyalism 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.

SYMPTOMS:

- 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 (PTYALISM/APTYALISM):

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.

DISPLACED ABOMASUM:

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.

SYMPTOMS:

- 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 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.

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.

SYMPTOMS:

- bloody diarrhea
- anemia
- weight loss
- general weakness
- severe straining accompanies excretion
- stringy feces and full of mucus
- delirium and 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 to ensure that such conditions do not occur.

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.

SYMPTOMS:

- obvious pain in the abdomen
- kicking at the belly
- perspiration
- blowing
- general unease
- excess gas

TREATMENT:

Expert help is needed if colic persists more than three hours or if the animal is in extreme pain. Place the animal in a large airy protected area and remove all restraint. A medicinal drench may help. 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. 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.

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):
- vomiting
- abdominal pain
- shock
- chronic cases (dogs and cats):
- mild vomiting
- mild abdominal pain
- stools orange or clay-colored and rancid-smelling
- 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.

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. Antiseptics may also offer relief. A general treatment for diarrhea consists of withholding all energy feeds and introducing anti-diarrheal medicine to the animal. There are a number of good commercial preparations. 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.

THE DIGESTIVE SYSTEM

Glossary

ABOMASUM	: the fourth or true digestive stomach of a ruminant.
ALIMENTARY CANAL	: the digestive tract between the mouth and the anus, including the esophagus, stomach, and the intestines.
ANUS	: the opening at the lower end of the alimentary canal.
BILE	: a bitter, golden brown or greenish digestive fluid secreted by the liver.
BLOAT	: to cause to swell, as with fluid or gas.
CARNIVORES	: a flesh-eating mammal.
CATALYST	: a substance that alters the speed of a chemical reaction.
CECUM	: a cavity with a single opening; the pouch between the large and small intestines.
CELLULOSE	: a complex carbohydrate forming the cell walls of plants and the principal component of wood, paper and cotton.
CHOKER	: to stop or obstruct the breathing of an animal.
CHYME	: partly digested food in liquid form as it passes from the stomach into the small intestine.
COLON	: the large intestine between the cecum and the rectum.
DIGESTIVE SYSTEM	: the system that converts food into forms that can be assimilated by the body.
DIGESTION	: the process of digesting food.
DUODENUM	: that part of the small intestine next to the stomach.



ENZYME	: a protein like substance produced by cells and having the power to initiate or accelerate specific biochemical reactions.
EPIGLOTTIS	: the leaf-shaped piece of cartilage, at the base of the tongue that closes the trachea during the act of swallowing.
ESOPHAGUS	: the tube through which food passes from the mouth to the stomach.
FERMENTATION	: the decomposition of organic compounds by the action of enzymes.
GASTROINTESTINAL TRACT	: the digestive tract pertaining to the stomach and the intestines.
GIZZARD	: the second stomach of birds, in which the food is ground.
HERBIVORES	: an animal that feeds on plants or vegetable matter.
ILEUM	: the last section of the small intestine, following the jejunum and leading to the large intestine.
INTESTINES	: the part of the alimentary canal between the stomach and the anus, consisting of the long small intestine and the shorter, wider large intestine including the colon and rectum.
JEJUNUM	: the part of the small intestine between the duodenum and the ileum.
LIVER	: the largest glandular organ of vertebrates, having many vital functions, as storing vitamins and nutrients, purifying the blood and producing bile.
MOUTH	: the opening at which food is taken into the body; also the cavity between the lips and throat.
OMASUM	: the third division of the stomach of a ruminant.
OMNIVORES	: eat both animal and vegetable food.



PANCREAS	: a large gland situated behind the stomach and manufacturing fat-digesting enzymes and the hormone insulin.
PULORUS	: the muscularly controlled opening between the stomach and the duodenum.
RECTUM	: the terminal part of the large intestine ending at the anus.
RETICULUM	: the second stomach of a ruminant.
RUMEN	: the first chamber of the stomach of a ruminant.
RUMINANTS	: any of a division of even-toed ungulates, as deer, sheep, cow, etc, that graze and chew the cud.
STOMACH	: a pouch like dilation of the alimentary canal, situated in most vertebrates next to the esophagus and serving as one of the principal organs of digestion.
TRACHEA	: in vertebrates, the duct by which air passes from the larynx to the bronchi and the lungs; the windpipe.
VILLUS	: any of numerous tiny projections from mucous membrane, as the absorptive processes in the small intestines.

GENETICS





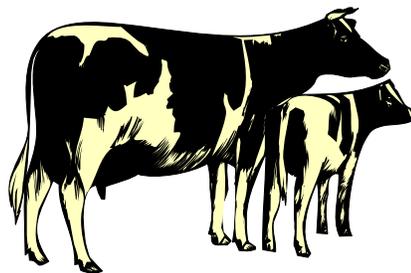
GENETICS

ROLL CALL

- Do you consider phenotypes when breeding your animals?
- What structures or objects do you take into consideration before breeding your animal? I.e. Feet and legs.

WHAT IS GENETICS?

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 *exactly the same DNA*.

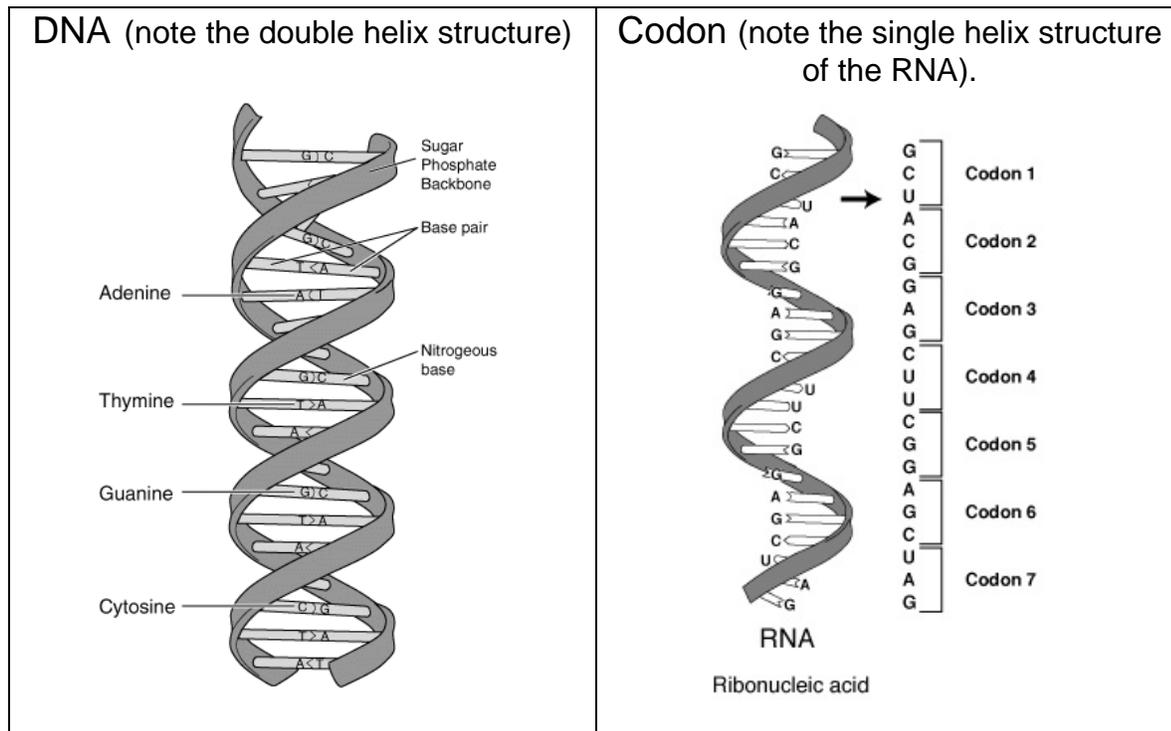
DNA is also known as **deoxyribonucleic acid** (de-oxy-ribo-nuclayic).

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 gets 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.

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 each individual 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.



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 particular breed. In order 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 particular individuals' offspring. They use an upper case letter to indicate a dominant allele and a lower case letter for recessive alleles.

		Mother →			
	Father ↓				
		BC	Bc	bC	bc
B (black)	BC	BBCC	BBCc	BbCC	BbCc
b (red)	Bc	BBCc	BBcc	BbCc	Bbcc
C (straight)	bC	BbCC	BbCc	bbCC	bbCc
c (curly)	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.

His genotype may be _____, _____, _____, or _____.

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 are able to 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. Therefore, 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. Boy or Girl?

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 boy, regardless of the presence of an X chromosome. A girl 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.

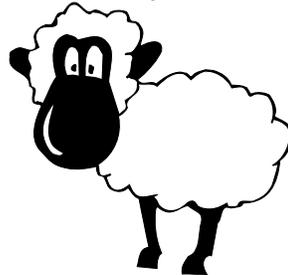
DID YOU KNOW

Goldfish have more than twice the number of chromosomes that humans have! Humans have 46, dogs have 78, and goldfish have a whopping 96!



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!



THE RESPIRATORY SYSTEM

“Disease Guide”

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.
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.

	<ul style="list-style-type: none"> • 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 destroyed. • It is caused by an abnormal recessive gene.
Hip Dysplacia	<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 • No treatment and no DNA test.



GENETICS

Glossary

ADENINE	: a purine base that is a constituent of DNA and RNA and an important energy transport and storage component in cellular metabolism.
ALLELE	: one member of a pair or series of genes that occupy a specific position on a specific chromosome.
AMINO ACID	: any of various organic acids containing both an amino group and a carboxyl group, especially any of the 20 or more compounds that link together to form proteins.
CHROMOSOME	: a threadlike linear strand of DNA and associated proteins in the nucleus of animal and plant cells that carries the genes and functions in the transmission of hereditary information.
CLONE	: a DNA sequence, such as a gene, that is transferred from one organism to another and replicated by genetic engineering techniques.
CODON	: a sequence of three adjacent nucleotides constituting the genetic code that specifies the insertion of an amino acid in a specific structural position in a polypeptide chain during the synthesis of proteins.
CYTOSINE	: a pyrimidine base that is an essential constituent of RNA and DNA.
DEOXYRIBONUCLEIC ACID	: a long linear polymer found in the nucleus of a cell and forms from nucleotides and shaped like a double helix; associated with the transmission of genetic information.
DNA	: a nucleic acid that carries the genetic information in the cell and is capable of self-



replication and synthesis of RNA. DNA consists of two long chains of nucleotides twisted into a double helix and joined by hydrogen bonds between the complementary bases adenine and thymine or cytosine and guanine. The sequence of nucleotides determines individual hereditary characteristics.

DOMINANT

: an allele that produces the same phenotypic effect whether inherited with a homozygous or heterozygous allele.

GENE

: a hereditary unit consisting of a sequence of DNA that occupies a specific location on a chromosome and determines a particular characteristic in an organism. Genes undergo mutation when their DNA sequence changes.

GENETICS

: the branch of biology that deals with heredity, especially the mechanisms of hereditary transmission and the variation of inherited characteristics among similar or related organisms.

GENOTYPES

: the combination of alleles located on homologous chromosomes that determines a specific characteristic or trait.

GUANINE

: a purine base that is an essential constituent of both RNA and DNA.

NUCLEUS

: a central or essential part around which other parts are gathered or grouped. A large, membrane-bound, usually spherical protoplasmic structure within a living cell, containing the cell's hereditary material and controlling its metabolism, growth, and reproduction.

OFFSPRING

: the progeny or descendants of a person, animal, or plant considered as a group.

PHENOTYPES

: the observable physical or biochemical characteristics of an organism, as determined by both genetic makeup and environmental influences.

**PROTEIN**

: any of a group of complex organic macromolecules that contain carbon, hydrogen, oxygen, nitrogen, and usually sulfur and are composed of one or more chains of amino acids. Proteins are fundamental components of all living cells and include many substances, such as enzymes, hormones, and antibodies, which are necessary for the proper functioning of an organism. They are essential in the diet of animals for the growth and repair of tissue and can be obtained from foods such as meat, fish, eggs, milk, and legumes.

RECESSIVE

: a trait that is expressed only when the determining allele is present in homozygous condition.

RNA

: Ribonucleic acid; a polymeric constituent of all living cells and many viruses, consisting of a long, usually single-stranded chain of alternating phosphate and ribose units with the bases adenine, guanine, cytosine, uracil bonded to the ribose. The structure and base sequence of RNA are determinants of protein synthesis and the transmission of genetic information.

THYMINE

: a pyrimidine base that is an essential constituent of DNA.

TRAIT

: a characteristic, especially one that distinguishes an individual from others.

MUSCLES



THE MUSCLES

ROLL CALL

- 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.

"Learn to do by Doing"

ACTIVITIES

DISEASE GUIDE-Case Studies

PROBLEM# 1:

Hi, my name is Jack. I am a five-year-old St. Bernard. Recently I woke up stiff and walking gives me pain in my hind legs.

Can you tell me what my problem could be and if I need an x-ray?

Solution:

Jack could have hip dysplasia. This happens because of abnormal bone development in the hips. Jack needs x-rays to confirm diagnosis. Sometimes surgery can correct the abnormality.

PROBLEM# 2:

My name is Sparkles. I am a two-year-old Bulldog. I just had my first litter of pups. I had a very hard time delivering my babies and my veterinarian had to give me a caesarean. The first pup had a large head.

Can you tell me what might have been the problem?

Solution:

Sparkles had dystocia, which often occurs in breeds having a large head.

PROBLEM# 3:

My name is Lucille. I am a four-year-old riding horse. It's been very hot lately, but it got cooler on the weekend and my owner took me for a long on ride on Sunday. As a reward, she gave me extra grain and two days off. Now, it's Wednesday morning and we are going for another ride. My owner has noticed that I am very stiff and that my urine is dark red.

What might be wrong with me?

Solution:

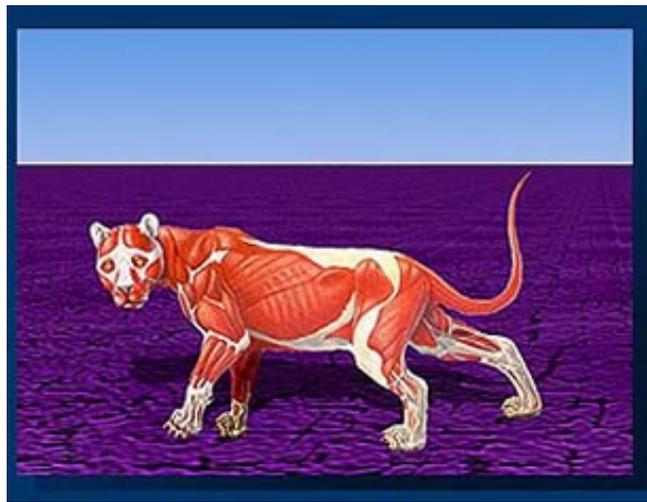
Lucille has "Classical" Azoturia or "Tying Up Disease". Overworking, excessive grain and rest causes this. Lucille needs immediate medical attention!

