

Introduction to Bovine Birthing and Ultrasound Curriculum



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Table of Contents

Curriculum Structure.....	4
Lesson Structure	4
Lesson One – Calving Stages and Care.....	5
FOCUS: Signs of Calving	6
LEARN: Calving Stages and Care	7
REVIEW: Signs of Calving and Care	12
Sources	16
Lesson Two – Common Calving Problems	17
FOCUS: Signs of Calving	18
LEARN: Common Calving Problems	22
REVIEW: Providing Assistance.....	33
Sources	38
Lesson Three – Calf Embryology and Development	39
FOCUS: Signs of Calving	40
LEARN: Calf Embryology and Development.....	45
REVIEW: Signs of Calving and Care	51
Sources	52
Lesson Four – Ultrasound	53
FOCUS: Pregnancy Scenario	54
LEARN: Ultrasound.....	55
REVIEW: Ultrasound Demonstration	57
Sources	59

Curriculum Structure

The *Introduction to Bovine Birthing and Ultrasound* curriculum is composed of the following lessons. Approximate lesson times are included.

Lesson	Title	Approximate Time
One	Calving Stages and Care	60 minutes
Two	Common Calving Problems	90 minutes
Three	Calf Embryology and Development	60 minutes
Four	Ultrasound	60 minutes
	Total	4-5 hours

Lesson Structure

Each lesson begins with a Lesson Overview, Lesson Objectives, and a Lesson at a Glance table that lists lesson activities, materials required, suggested preparation steps, and approximate class time.

Lesson Sections

The actual lesson follows the overview, which contains some of the sections described below.

FOCUS

Every lesson begins with a FOCUS activity intended to capture participants' attention. This may be in the form of a small or large class discussion, a game, a demonstration, or a review of previous lesson information. During this activity, participants are introduced to the topic of the lesson.

LEARN

The LEARN activity in each lesson varies in its presentation mode. It may be a slide presentation, group activity, or demonstration.

REVIEW

The majority of lessons end with a REVIEW activity intended to briefly review the lesson's key messages or main points.

Lesson One – Calving Stages and Care

Lesson Overview

During calving, there are three stages of labor a cow will go through. As producers, it is vital to know these stages in order to monitor labor and ensure a safe and healthy delivery, or provide assistance when necessary. This lesson will identify the stages and participants will practice the steps to care for a cow and calf.

Lesson Objectives

After completing this lesson, participants will be able to:

- Identify the stages of calving
- List and demonstrate the proper care needed for a cow and calf during calving and immediately following

Lesson at a Glance

Activity	Materials	Preparation	Approximate class time
FOCUS	• Whiteboard, blackboard, or projector		10 minutes
LEARN	• Whiteboard, blackboard, or projector • <i>Calving Stages and Care</i> slide presentation • Bovine Birthing Simulator • <i>Calving Stages and Care Note Sheet</i> • <i>Calving Stages and Care Note Sheet – Answer Key</i>	1. Print/photocopy <i>Calving Stages and Care Note Sheet</i> (one per participant). 2. Prepare <i>Calving Stages and Care</i> slide presentation for viewing.	30 minutes
REVIEW	• <i>Stage Identification Quiz</i> • <i>Stage Identification Quiz – Answer Key</i> • <i>Calving Care Demonstration Checklist</i> • Bovine Birthing Simulator	1. Print/photocopy <i>Calving Care Demonstration Checklist</i> and <i>Stage Identification Quiz</i> (one per participant).	25 minutes

Lesson One – Calving Stages and Care

FOCUS: Signs of Calving

10 minutes

Purpose:

Students will recognize the importance of knowing the signs of calving.

Materials:

- Whiteboard, blackboard, or projector

Facilitation Steps:

1. Present the following scenario. “You are helping on a dairy farm and are told to examine the cows to see if any are going to have a calf today. What are the things you should look for? What signs do you think will show that a cow is ready to have her calf?”
2. Allow five minutes for a discussion amongst the class. If stuck, provide prompting questions, such as, “what do we know about human labor and how can those signs connect to cattle?”
3. After the class discussion, speak with the class about the importance of knowing the signs of calving. Topics could include monitoring health and safety, providing a safe environment, preparing for a calf, etc.
4. Inform the class that this lesson will teach them specific signs to look for during calving.

Lesson One – Calving Stages and Care

LEARN: Calving Stages and Care

30 minutes

Purpose:

Students will identify the stages of labor based on provided signs and demonstrate the proper care needed for a cow and calf during and immediately following calving.

Materials:

- Whiteboard, blackboard, or projector
- Bovine Birthing Simulator
- *Calving Stages and Care* slide presentation
- *Calving Stages and Care Note Sheet*
- *Calving Stages and Care Note Sheet – Answer