THE MUSCLES

ROLL CALL

- 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.

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.

STRIATED MUSCLE

There are two types of striated muscle fibre:

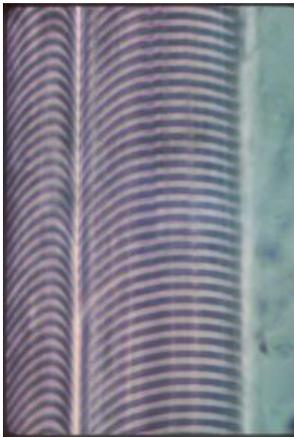
- Red and white.

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 higher percentage of white fibres than thoroughbreds. This is because their training (short runs, quick turns) demands a greater number of "quick" fibres.

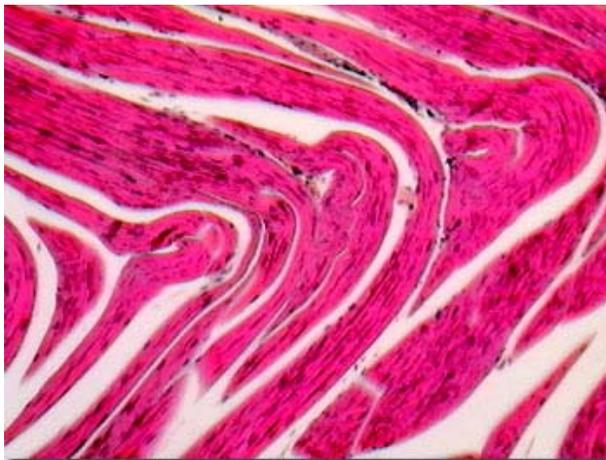
Skeletal muscles are voluntary. This means that they are controlled by conscious thought such that you need to "think" before you move your arm.

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**.

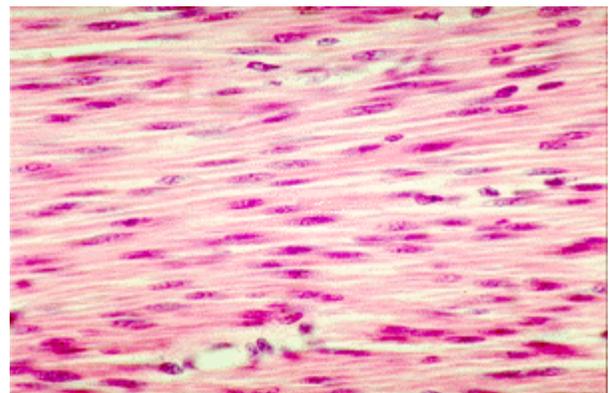
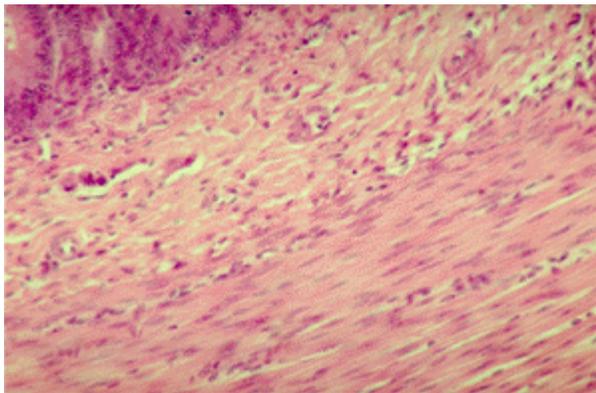
Striated muscle in a frog's leg showing the red and white fibers



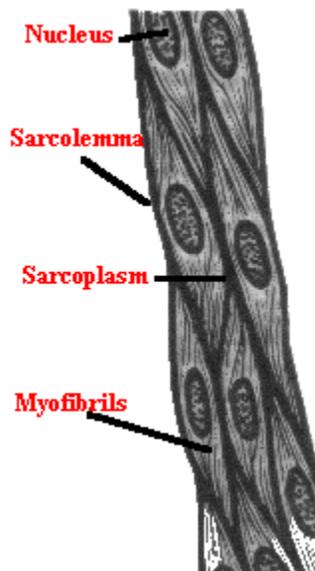
SMOOTH MUSCLES

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.



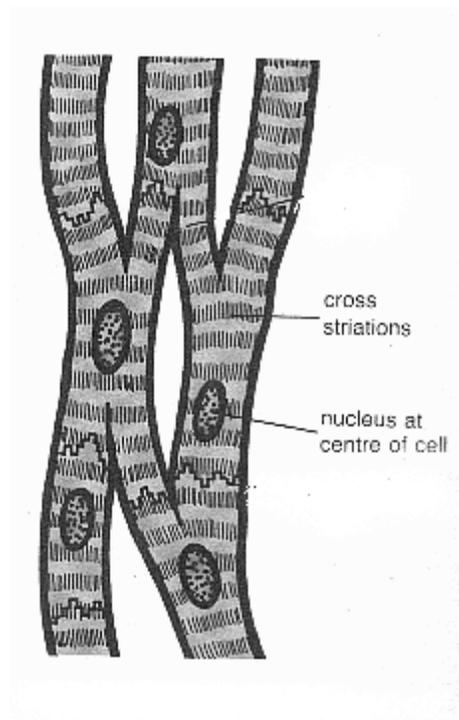
Smooth muscle features long, narrow "spindle" shaped cells with a single central, somewhat elongated, nucleus. These cells are arranged parallel to one another *in situ* and do not show any striations microscopically.

CARDIAC MUSCLE

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.

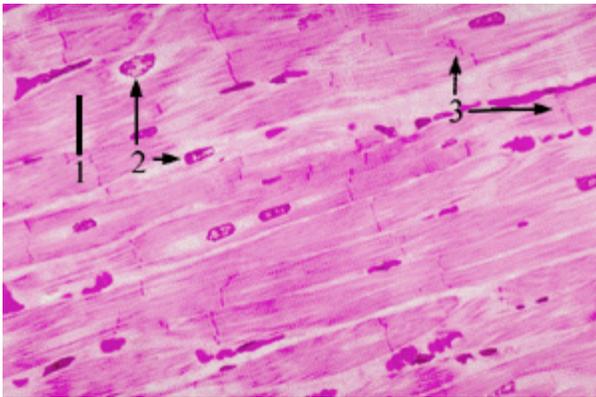
The cardiac muscle has some qualities of both striated and smooth muscles. The heart is capable of functioning independently because the heart has its own nerve supply and starts its own beat. It is the only muscle that can do this. The heart can be removed from an animal and continue to beat if kept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

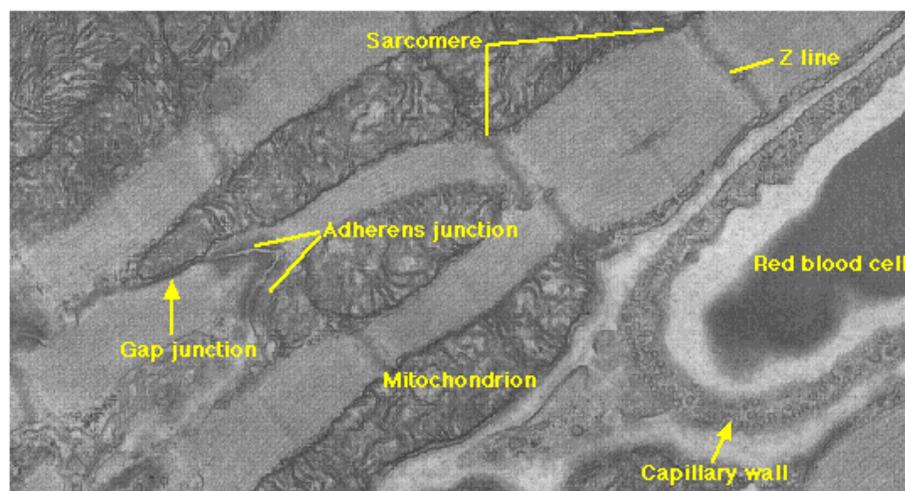


1. Cardiac Muscle Cell
2. Nuclei
3. Intercalated Discs

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.



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

ANIMAL	HEART RATE (beats/min.)	MATURE HEART WEIGHT
1. cow	60 - 70	2-4 kg
2. sheep	60 - 120	220 - 240 g
3. horse	23 - 70	3-5 kg
4. pig	55 - 86	450 g
5. dog (30 kg)	100-130	200 - 400 g
6. dog (10 kg)	100-130	60 - 130 g
7. cat (5 kg)	110 - 140	20 - 40 g
8. budgie	250 - 450	2 - 5 g
9. owl	600 - 700	50 g
10. mouse	324 - 858	2 - 5 g
11. human (70 kg)	58 - 104	1 kg

DID YOU KNOW?

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

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

THE MUSCLES

“Disease Guide”

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 chart lists some problems, their causes and treatments.

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.

MUSCLE CONDITIONS

PROBLEM	CAUSE	EFFECT	TREATMENT	RECOVERY
Strains	Over-stretched or overexerted part of musculature.	Pain and painful to move.	Rest - prevent by avoiding over-exertion.	Complete to near complete.
"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.	Complete or nearly complete if properly treated - can re-occur.
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.	Probable.
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.	Complete if detected early.
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	No treatment - prevent by using PSS free breeding stock.	None - usually death occurs.

PROBLEM	CAUSE	EFFECT	TREATMENT	RECOVERY
		is condemned.		
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.	None.

CANINE FORM DEVELOPED WITH PROBLEMS

The following chart highlights some problems.

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.

THE MUSCLES: DISEASE GUIDE

CASE STUDIES

Problem # 1

Hi, my name is Jack. I am a five-year-old St. Bernard. Recently I woke up stiff and walking gives me pains in my hind legs.

Can you tell me what my problem could be and if I need an x-ray?

Problem # 2

My name is Sparkles. I am a two-year-old Bulldog. I just had my first litter of pups. I had a very hard time delivering my babies and my veterinarian had to give me a caesarean. The first pups had a large head.

Can you tell me what might be the problem?

Problem # 3

My name is Lucille. I am a four-year-old riding horse. It's been very hot lately, but it got cooler on the weekend and my owner took me for a long ride on Sunday. As a reward, she gave me extra grain as a treat, and she gave me two days off. Now it is Wednesday morning and we are going to go for another ride. My owner notice that I am very stiff and that my urine is a dark red colour.

What might be wrong with me?
Should I be concerned?

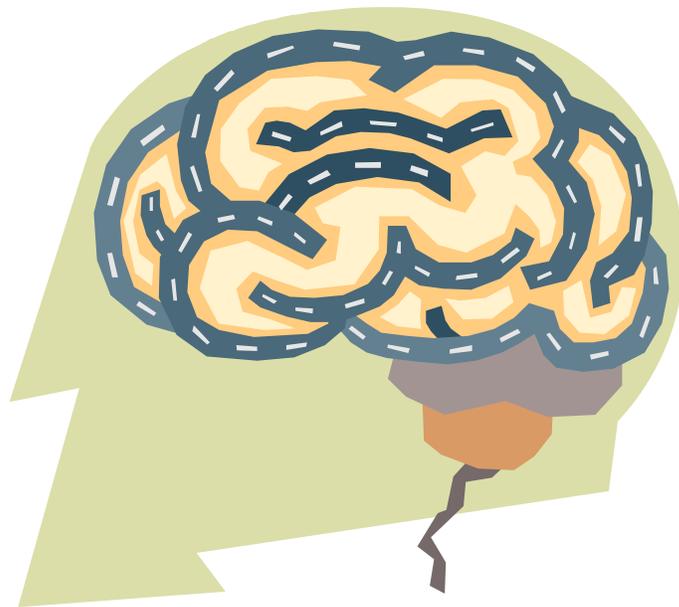
THE MUSCLES

Glossary

ARTERY	: any of the numerous muscular vessels and their branches that convey blood from the heart to every part of the body.
ATRIUM	: an upper chamber of the heart through which venous blood is transmitted to the ventricles.
ATROPHY	: a wasting away of the body or any of its parts.
CARDIAC MUSCLES	: involuntary striated muscles. Possesses characteristics of both striated muscles and smooth muscles. One of the strongest muscles in an animal.
CONNECTIVE TISSUE	: the cellular tissue that serves to support muscles, nerves and epithelial tissue in the body, as cartilage, bone, and tendons.
FLAP	: a broad, thin, and loosely hanging part or attachment.
HEARTRATE	: the number of times a heart beats per minute.
ITSCHEMIA	: inadequate blood circulation in an organ or tissue.
JOINTS	: a place of union of two bones.
LIGAMENTS	: a band of tough tissue binding together bones or holding organs in place.
MULTI-UNIT MUSCLES	: muscles found in and around the eye area and the lungs. They perform more specific tasks than Visceral.
MUSCLES	: any of the organs, composed of bundles of fibres, by whose contraction effects all bodily motion.
MYCOLOGY	: the study of muscles.

MYOSITIS	: an inflammation of the muscles.
SMOOTH MUSCLES	: muscle tissue consisting of flat sheets of spindle-shaped cells, by which involuntary movement is effected in blood vessels.
STRIATED MUSCLES	: are grooved muscles. They are the largest group of muscles in our bodies. They allow the body to move and they protect organs.
TENDON	: one of the bands of tough, fibrous tissue attaching a voluntary muscle to a bone.
VALVE	: a membranous structure inside a vessel or other organ, allowing fluid to flow in one direction only.
VEINS	: transport blood back to the heart. They have valves, so the blood can only travel in one direction.
VENTRICLE	: the lower chambers of the heart, from which blood is forced into the arteries.
VISCERAL	: the internal organs of the body, as the stomach, lungs, heart etc. These perform a generalized function on an entire organ.

NERVOUS SYSTEM





THE NERVOUS SYSTEM

ROLL CALL

- Like humans, animals use their five senses to know the world around them. Pick one sense (sight, hearing, taste, touch and smell), and name an animal that you think uses that sense particularly well.
- Name one part of the nervous system. What is one of the functions?
- Name a disease associated with the nervous system

"Learn to do by Doing"

ACTIVITES

A) Transmitting messages

Purpose: Members will gain a better understanding of nerve transmission.

Required Materials: Small items such as a button or marble to represent neurotransmitters; you will need as many neurotransmitters as you have members in your club; stopwatch.

Leader:

- 1) Ask each member to stand up and form a line and explain that each person in line is a neuron. Tell them that their: *left hands are the dendrites of a neuron; their bodies are cell bodies; their right arms are axons and their right hands are synaptic terminals.*
- 2) Give each person in line the small item that representative of a neurotransmitter; they should hold it in their right hands.
- 3) When you say "go," have the first person in line start the signal transmission by placing his or her "nerve signal" into the dendrite of the next neuron. Then the second person passes his or her neurotransmitter into the dendrite of the next neuron and the "signal" travels to the end of the line. At this time, the transmission is complete.

- ◆ *Remember that each "neuron will pass its own transmitter to the next neuron in line. Each neuron HAS ITS OWN neurotransmitter."*

Measure how long it takes the message to get from the first neuron to the last. Also, measure the distance from the first to the last neuron. Now calculate the speed (divide the distance by the time). How fast did the message travel from first to last neuron?



B) The Cerebrospinal Fluid

Purpose: Members will gain a better understanding of the role cerebrospinal fluid plays in protecting the brain from sudden impacts. The inside of a raw egg represents the brain and the shell represents the pia mater, a protective layer that covers the brain.

Required Materials: raw eggs, small containers with lids, water (to fill a small container)

Leader:

- 1) put the raw egg into a small plastic container that is slightly larger than the egg (the container represents the skull).
- 2) Cover the container with a tightly-fitting lid and shake it.
- 3) Members should notice that shaking the “brain” results in “damage” (a broke egg).
- 4) Repeat this experiment with a new egg. Fill the container with water, witch represents the cerebrospinal fluid.
- 5) Members should notice that shaking the container does not cause the “brain damage” as before – the fluid has cushioned the brain from injury.

Extension: Drop a raw egg (in the plastic container) from a standard height (or heights) in different conditions and compare results:

- ◆ With fluid in the container
- ◆ Without fluid in the container
- ◆ With different fluids or materials (sand, Jello)
- ◆ Different shaped materials

NOTE: This could also be a homework assignment for the members. You can tell the members to bring their project to the next meeting so that everyone has had time to work on them and then the group can do an analysis on each project. This may some members the opportunity to work with other members to come up with a “brilliant” design. An assignment like this may also stimulate more members to participate.



NERVOUS SYSTEM: DISEASE GUIDE – Case Studies

Problem# 1:

Your dog has just brought home a fox carcass. You aren't sure if Fido's vaccinations are up to date.

Name two things that you should do.

Solution:

Call your veterinarian; tie the dog up; have the fox's brain checked for rabies. Look up the rabies vaccination certificate and tag.

Problem #2

It's November. You are out with your parents checking the calves you weaned last week and you notice one calf off by itself. As you get closer, the calf turns and bumps into the feeder. Its mouth is open and it is making a choking, bawling sound. Your brother thinks it has something caught in its throat.

What do you think? What do you do?

Solution:

It shouldn't bump into the feeder; stay away from the animal and call the vet.

Problem #3:

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.

What is the most likely cause of Tiny's problems?

Solution:

Intervertebral disc disease, the breed of dog, overfeeding, and lack of exercise could all be contributors to the problem.

Problem #4:

You come into the barn to begin the evening milking and you notice that Milly hasn't cleaned up her feed. She calved two months ago and she hasn't been bred back yet. She is having trouble swallowing, is bellowing, and appears to be straining.

What do you do now?

Solution:

Keep her inside, stay away from her head, and call the vet. This kind of unusual behavior may lead you to suspect a nervous disorder.



THE NERVOUS SYSTEM

ROLL CALL

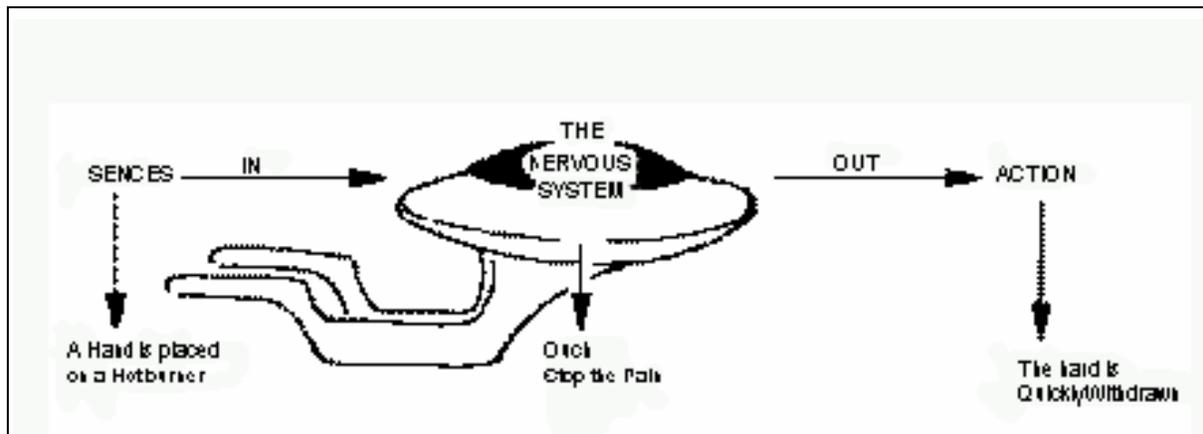
- Like humans, animals use their five senses to know the world around them. Pick one sense (sight, hearing, taste, touch and smell), and name an animal that you think uses that sense particularly well.
- Name one part of the nervous system. What is one of the functions?
- Name a disease associated with the nervous system

What is the NERVOUS SYSTEM?

The nervous system is the main control center of the animal's body. Think of it as the commander on the bridge of the Starship Information. The nervous system receives messages both from within the ship, and outside the ship (in our case, the body). It thinks about the messages, and then sends out commands to different parts of the ship to keep things running smoothly.

The final response can be a very complex movement, like a horse jumping a gate at The Royal Winter Fair, or a dog swimming to retrieve a fallen duck.

But, it could also be a very simple reflex, like blinking.



Hot = External Stimulus

Co-ordination

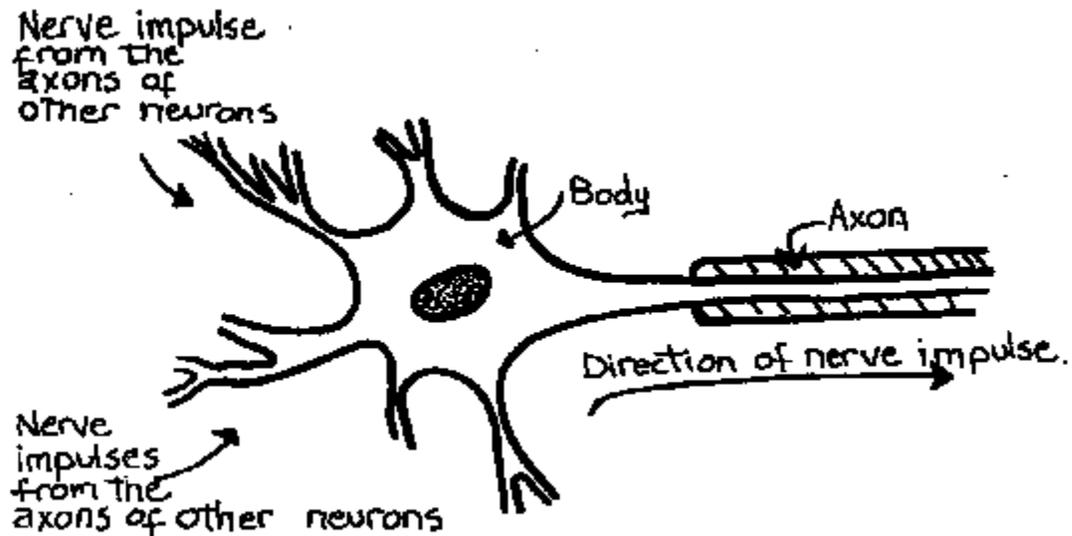
Response

Let's learn how the nervous system is organized to do these different jobs!

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:

A NEURON



Each neuron has a body. Inside the body is the nucleus, which is like the brain. It is the main processing center, as well as an axon, which sends out all of the nerve impulses or messages. When millions of these axons are bundled together, they form a long, white structure called a nerve. Nerves can usually be seen by the naked eye, although some nerves are very small and difficult or even impossible to see.

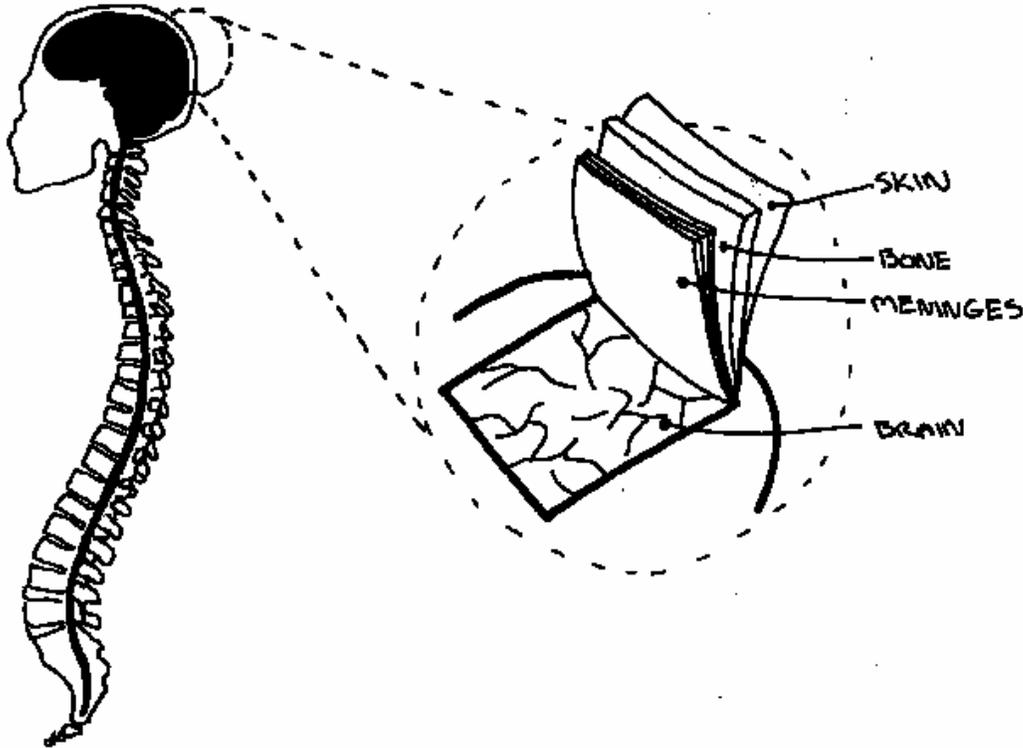
Think of the nervous system as having three main compartments or locations that work together:

- 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 Starship Information, the CNS is the main control bridge. The engineering deck, which oversees the proper running of all the other parts of the ship, is the PNS. The engineering deck always reports to the bridge 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 actually float in their protective cushions.



Here is a diagram of the CNS of a human, showing the skull, brain, vertebrae and spinal cord.

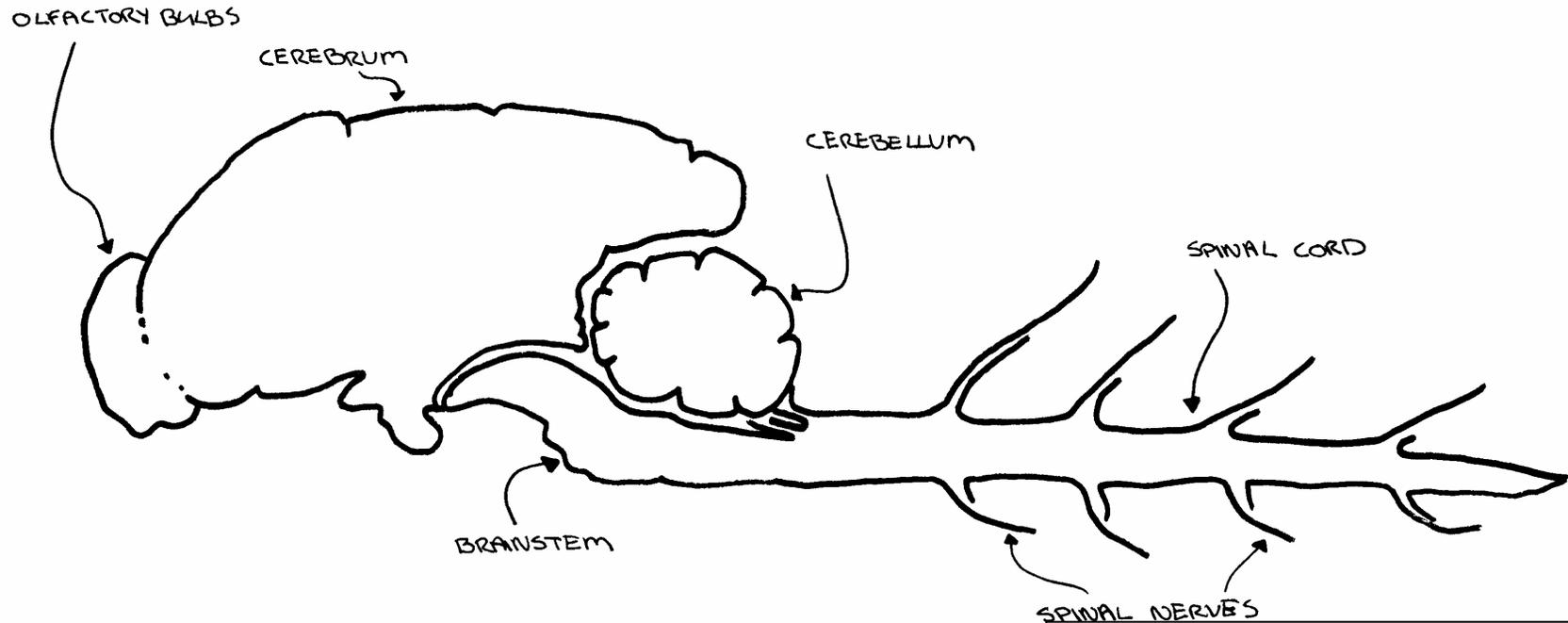
The main part of the CNS is the cerebrum. It is responsible for interpretation of sensory impulse and the exercise of emotion and thought. In humans, the cerebrum is highly developed. It is divided into halves, and at the front of each half is an olfactory bulb. The olfactory bulb is where your sense of smell is found. Animals with large olfactory bulbs have — you guessed it — a good sense of smell! (see *diagram on page 4*)

The cerebellum comes next. It is responsible for the regulation and coordination of complex voluntary muscular movement for balance and coordination. For example moving your arms.

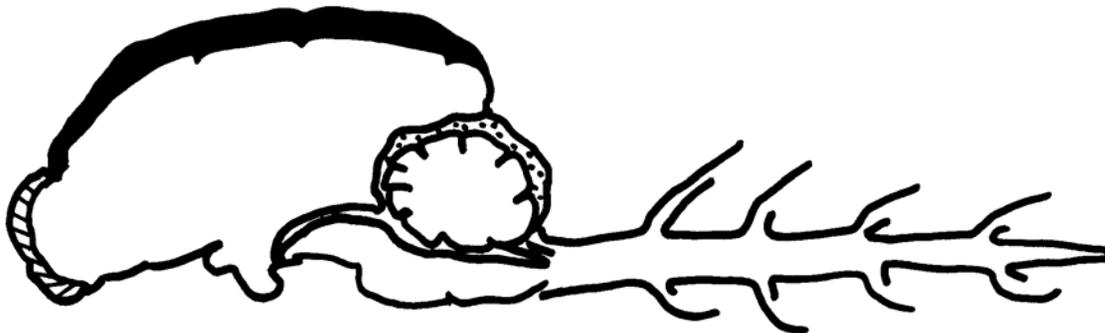
Just below the cerebellum is the brainstem. Despite the fact that not much "thinking" goes on here, this is the heart of the body's life support system. All major bodily functions such as breathing, growth and heartbeat are controlled here. It works by receiving messages coming into the brain, and then 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.

THE CENTRAL NERVOUS SYSTEM



THE RELATIVE SIZES OF THE DOG, CAT, HORSE AND HUMAN BRAINS



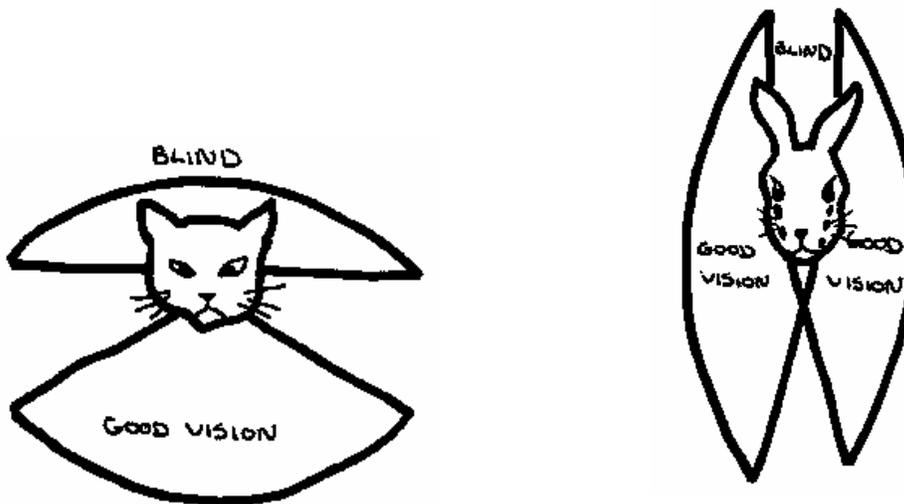
- 1= Human:**
 Larger cerebrum; "higher thinking"
- 2= Dog:**
 Larger olfactory bulbs; good sense of smell
- 3= Cat, Horse:**
 Larger cerebellum; good balance

The areas that are affected by the legend are the only areas that change drastically from each animal.

COMPARATIVE VISUAL FIELDS

Just as the olfactory bulbs of the brain are responsible for an animal's sense of smell, the visual cortex, in the cerebrum, allows animals to see. Damage to this area (ie. through a head injury) can result in blindness.

An animal's visual field — the area that it can see without moving its head — depends upon its role in the animal kingdom. Predators, such as the cat, have a fairly narrow field, straight ahead. They can focus very sharply on the object in front of them. Animals that are usually preyed, such as the rabbit, have a much wider field, so that they can see danger coming from all angles. Their focus, however, is not as good.



THE 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.

Specialized endings of the Peripheral Nervous System form the receptors that act as sensors and also 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.

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

THE 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.

Go CRAZY!

TRY THIS: CHECK DEXTERITY! HOW ARE YOUR REFLEXES?

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. 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 a dog does not react to a loud noise, it may be deaf or have a nervous disorder.

If a sow does not feel pain in her hind legs, she likely has a nervous disorder in her spinal cord.

Let's try some reflexes...

1. Can you make a friend blink? Sure you can! It's a reflex.
2. When you support a dog's hind leg under the thigh and tap below the knee, it will kick. You would too! It's a reflex.
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!
4. If you spin a friend round and round, he'll get dizzy. Quickly stop spinning him and look at his eyes. They should be "flicking" in the opposite direction. This is a reflex action of the inner ear attempting to maintain balance.



THE NERVOUS SYSTEM

“Disease Guide”

What is Rabies?

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 signs or symptoms 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.

TIP: 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, trappers).

What is Tetanus?

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 symptom.

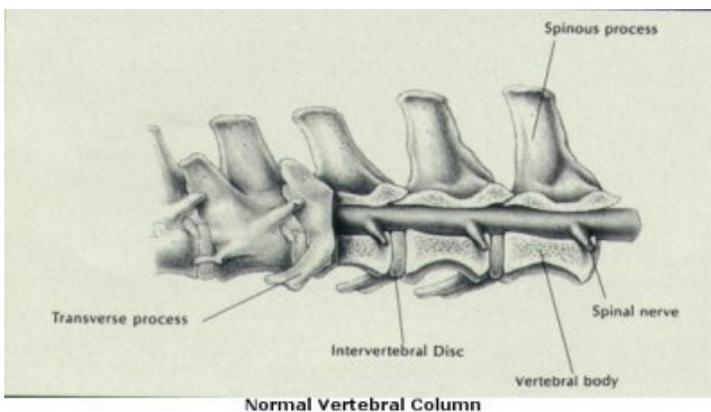


PREVENTION

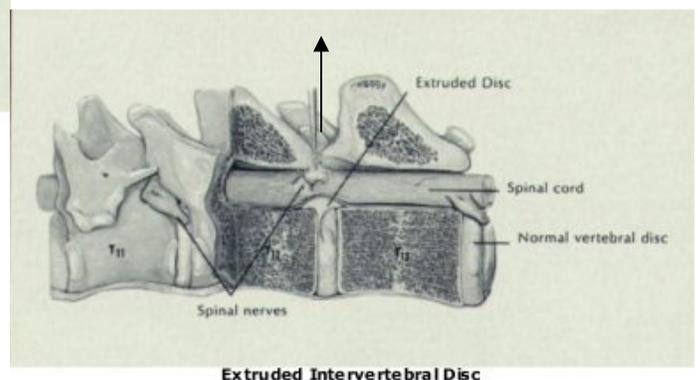
1. Cleaning all wounds well will reduce the risk of tetanus.
2. Humans and horses, including foals, should be routinely vaccinated.
3. Castration (removal of the testicles) and docking (cutting tail) of animals should be done as cleanly as possible, with sterilized instruments.
4. Use of disinfectants.

What is Intervertebral Disc Disease?

Most common neurological disorder, and results in extrusion of disk material into the vertebral canal with subsequent compression of the spinal cord or spinal nerve root. Most common in dogs, Dachshunds, Beagles, Pekingese, Poodles, Cocker Spaniels, Shih Tzus, and Welsh Corgis between 3 & 7 years of age.



(on the left, this is a normal spine. The space between the vertebral body is the part that ruptures)
 (At the bottom, the rupture has occurred putting pressure on the spinal cord, causing pain.)





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.)
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	Dogs and Cats	A common cause of spinal cord injury.	Supervise your pets.



Type of Disorder	Animal	Description	Prevention
Intervertebral Disc Disease	Dogs	This is common in older, overweight, shortlegged 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.



THE NERVOUS SYSTEM

Glossary

AUTONOMIC NERVOUS SYSTEM (ANS)	: the part of the nervous system that controls mandatory bodily actions.
CENTRAL NERVOUS SYSTEM (CNS)	: consists mainly of the brain, spinal cord, and the cerebrum. It basically controls all major body functions.
CEREBELLUM	: the part of the brain that acts as the coordination center of voluntary movement, posture, and equilibrium.
CEREBROSPINAL FLUID	: fluid of the brain and spinal cord.
CEREBRUM	: the upper part of the brain consisting of two hemispheres connected at the base.
CORTEX	: a distinctive outer layer of an organ.
DEXTERITY	: is a manual skill
EPILEPSY	: a chronic nervous affection characterized by sudden interruption of consciousness, sometimes accompanied by convulsions.
HYDROCEPHALUS	: an abnormal, usually congenital condition marked by an enlarged head and brain damage due to an accumulation of fluid within the cranium.
INTERVERTEBRAL DISC DISEASE	: results when a rupture occurs in the vertebral canal, which puts pressure on the spinal cord, causing pain.
LISTERIOSIS	: bacterial infection that causes abscesses in the brain and may cause the animal to abort.



MEMBRANE	: is a thin, pliable sheet of material. Normally a tissue serving as a cover, connection, or lining.
MENINGES	: the thin membranes enveloping the brain and spinal cord.
MENINGITIS	: inflammation of the meninges, often caused by infection.
NERVOUS SYSTEM	: the organized network of all the nerve cells in an organism.
NEURONS	: a nerve cell, consisting of a nucleated central body and two long processes.
OLFACTORY BULB	: pertaining to the sense of smell. The larger the bulb the greater sense of smell the animal possesses.
PERIPHERAL NERVOUS SYSTEM (PNS)	: all nervous system structures that are connected to the CNS. It is the sense and action area. It is directly linked to coordination.
RABIES	: an acute viral disease affecting the central nervous system of dogs, bats, and other warm blooded animals. It is transmissible to man by the bite of an infected animal.
SPINAL COLUMN	: a series of hollow, articulated bones that enclose the spinal cord and form the axis of the skeleton of a vertebrate animal.
SPINAL CORD	: the thick, soft cord of nerve tissue that is enclosed by the spinal column.
TETANUS	: an acute and often fatal infectious bacterial disease marked by spasmodic contraction of voluntary muscles, especially the muscles of the jaw.
VERTEBRA	: pl. vertebrae. Any of the individual bones of the spinal column.
WARBLES	: an infection of the spinal cord caused by fly larva.



WOBLER SYNDROME

: caused by instability in the vertebral column, this puts pressure on the spinal cord causing the animal to become uncoordinated.

REPRODUCTIVE SYSTEM



REPRODUCTIVE SYSTEM

ROLL CALL

- *What was the largest litter of animals you have seen? What type of animal was it?*
- *Name one structure of the female reproductive system. What is its function?*
- *Name one hormone involved in the reproductive system. Where does it come from and what is its function?*
- *What happens during the process of an embryo transfer? How is sperm collected to be used for artificial insemination?*
- *Name one method of measuring the reproductive health of a herd. How do you use it?*

"Learn to do by Doing"

ACTIVITIES

This section is very technical and would be best for the members to have some hands on experience.

Some possible ideas for this section are:

- 1) Call a large animal vet. Ask him to talk to your club about the reproductive system. The vet may bring a slide presentation or even props like a cows reproductive organs.
- 2) Call an Artificial Inseminator. See if they would do a demonstration at a farm or even some of their equipment for the members to see and try.
- 3) Visit a place like Gencor in Guelph. You would have to call and see if it was alright first but if you went to a place like this you could see how the semen is collected and the rest of the process that it goes through before it arrives at your farm with the AI Technician.
- 4) Visiting a cow-calf operation may be very informative. The members can learn about different setups and their pros and con's. They can then establish a mental picture of how they want their operation setup when they have their farm.
- 5) Depending on the group size, smaller group is recommended; you may be able to see an ultrasound of a pregnant animal.

REPRODUCTIVE SYSTEM

“Female –Basics”

ROLL CALL

- *What was the largest litter of animals you have seen?*
- *What type of animal was it?*

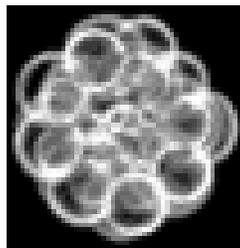
Every mammal has its own special way of producing offspring. The process is called reproduction. To be successful, it needs a healthy reproductive system. The reproductive system is a group of body parts called organs that work together to produce, carry and deliver an animal’s young into the world.

THE FEMALE SYSTEM

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.

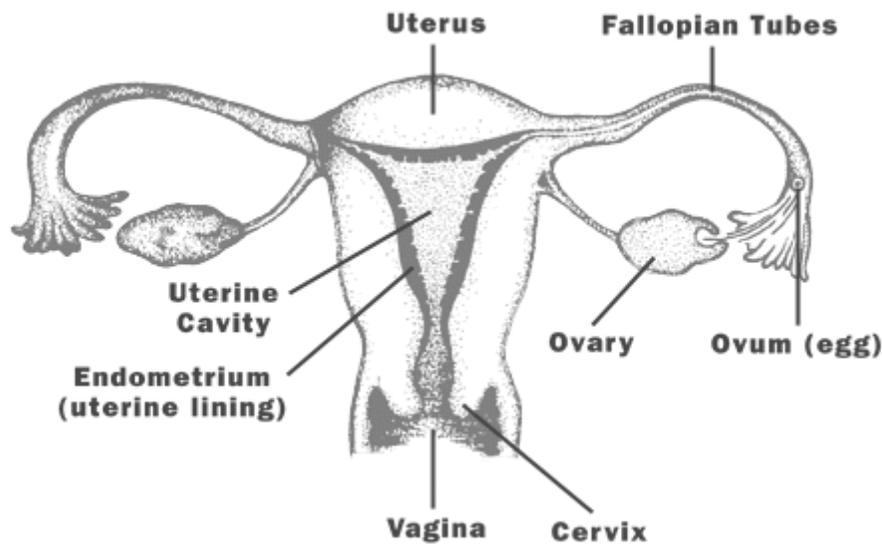
Once the egg is released it is picked up by the oviduct, also called the fallopian tube. The egg travels down this tube. If it meets up with a sperm cell from a male then fertilization occurs. This single cell is now ready to grow and develop into a newborn animal. The cell continues to divide into many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



<http://zygote.swarthmore.edu/other5.GIF>

The oviduct opens into the horns of the uterus, which then enters into 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 below for the structure of the female reproductive system. Try to identify the path an egg would take once released from the ovary.



<http://www.fda.gov/fdac/graphics/reprints/ovaries.gif>

Together to 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 also 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.

REPRODUCTIVE SYSTEM

“Male-Basics”

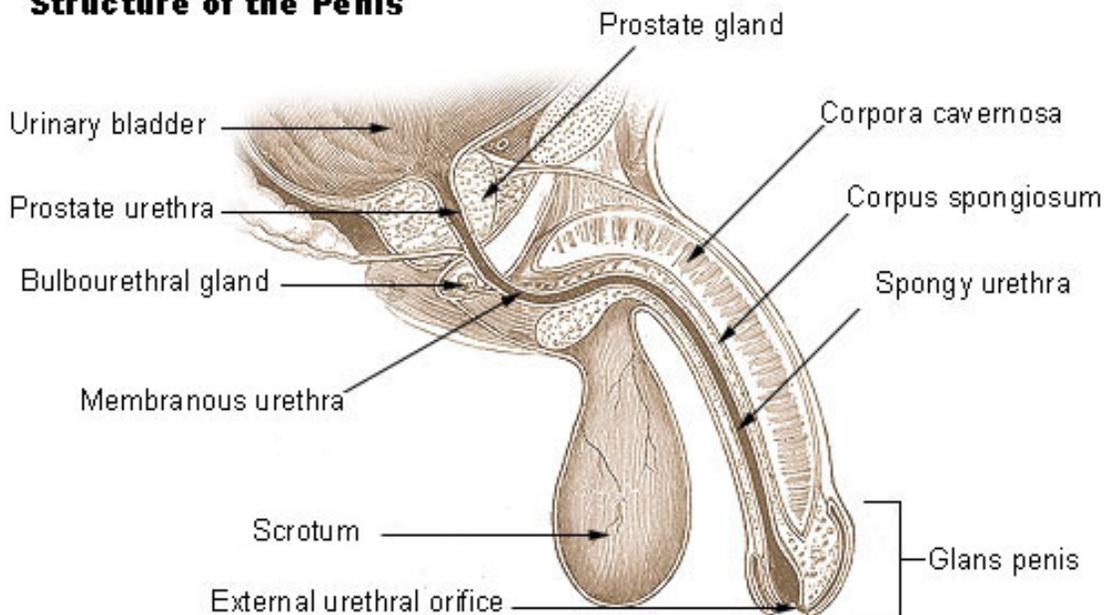
THE MALE SYSTEM

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**.

Structure of the Penis



BREEDING FAILURE

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 number of 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.

REPRODUCTIVE SYSTEM

“Female –Breeding and Pregnancy”

ROLL CALL
<ul style="list-style-type: none"> ➤ <i>Name one structure of the female reproductive system.</i> ➤ <i>What is its function?</i>

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 “in heat.” The behaviour of the female will change when she is in heat.
- The follicle(s) in the ovary release the ova (egg). This as you recall is ovulation.
- Each follicle forms a corpus luteum (C.L.). If fertilization does not occur the C.L. shrinks.
- 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.

SIGNS OF ESTRUS

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

The Pregnancy Cycle

- This cycle starts only if fertilization occurs.
- The C.L. does not shrink. Instead, it secretes hormones that tell the animal that it is pregnant.
- 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 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: 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, while a horse's lasts 330 days.

Man can artificially start the birth process in most animals, but what normally begins the process is unknown. It is thought to be 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 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.

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.

THE COLOSTRUM

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.

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.

HORMONES CONTROL THE CYCLES

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.

HORMONES INVOLVED IN THE REPRODUCTIVE SYSTEM

Hormone	Source	Principle Effect	Additional Information
Follicle Stimulating Hormone (FSH)	<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
Lutenizing 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

REPRODUCTIVE SYSTEM

“Female –Embryo Transfer and AI”

ROLL CALL

- Name one hormone involved in the reproductive system.
- Where does it come from and what is its function?

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 can have ten calves per year?!

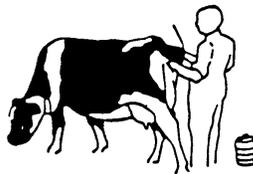
This is possible, but how? The answer to this is by using embryo transfer.

- To start the process a cow is injected with follicle stimulating hormone (FSH) for a number of 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 at a later time or transferred directly into another cow’s uterus by a method similar to 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:



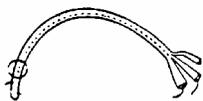
superovulation of donor cow



Artificial insemination 5 days later



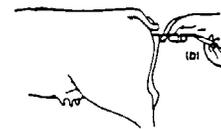
Flushing" of embryos 6 to 8 after artificial insemination



foley catheter for recovery of embryos



Isolation of embryos



Transfer of embryos to recipient cow

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 breeding 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.

REPRODUCTIVE SYSTEM

“Female –Measuring Reproductive Health”

ROLL CALL

- | |
|--|
| <ul style="list-style-type: none"> ➤ <i>What happens during the process of an embryo transfer?</i> ➤ <i>How is sperm collected to be used for artificial insemination?</i> |
|--|

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!

Some herd managers can keep all this information in their heads, but most people could not. Do you think you could keep this all in your head?

A record keeping system could be:

- a chalk board in the milk house
- a calendar
- health file cards
- breeding wheel
- 3 ring binder
- computer data file/spreadsheet

Whichever record system you choose it should be:

- simple so any one can use it
- easy to update
- able to summarize herd events
- able to pinpoint problem cows
- dust resistant
- inexpensive

COUNTING THE EVENTS

How can you measure the reproductive health of the heard?

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.

Here are some generally accepted yearly levels for Ontario:

< = less than

Disorder	Target Level	Action Level
metritis	< 5%	10%
retained placenta	<8%	12%
abortions	<2%	5%
still births	<3%	5%

However, there are problems with this method:

- you may not be able to find good target levels for your area
- the disorders do not usually happen frequently enough to allow you to get an idea of what is happening month by 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

***Note: You can compare your herd performance to figures that are available for herds enrolled in Ontario Dairy Herd Improvement Record Keeping System. ***

ADDITIONAL MEASURING METHODS

There are other methods to measure a herd's health:

- 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).

REPRODUCTIVE SYSTEM

“Female –Reproductive Failure”

ROLL CALL

- | |
|---|
| <ul style="list-style-type: none"> ➤ <i>Name one method of measuring the reproductive health of a herd.</i> ➤ <i>How do you use it?</i> |
|---|

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:** Most 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** → The embryo and fetus are susceptible to many types of infection.
 Some of these are:
Parvovirus - cat, swine, dog
Bovine Viral Diarrhea (BVD) - cattle
Equine Rhinopneumonitis - horses
Infectious Bovine Rhinotracheitis (IBR) - cattle
Leptospirosis - cattle, swine
- All of these 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.
- Stress** → Transportation, high temperatures, sickness of the pregnant female or poor nutrition could all stress the fetus enough to cause its death and abortion.

PREVENTION OF REPRODUCTIVE FAILURE

- Diagnosis** → 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.
- 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.

Vaccination

→ 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.

REPRODUCTIVE SYSTEM

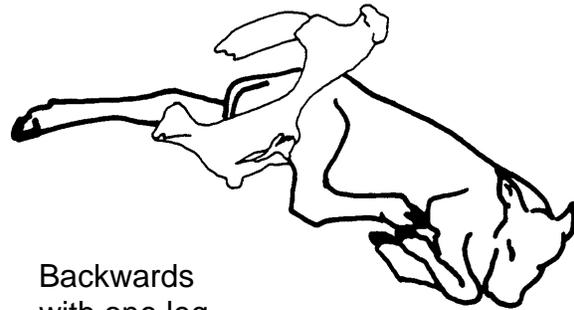
“Disease Guide”

There are many things that can go wrong during and after birth.

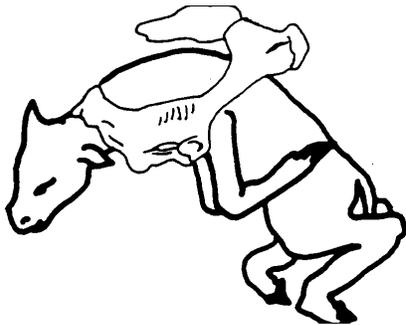
Dystocia:

-This means “a difficult birth” because the fetus did not come through the birth canal easily. The birth canal can be too small for the fetus or the fetus may have a leg or its head in the wrong position. This can cause the fetus to be stillborn (dead at birth) or weak.

THREE DIFFERENT DYSTOCIAS

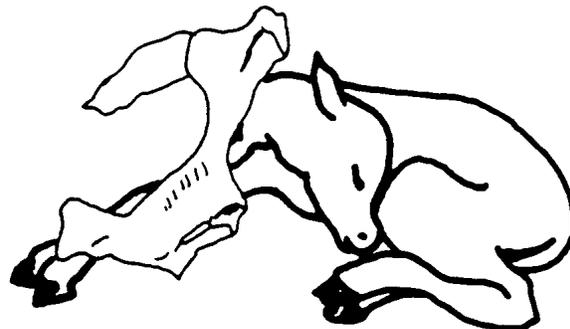


Backwards
with one leg
back.



Head back

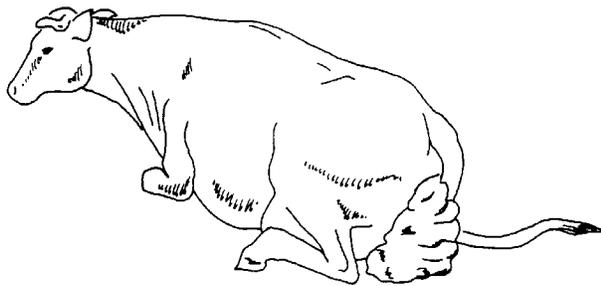
Frontwards with
the legs back.



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.

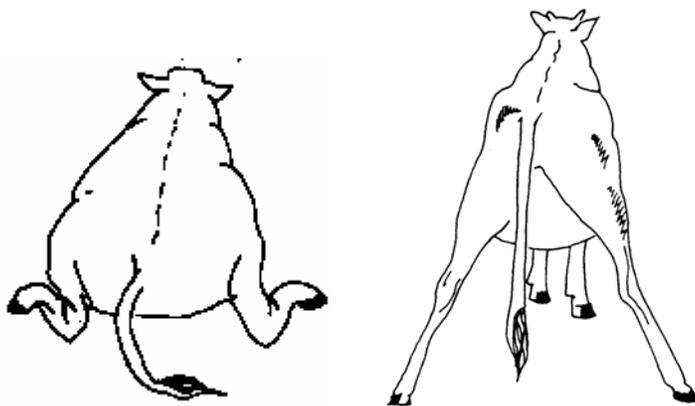
Prolapsed Uterus: -The uterus passes through the birth canal, turning inside out. It hangs from the vulva. This condition can be caused by a difficult birth or a low calcium level in cows after calving.



A PROLAPSED UTERUS IN A COW AFTER CALVING

The uterus turns inside out and pushes through the vulva.

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.



Nerve and muscle damage in cows after dystocia. They do not have proper control of their hind limbs.

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 mother 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 dystocias 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.

REPRODUCTIVE SYSTEM

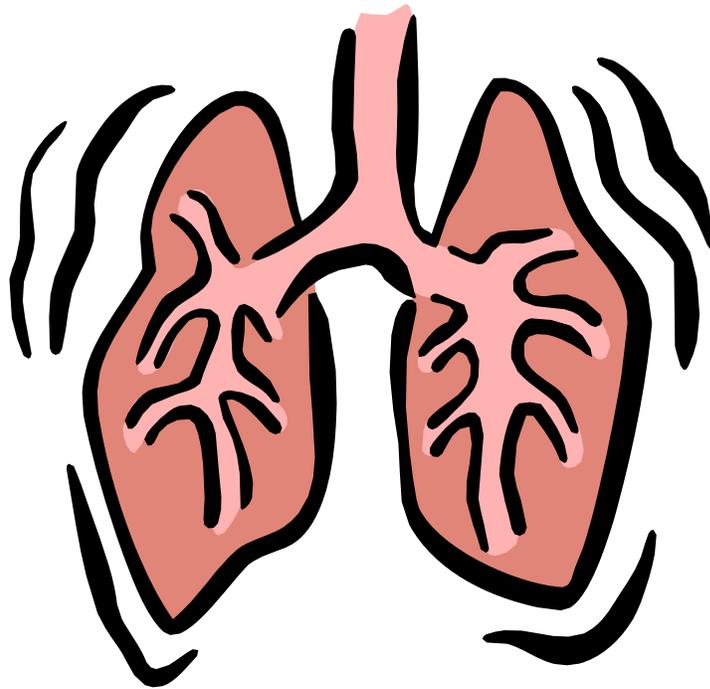
Glossary

ABORTIONS	: the expulsion of a fetus prematurely.
BIRTH	: the act or fact of being born.
CATHETER	: a slender tube for drawing off fluid from a body cavity.
CERVIX	: any neck like part, as the constricted end of the uterus.
CHROMOSOMES	: one of the rod-like bodies formed from chromatin in the nucleus during cell division, acting as a carrier of the genes or units of hereditary.
EMBRYO	: an animal in the early stages of development of the fertilized ovum.
ESTROGEN	: any of several hormones exercising a critical influence on the female sexual cycle.
ESTRUS	: the peak of the sexual cycle in animals, culminating in ovulation.
FALLOPIAN TUBE	: one of a pair of slender ducts that carry the ovum from the ovary to the uterus.
FERTILIZATION	: to render (an ovum) capable of growth, usually by fusion with a male gamete.
FETUS	: the young in the womb of animals.
FOLLICLE	: a small cavity or saclike structure.
IMPLANT	: to insert or graft in or onto living tissue.
LACTATION	: to form or secrete milk.

ORGANS	: a structure of specialized tissue in a plant or animal performing a definite function.
OVARY	: the genital organ of female animals in which produces the eggs and certain sex hormones.
OVIDUCT	: the passage through which ova are conveyed from an ovary.
OVULATION	: to produce and discharge ova from an ovary.
OVUM	: a female reproductive cell; an egg
PARVOVIRUS	: a tiny virus, containing DNA, occurring in various animals.
PALPATION	: to examine by touch.
PLACENTA	: in higher mammals, the vascular organ of interlocking fetal and maternal tissue by which the fetus is nourished in the uterus.
PREGNANCY	: the condition or a time of carrying developing offspring in the uterus.
PROGESTERONE	: an ovarian hormone active in preparing the uterus for reception of the fertilized ovum.
RECTUM	: the terminal part of the large intestine ending at the anus.
REPRODUCTIVE SYSTEM	: the system in which offspring are produced.
SEMEN	: the sperm containing fluid of male animals.
SPERM	: the male fertilizing fluid; semen. A male reproductive cell.
TESTOSTERONE	: a natural or synthetic male sex hormone.
ULTRASOUND	: very high sound waves bounce off the fetus and produce an image on the screen.
UMBILICAL CORD	: the ropelike structure connecting the navel of a fetus with the placenta.

- UTERUS** : the organ of a female mammal in which the fertilized ovum is deposited and develops until birth; womb.
- VAGINA** : the canal leading from the external genital orifice in female mammals to the uterus.
- VULVA** : the external genital parts of the female.
- WEANING** : to transfer the young from dependence on its mother's milk to another form of nourishment.

RESPIRATORY SYSTEM





THE RESPIRATORY SYSTEM

ROLL CALL

- 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.

"Learn to do by Doing"

ACTIVITIES

A) Lung Fun: A Demonstration Activity

Purpose: Members will be required to apply their knowledge of the respiratory system and make conclusions.

Required Materials: Two sets of lungs: one from a stillborn fetus, the other from a piglet that died shortly after birth.

Leader:

Place each set of lungs in a container of water and observe what happens. Help discover that once an animal has taken it's first breath, the lungs will never completely collapse (some air remains in the lungs). For this reason, the lungs belonging to the stillborn fetus will sink and the other will float.

(Your local butcher or dead stock facility maybe able to provide you with the pigs' lungs.)

B) Breathing in a Bag

Purpose: Members will gain a better understanding of gas exchange.

Required Materials: plastic bags

Leader: Instruct members to breathe into a bag. They will notice that their breathing rate increases. 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.



RESPIRATORY SYSTEM: DISEASE GUIDE-CASE STUDIES

PROBLEM# 1:

Dear Gaspy,
I've been having a lot of trouble breathing lately, particularly when I try to breathe out. I really don't know how it all started, but I've noticed that the man in the house also seems to suffer from the same complaint.
Signed: Easier in than out

What is wrong?

Solution:

Dear Easier In Than Out,
You may both have pulmonary emphysema. If serious, this can result in the rupture of some of the alveoli in the lungs.

PROBLEM# 2:

Dear Gaspy,
I'm a five year old collie. For the past four days I've been coughing and gagging quite badly. Others in my kennel have had the same problem. Most recovered after a week or so, but some have been coughing for over two weeks.
Signed: Doggone Worried

Should I worry about this?

Solution:

Dear Doggone Worried,
You are sick, but there's no need to worry too much. You have kennel cough, and as long as you are healthy and well cared for, you will recover just fine. Ask your owner or handlers to give you cough depressants to ease your coughing and gagging. You might also like to suggest that you be separated from any healthy dogs, so that you do not infect them.

PROBLEM# 3:

Dear Gaspy,
I feel awful! I have a fever, my eyes and nose are running, my throat hurts and I haven't been eating well. I'm even having a bit of trouble with coordination. Help!
Signed: Horse Alert

Solution:

Dear Horse Alert,
I am sure you feel horrible, but there is not much I can do to help. You have equine viral rhino-pneumonitis. Unfortunately, since your disease is viral



there is no treatment. Stay quiet, eat and drink as much as you can, and you should start to feel better soon.

PROBLEM# 4:

Dear Gaspy,

I'm a two-year-old Arabian, and I've been boarding at a second-rate stable for most of the summer. The past few weeks have been very hot and dry, and I'm beginning to have a lot of trouble breathing: breath comes in quickly, yet I have to force the air back out of my lungs. All of this makes me very tired most of the time.

Signed: All tuckered out

What's wrong with me?

Solution:

Dear All Tuckered Out,

Sounds like a classic case of heaves to me. You've probably been breathing in dust from mouldy hay, stable dust and bedding, and this has irritated your lungs. Unfortunately, you're in for a long bout of heaves before you recover. Be sure that you are kept in a dust-free barn for now on, and ask your owner to discuss possible treatments or medicines with the veterinarian.

PROBLEM# 5:

Dear Gaspy,

I am a young piglet. My brothers and sisters and I are always sneezing and sniffing. When I looked in the mirror this morning I saw that my nose was starting to go crooked.

Signed: Almost Out Of Kleenex

What is the matter with me? What can I tell my owner to do to help me?

Solution:

Dear Almost Out Of Kleenex,

You probably have atrophic rhinitis. Ask your owner to provide you with good ventilation and a warm, dry, draft-free environment. As well, ask him or her to keep your pen clean and not crowd you with a lot of fellow piglets.

PROBLEM# 6:

Dear Gaspy,

I am a two-month old calf that lives with my friends in the passageway just behind our mothers. I always feel cold because it is drafty where I live. I often cough a lot and feel as if I have a fever. Some of my friends have also been quite sick.

Signed: Can't Stop Shivering



Can you tell me if I have a bad disease? Where can I move so that I'll at least be warm?

Solution:

Dear Can't Stop Shivering,
You probably have enzootic pneumonia. Living in the passageway behind your mother will make your disease worse. Ask to move to a calf barn with your friends where it is warm and dry, or outside into a calf hutch.

PROBLEM# 7:

Dear Gaspy,
We are beef calves born in Alberta. We arrived in Ontario at a feedlot two weeks ago. We were just weaned from our mothers before getting on the truck, and the weather all the way here was cold, wet and windy. For the last week we haven't felt like eating and we've had trouble breathing. We think we have pneumonia.
Signed: It Hurts To Breathe

What advice can we send to our friends back home who will be leaving for Ontario in three weeks time?

Solution:

Dear It Hurts To Breathe,
Suggest to your friends that they ask to be weaned now so that they have some time to adjust to being away from their mothers. Starting to use weaning troughs and feed bunks would be a big help. Have them ask for a quick trip to Ontario so that the weather does not bother them as much. Relax, eat and drink well before leaving to help lesson the stress.

REVIEW ACTIVITY - CROSSWORD PUZZLE

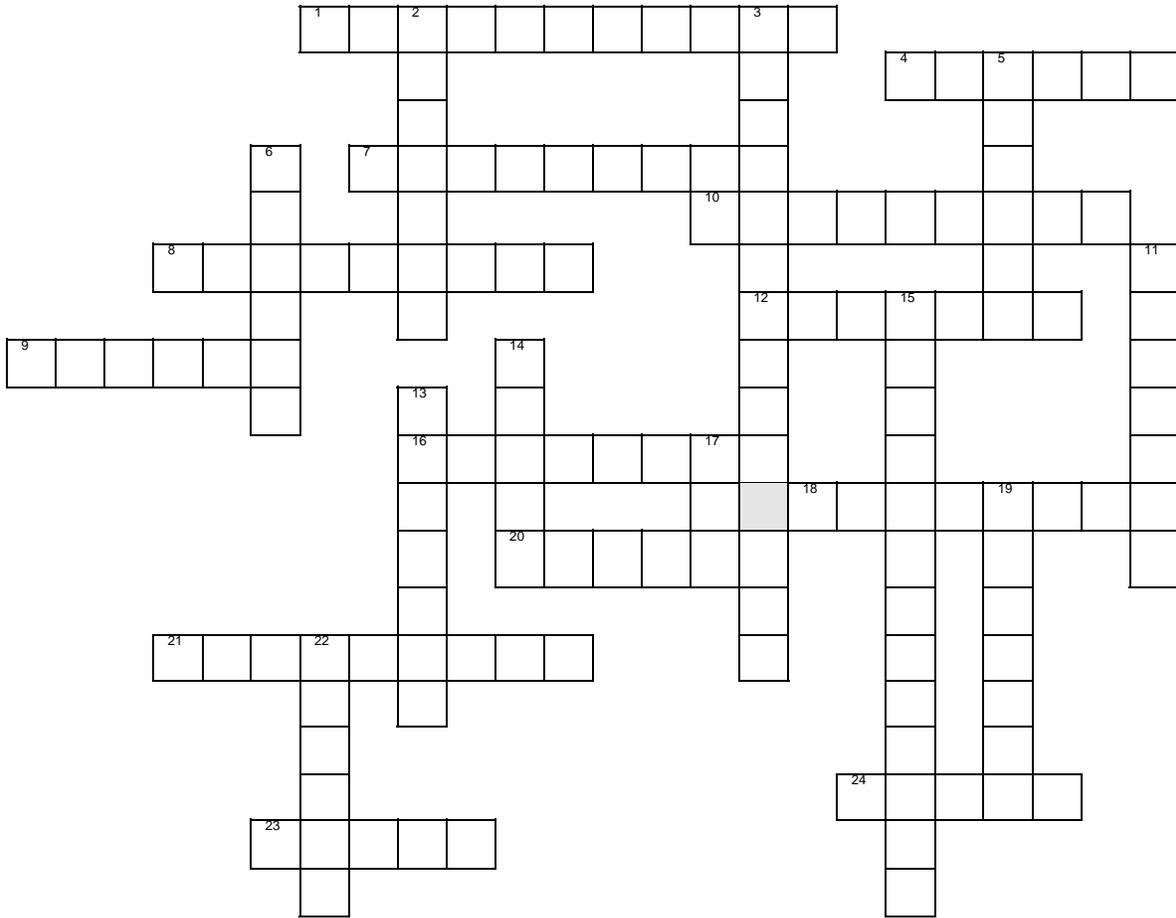
ANSWERS

ACROSS

1. Capillaries
4. Twenty
7. Bronchi
8. Turbinate
9. Oxygen
10. Olfaction
12. Trachea
16. Nostrils
18. Thoracic
20. Larynx
21. Diaphragm
23. Brain
24. Cilia

DOWN

2. Pharynx
3. Epiglottis
5. Expire
6. Syrinx
11. Airsacs
13. Inspire
14. Nasal
15. Carbon dioxide
17. Lungs
19. Alveoli
22. Pleura



ACROSS

1. Tiny blood vessels in the lungs.
4. Average respiratory rate in a cow.
7. Trachea divides into these structures.
8. Bones in the nose.
9. Exchanged for "15 down" in the lungs.
10. Sense of smell.
12. Flexible tube.
16. Two in number.
18. _____ cavity.
20. Cartilages and muscles.
21. Muscular wall between chest and abdomen.
23. Control of breathing.
24. Tiny hairs on cells which wave back and forth.

DOWN

2. Shared between respiratory and digestive systems.
3. Protects entrance to larynx.
5. Opposite of "13 down".
6. Voice production in a bird.
11. Only in birds (2 words).
13. Air in.
14. _____ cavity - contains hairs and special bones.
15. Waste product produced in the body (2 words).
17. Soft and spongy.
19. Thin walled sacs in the lung.
22. Thin membranes covering the lungs.





THE RESPIRATORY SYSTEM

"As Vital as the Air we Breathe"

ROLL CALL
<ul style="list-style-type: none">➤ <i>Name one part or function of the respiratory system.</i>➤ <i>Name one problem of the respiratory system that you or a family member has had.</i>➤ <i>Name one thing in the air that you or your animal(s) should not breathe.</i>

What does the Respiratory system do?

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.

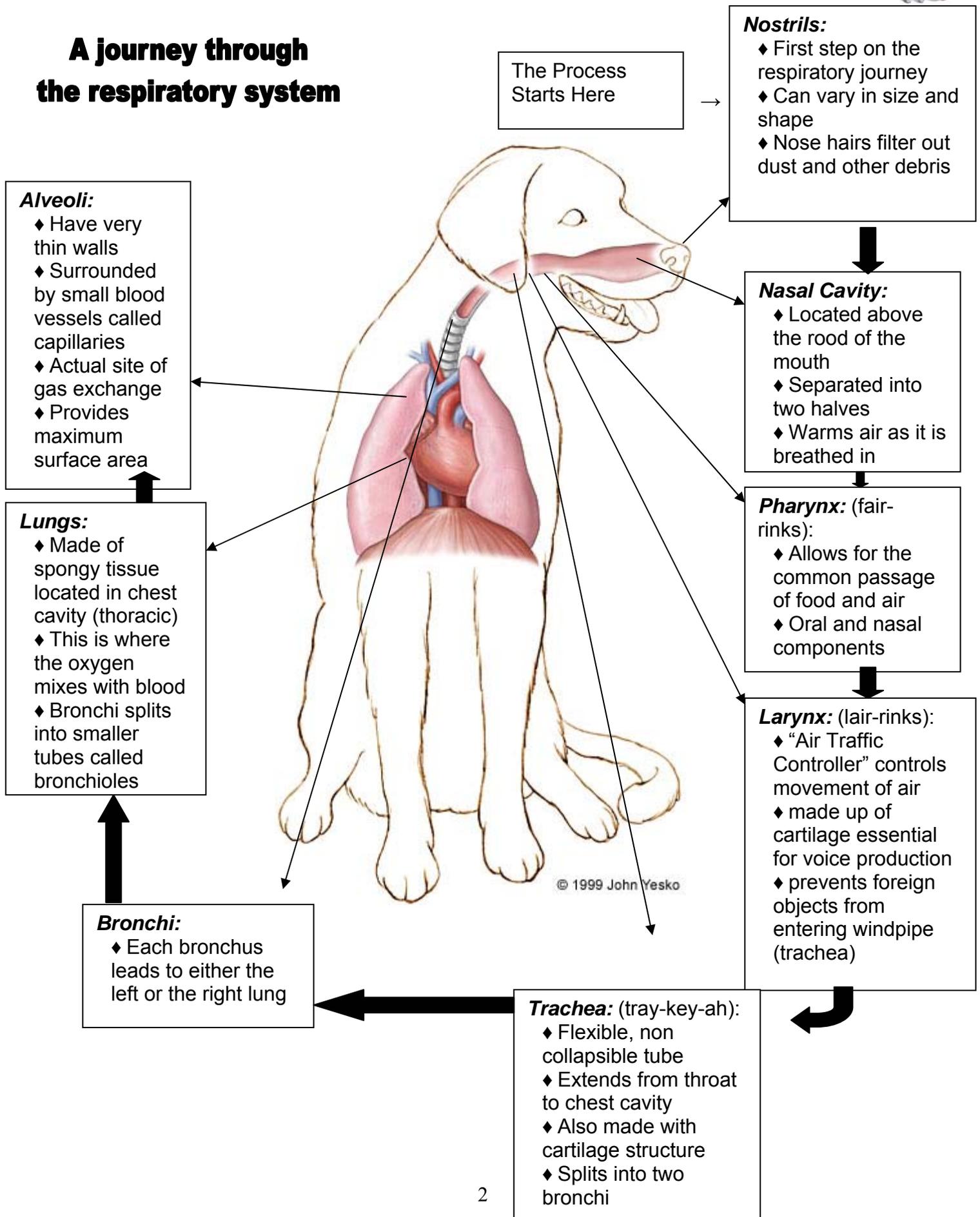
Many parts of the body work together to form the respiratory system. Together they allow for gas exchange by creating a pathway for air to move from the environment (outside) into your body, and then out again.

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:



A journey through the respiratory system



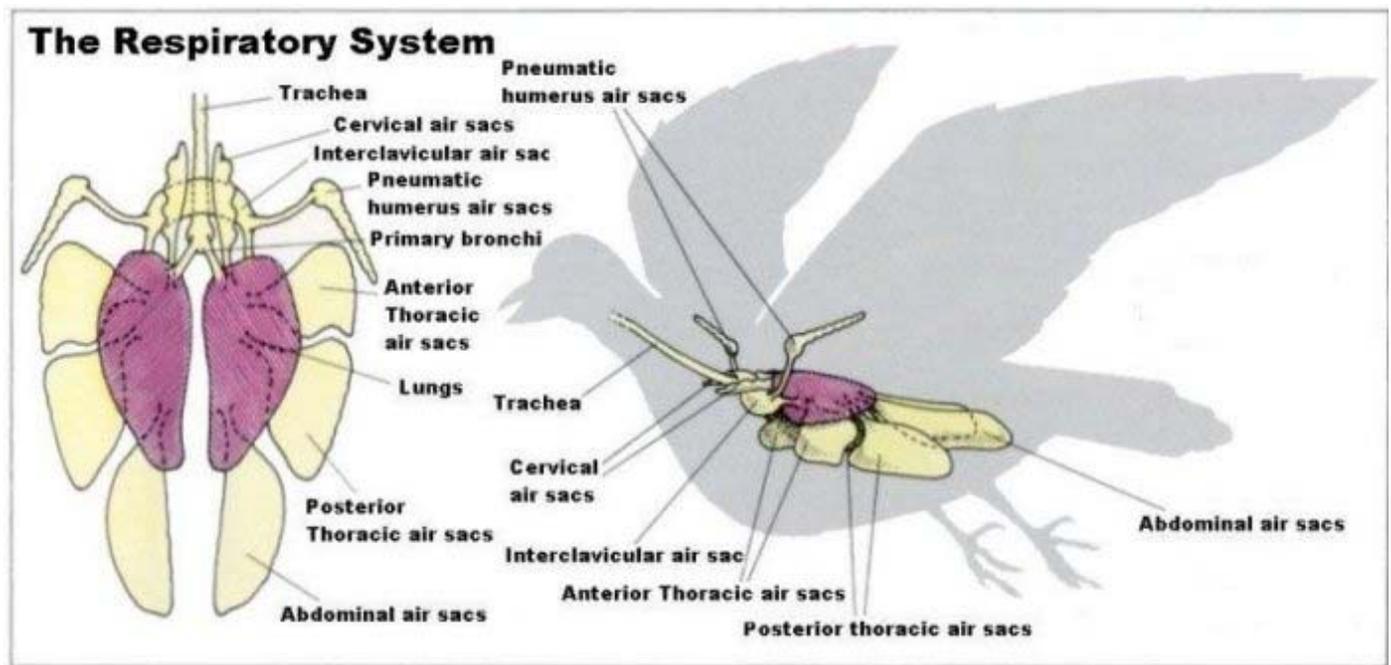


Birds are a little different

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

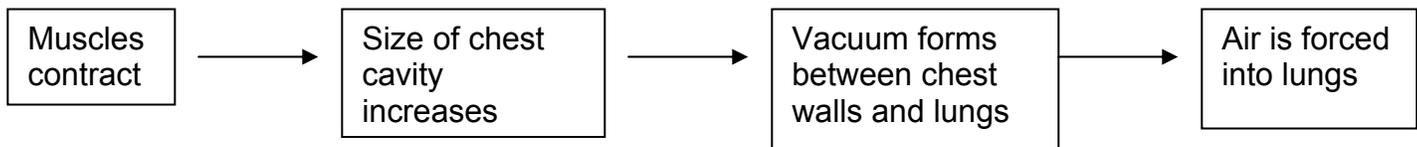




A little bit of inspiration...

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

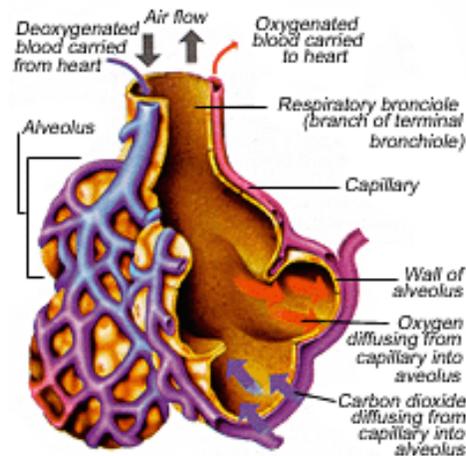
INSPIRATION is done by your muscles. The muscles used include the diaphragm, the intercostal muscles (between the ribs), and the abdominal muscles.



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 flow enters the pulmonary vein and the oxygen is carried to the heart, where it is distributed to the rest of the body.





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
 - nasal hairs, mucous membranes, and the cough reflex

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. 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



Go CRAZY!

TRY THIS: HOW IS YOUR BREATHING?

You can increase the length of time that you can hold your breath. If you breathe deeply for one minute and then fill your lungs with as much oxygen as possible, you will be able to hold your breath for a longer time than if you hadn't performed this exercise.

DID YOU KNOW?

Yawning helps respiration by getting more air into the lungs. The yawn is essentially an exceedingly deep inspiration and involves most of the muscles of the body.

Muscles that are involved in flight contain chemicals that carry oxygen. These chemicals give the tissue a reddish colour – you know it as dark meat! The rest is “white meat”.

You have 300,000,000 alveoli in each lung! If all the alveoli in the lungs of an adult man were spread out the surface area would be approximately equal to the size of a TENNIS COURT!!



THE RESPIRATORY SYSTEM

“Disease Guide”

The charts to follow explain all of the diseases and what they are from a medical stand point.

VACCINATIONS

These are a way of controlling or preventing the diseases. 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 comes in contact with the disease in the future.

Pet vaccinations can protect against the following: rabies, distemper, hepatitis, parvovirus infection and tetanus. Therefore, 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, who must now nurse the sick animals.
4. Death of animals.
5. Cost of medication.

ENZOOTIC PNEUMONIA OF CALVES (en-zu-aht-ik nu-mo-nee-ah)

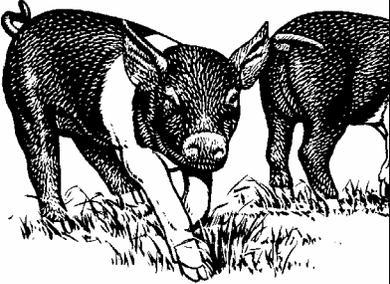


- The most common type of infectious pneumonia, occurring in calves up to 6 months of age.
- Occurs when calves are housed in a damp, drafty environment.
- Characterized by a harsh dry cough, increased respiratory rate and fever. Though calves often continue to eat and drink.
- Damages the lungs, which 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 free of drafts.
- This disease is carried by adult cattle, and so moving calves to a calf barn or outdoor hutches immediately after birth offers added protection.



<p>INFECTIOUS BOVINE RHINOTRACHEITIS (I.B.R.) (ry-no-tray-kee-eye-tis)</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>	<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 prevent the occurrence of shipping fever.
<p>ATROPHIC RHINITIS (Ah-tro-fik ri-ny-tis)</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 "bull-nose".) • 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> 	<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 mycoplasmal 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 become so bad that the farmer must sell all of the pigs and start over. • Good barn management practices are the key to keeping this disease under control.
<p>ACTINOBACILLUS (Ak-ti-no-bah-sil-us) PLEUROPNEUMONIA (Ploor-o-nu-mo-nee-ah)</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.



DISEASES THAT AFFECT HUMANS

<p>FARMER'S LUNG</p> 	<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.
<p>BRONCHITIS</p>	<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.
<p>SILO FILLER'S DISEASE</p>	<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 most deadly 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).

COMMON CONDITIONS AND DISEASES

Type of Disease	Description
Nose Bleed	<ul style="list-style-type: none"> ▪ Epistaxis (epp-is-tax-is) is the fancy name. ▪ Occasionally occurs in an animal when one or more of the many small blood vessels in the lining of the nose breaks. ▪ Most often seen in race horses during races, possibly because of the increased blood pressure that accompanies great physical exertion.
Sore Throat	<ul style="list-style-type: none"> ▪ Technically referred to as pharyngitis (fare-in-jy-tis). ▪ An inflammation of the pharynx. ▪ May lead to tonsillitis.
Bronchitis (brong-ky-tis)	<ul style="list-style-type: none"> ▪ An inflammation of the bronchi. ▪ May lead to pneumonia, pleurisy or both.
PLEURISY (ploo-ry-see)	<ul style="list-style-type: none"> ▪ Also called pleuritis. ▪ An inflammation of the pleura (the lining on the outside of the lungs and inside of the chest cavity). ▪ May produce a rasping sound with each breath as the roughened surfaces rub together. ▪ Usually very painful.
PNEUMONIA (nu-mo-ne-ah)	<ul style="list-style-type: none"> ▪ An inflammation of the lung tissue. ▪ Noninfectious pneumonia can be caused by the inhalation of feed, water or improperly administered medication. ▪ Infectious pneumonia is commonly caused by bacteria or viruses, and can also be caused by parasites such as lungworms.
PULMONARY EMPHYSEMA (em'fi-se'mah)	<ul style="list-style-type: none"> ▪ Characterized by the enlargement of alveoli to the point where some of them rupture. Air then escapes into the lung tissue, resulting in difficult expiration.

COMMON CONDITIONS AND DISEASES PARTICULAR TO CERTAIN ANIMALS

	DISEASE	CAUSE	CHARACTERISTICS AND SYMPTOMS	TREATMENT	CONTROL
D O G	KENNEL COUGH (Infectious tracheo-bronchitis) (tra"ke-o-brong-ki'tis)	Virus with bacterial complications	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • Isolation of sick dogs from those that are healthy. • Cough depressants and possible antibiotics (if disease is complicated by a bacterial infection). 	<ul style="list-style-type: none"> • Prevented by vaccination of healthy puppies and dogs.



<p>C A T</p>	<p>FELINE RHINO-TRACHEITIS ("cold") (ri"no-tra"ke-i'tis)</p>	<p>Virus, often part of a complex of respiratory diseases.</p>	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • Frequent cleaning of discharges from eyes and nose to make cat comfortable • Antibiotics (if bacterial infections complicate the disease). 	<ul style="list-style-type: none"> • Prevented by vaccination of healthy kittens and cats.
<p>H O R S E</p>	<p>EQUINE VIRAL RHINO-PNEUMONITIS (EVR) (ri"no-nu"mo-ni'tis)</p>	<p>Virus</p>	<ul style="list-style-type: none"> • 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. Constipation followed by diarrhea may sometimes occur. • Nervous signs may develop - horse has poor muscle coordination to point of being paralyzed in hind limbs. • Disease may cause pregnant mares to abort - particularly in 8th to 11th month. 	<ul style="list-style-type: none"> • None if virus infection alone. • Antibiotics if bacterial complications occur. 	<ul style="list-style-type: none"> • Vaccines used to control disease. (However cases reported where prevention of both respiratory signs and abortion is not total.)



H O R S E	HEAVES (Chronic Alveolar Emphysema)	<p>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.</p>	<ul style="list-style-type: none"> • A chronic (long-lasting) non-infectious respiratory disease. • Affected horse has difficulty breathing: inspirations are hurried, 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"). • Chronic cough, unthrifty, lacks stamina and often a nasal discharge. • Signs are worse in hot, dry weather with dusty conditions. 	<ul style="list-style-type: none"> • Keep horse in dust-free surroundings (dampen feed and bedding). • Medications may be used under direction of veterinarian. 	<ul style="list-style-type: none"> • Do not expose to inhaled allergens.
----------------------------------	-------------------------------------	--	--	---	---

RESPIRATORY SYSTEM: DISEASE GUIDE-Case Studies

Problem # 1

Dear Gaspy,

I've been having a lot of trouble breathing lately, particularly when I try to breathe out. I really don't know how it all started, but I've noticed that the man in the house also seem to suffer from the same complaint.

Signed: Easier In Than Out

What is Worng?

Problem # 2

Dear Gaspy,

I'm a five year old collie. For the past four days I've been coughing and gagging quite badly. Others in my kennel have had the same problem. Most recovered after a week or so, but some have been coughing for over two weeks.

Signed: Doggone Worried

Should I worry about this?

Problem # 3

Dear Gaspy,

I feel awful! I have a fever, my eyes and nose are running, my throat hurts and I have not been eating well. I am even having a bit of trouble with coordination. Help!

Signed: Horse Alert

Problem # 4

Dear Gaspy,

I am a two-year-old Arabian, and I've been boarding at a second-rate stable for most of the summer. The past few weeks have been very hot and dry, and I am beginning to have a lot of trouble breathing: Breath comes in quickly, yet I have to force the air back out of my lungs. All of this makes me very tired most of the time.

Signed: All Tuckered Out

What's wrong with me?

Problem # 5

Dear Gaspy,

I am a young piglet. My brothers and sisters and I are always sneezing and sniffing. When I looked in the mirror this morning I saw that my nose was starting to go crooked.

Signed: Almost Out Of Kleenex

What is the matter with me? What can I tell my owner to do to help me?

Problem # 6

Dear Gaspy,

I am a two-month old calf that lives with my friends in the passageway just behind our mothers. I always feel cold because it is drafty where I live. I often cough a lot and feel as if I have a fever. Some of my friend have also been quite sick.

Signed: Can't Stop Shivering

Can you tell me if I have a bad disease? Where can I move so that I'll at least be warm?

Problem # 7

Dear Gaspy,

We are beef calves born in Alberta. We arrived in Ontario at a feedlot two weeks ago. We were just weaned before we got on the truck, and the weather all the way here was very cold, wet and windy. For the last week I have felt like eating and we've had trouble breathing. We think we have pneumonia.

Signed: It Hurts To Breathe

What advice can we send to our friends back home whom will be leaving for Ontario in three time?



THE RESPIRATORY SYSTEM GLOSSARY

ACTINOBACILLUS PLEUROPNEUMONIA	: an infectious bacterial disease of pigs, affecting lung tissue and the membrane (pleura) covering the lungs and chest cavity.
AIR SACS	: thin-walled sacs found in birds, extending from the chest to organs and bones.
ALVEOLI	: (singular: alveolus) small sacs in the lungs through whose walls the exchange of carbon dioxide and oxygen occurs.
ANTIBIOTIC	: a chemical substance used in the treatment of bacterial infection.
ANTIBODIES	: naturally occurring molecules in the body whose function is to fight off infection or disease.
ATROPHIC RHINITIS	: bacterial disease of pigs that attacks the turbinate bones and changes the shape of the nose.
BACTERIA	: microorganisms occurring in animal tissue, soil, water and organic material. Some are useful. Some produce disease.
BRONCHI	: (singular: bronchus) the larger passages conveying air to the lungs.
BRONCHIOLES	: the finer branches from the bronchi to the alveoli
BRONCHITIS	: inflammation of one or more bronchi.
CAPILLARIES	: small vessels connecting veins and arteries, the walls of which act as a membrane for the exchange of gases.
CARTILAGE	: elastic tissue serving many of the same purposes of bone; gristle.
CILIA	: (singular: cilium) microscopic hairs attached to individual cells that move in a wave-like fashion.
DIAPHRAGM	: the muscular partition separating the abdominal and thoracic cavities.



ENZOOTIC PNEUMONIA OF CALVES	: infectious disease of the lungs in calves up to six months of age.
ENZOOTIC PNEUMONIA OF PIGS	: common infectious disease of the respiratory tract in pigs.
EPIGLOTTIS	: the lid-like cartilage at the entrance to the larynx, guarding it during swallowing.
EQUINE VIRAL RHINO-PNEUMONITIS	: an infectious viral disease of horses that leads to fever, sore throat, cough and poor appetite; can cause abortion in mares.
ESOPHAGUS	: the tube extending from the pharynx to the stomach.
EXPIRATION	: the act of breathing out.
FARMER'S LUNG	: acute allergic response in humans to a variety of dusts such as those from mouldy hay, straw and grains.
FELINE RHINOTRACHEITIS	: infectious viral disease in cats marked by cold symptoms that can lead to more serious complications.
HEAVES	: a long-lasting, non-infectious disease of horses, thought to be caused in part by an allergic response to inhaled substances.
INFECTIOUS BOVINE RHINOTRACHEITIS	: an infectious viral disease of beef and dairy cattle that attacks the nasal passages and trachea; can cause abortion in cows.
INSPIRATION	: the act of breathing in.
KENNEL COUGH	: infectious viral disease of dogs affecting the trachea and bronchi, resulting in a harsh dry cough.
LARYNX	: the air passage (gate) between the pharynx and the trachea; primarily guards the entrance into the trachea and secondarily is responsible for voice (vocal cords)
LIGAMENTS	: string-like tissue that connects bones or cartilages.
LUNGS	: the organs of respiration, where gas exchange occurs.
MEDULLA OBLONGATA	: part of the brain, located on the brain stem just above the spinal cord, at the back of the neck (eg. mouth, nasal cavity, ear canal, etc.).
MUCUS MEMBRANE	: the moist lining of various canals and cavities of the body.

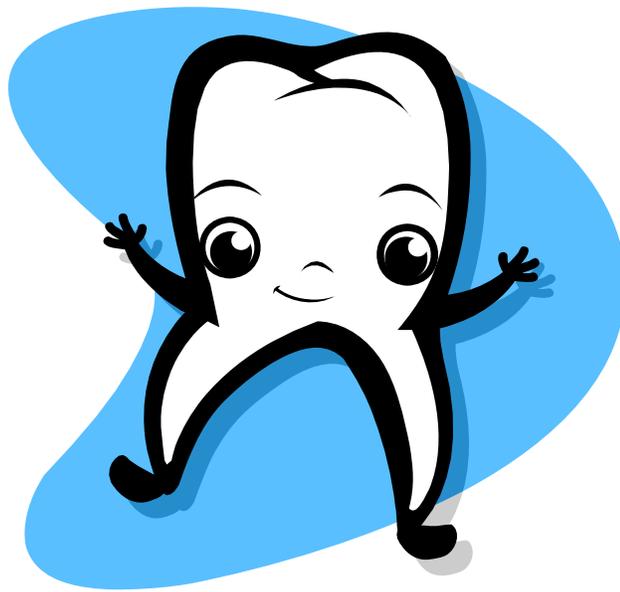


NASAL CAVITY	: the upper part of the respiratory tract, separated into halves by the nasal septum and extending from the nostrils to the pharynx.
NASAL SEPTUM	: the partition between the two nasal cavities.
NOSTRILS	: also called nares; the external openings of the nasal cavity.
OLFACTION	: the sense or act of smelling.
ORAL CAVITY	: the hollow of the mouth.
PHARYNX	: the throat; the hollow behind the nasal cavity, mouth and larynx that communicates with them and the esophagus.
PLEURA	: the membrane covering the lungs and lining the walls of the thorax. It produces a small amount of fluid to act as a lubricant to allow the lungs to inflate/deflate easily.
PLEURISY	: inflammation of the pleura.
PNEUMONIA	: inflammation of the lungs, with fluid that subsequently hardens.
PULMONARY	: pertaining to the lungs.
PULMONARY EMPHYSEMA	: abnormal increase in the size of the alveoli to the point where some of them rupture.
SHIPPING FEVER PNEUMONIA	: a respiratory disease that usually occurs in young cattle as the result of both a bacterial infection and stress.
SILO FILLER'S DISEASE	: fluid accumulation and scarring in the lungs of humans, due to exposure to the nitrogen oxides present in some silos.
STERNUM	: long flat bone forming the front wall of the chest (breast bone).
SYRINX	: the lower part of the trachea of birds, where vocal sounds are produced.
THORACIC CAVITY	: the hollow between the neck and the diaphragm that contains the lungs and heart; also called thorax or chest.
THORAX	: the thoracic cavity or chest.
TONSILLITIS	: inflammation of the tonsils.



- TRACHEA** : the windpipe or tube descending from the larynx and branching into the left and right main bronchi.
- TURBINATE BONES** : bones in the nasal cavity shaped like a top or spiral.
- VACCINE** : attenuated (weakened) or killed microorganism whose purpose, when administered to the animal, is to produce immunity.
- VIRUS** : a minute infectious agent that can produce a disease in the animal.

TEETH



THE TEETH

ROLL CALL

- | |
|--|
| <ul style="list-style-type: none">➤ <i>Have you ever had a cavity? How was it treated?</i>➤ <i>Why is it important to visit the dentist regularly?</i>➤ <i>List one thing you do to take care of your teeth or your animal(s)'s teeth.</i> |
|--|

"Learn to do by Doing"

ACTIVITIES

- 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) Call a vet and ask him to brief the group on how important proper dental care is to your animals well being.

- 3) Find different teeth of varies 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.

THE TEETH

ROLL CALL

- *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.*

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

The appearance of teeth occurs at different times in different species.

 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 all permanent teeth are in.

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.

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, periodontis and gingivitis. Plaque is the major cause of periodontis 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.

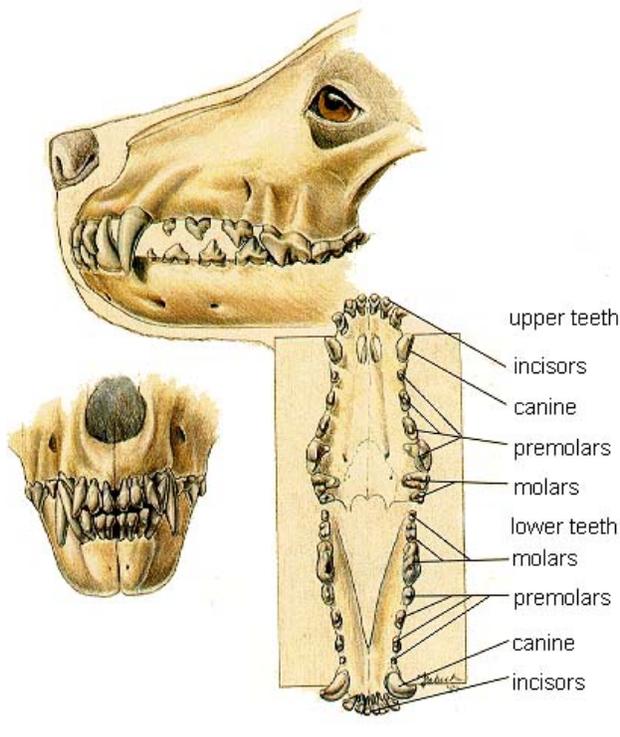
Bad Breath: Not Just Bad Teeth and Gums...

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.

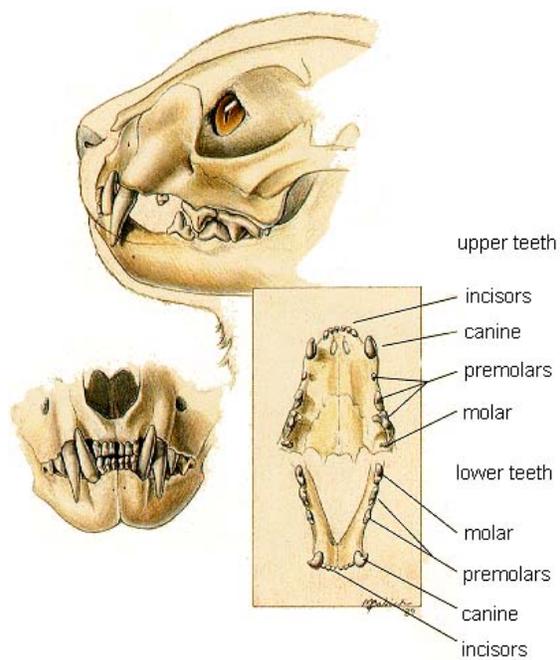
Both plaque and tarter can damage the teeth and gums. Disease starts with the gums – they become inflamed (red, swollen, and sore). The gums finally separate from the teeth, creating pockets where more bacteria, plaque and tartar build up. This in turn causes more damage, and finally it causes tooth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

PROBLEM	CAUSE	EFFECT	TREATMENT	RECOVERY
1. Losing several teeth, often sheep and goats "broken mouth"	Old age.	Difficulty eating and subsequent weight loss likely.	None.	None.
2. 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.
3. 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.

THE TEETH

Glossary

CANINE	: a pointed conical tooth located between the incisors and the first bicuspids.
CAVITY	: a pitted area in a tooth caused by caries.
DENTIN	: the main, calcareous part of a tooth, beneath the enamel and surrounding the pulp chamber and root canals.
DENTISTRY	: the science concerned with the diagnosis, prevention, and treatment of diseases of the teeth, gums, and related structures of the mouth including the repair or replacement of defective teeth.
GINGIVITIS	: inflammation of the gums, characterized by redness and swelling.
INCISORS	: a tooth adapted for cutting or gnawing, located at the front of the mouth along the apex of the dental arch.
MOLARS	: a tooth with a broad crown used to grind food, located behind the premolars.
PERIODONTICS	: the branch of dentistry that deals with the study and treatment of periodontal disease.
PLAQUE	: a film of mucus and bacteria on a tooth surface.
PREMOLARS	: one of eight bicuspid teeth located in pairs on each side of the upper and lower jaws behind the canines and in front of the molars.
TOOTH	: one of a set of hard, bonelike structure rooted in sockets in the jaws of vertebrates, typically composed of a core of soft pulp surrounded by a layer of hard dentin that is coated with cementum or enamel at the crown and used for biting or chewing food or as a means of attack or defense.

TOXICOLOGY



TOXICOLOGY

ROLL CALL

- *Have your animals ever eaten poison? If so what did you do?*
- *How would you prevent animals from ingesting toxins?*

POISONING

Poisons are toxic substances that can be eaten, absorbed through the skin, and inhaled. Poisoning is sometimes misdiagnosed because its symptoms 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 symptoms 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?

If you suspect poisoning, call your veterinarian or veterinary emergency clinic immediately. If it is possible, have the following information ready:

- Name of toxin ingested, inhaled, or absorbed.
- Approximately how much of the toxin was ingested.
- How long ago you suspect the poison was ingested.
- Approximate weight of your pet.
- What symptoms 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:

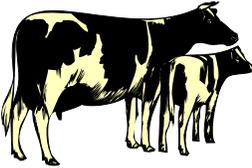
- Antifreeze (Ethylene glycol)
- Slug/Snail bait
- Prescription medications
- Mouse and rat poison
- Lawn fertilizers, weed killers
- Household cleaners and chemicals
- Some plants (indoor and outdoor) including azalea, oleander, mistletoe, and Easter lilies; shrubs, and trees. Check with your veterinarian 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 likely to eat large quantities of toxic plants than well-fed animals.

Classification of Poisons

TYPE OF POISON	PROPERTIES	SYMPTOMS	WATCH OUT FOR THESE PLANTS:
Alkaloids (examples include morphine, atropine, nicotine, quinine, and strychnine)	<ul style="list-style-type: none"> Basic organic substances with a bitter taste 	<ul style="list-style-type: none"> 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 nightshade
Glycosides (natural plant products containing the sugar glucose):			
1. Cyanogenic glycosides	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> Interferes with oxygen exchange from the lungs to the body tissues, causing muscle tremors, difficult respiration, and convulsions Often symptoms are not seen because death occurs quickly 	<ul style="list-style-type: none"> Sorghum Sudan grass Marsh-arrow grass Wild cherries
2. Saponin glycosides	<ul style="list-style-type: none"> 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
3. Mustard oil glucosides	<ul style="list-style-type: none"> Severe gastroenteritis causes severe colic and purging. 		<ul style="list-style-type: none"> Found in plants belonging to the Mustard family
Nitrates	<ul style="list-style-type: none"> Poisoning occurs when nitrate is converted to nitrite in the gastrointestinal tract Nitrite is absorbed into the bloodstream where it reacts with hemoglobin to form methemoglobin Gas exchange is 	<p>Acute poisoning:</p> <ul style="list-style-type: none"> Trembling and staggering, Rapid breathing, Death <p>Chronic poisoning:</p> <ul style="list-style-type: none"> Poor growth Poor milk production Abortions 	<p>Weeds: pigweed, thistle, hemlock, wild Morning Glory</p> <p>Crops: oats, rye, wheat, barley, corn, sorghum, sugar beets, turnip</p> <p>(Drought and low</p>

	interrupted.	<ul style="list-style-type: none"> • Affects vitamin A storage in cattle 	light intensity may cause nitrates and nitrites to accumulate in stem and leaves of crop plants)
Selenium	<ul style="list-style-type: none"> • Element needed for normal metabolism • Poisoning occurs when quantities are taken in exceeding what is normally needed 	<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	<ul style="list-style-type: none"> • Produced by fungi • Produced only in the right environmental conditions • Mycotoxin production may occur while crop is standing or after it is harvested. • Two types of toxins; vomitoxin and zearalenone 	<p>Vomitoxin: causes animal which ate the contaminated feed animal to vomit.</p> <p>Zearalenone: a female estrogen; females show signs of irregular estrus and reduced litter sizes</p>	<ul style="list-style-type: none"> • Crops infected by fungi including corn and cereals 
Photo-sensitization	<ul style="list-style-type: none"> • Certain plants contain toxic agents which cause animals to become sensitive to strong sunlight when eaten. 	<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. 	<ul style="list-style-type: none"> • St. John's wort • Spring parsley • Buckwheat • Blue-green algae



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:
 - pennies (high concentration of zinc),
 - mothballs (contain toxic chemicals)
 - potpourri oils,
 - fabric softener sheets,
 - automatic dish detergents (can cause lesions),
 - batteries (contain acids which can cause lesions),
 - homemade play dough (contains high quantity of salt),
 - cigarettes,
 - coffee grounds,
 - alcoholic drinks.

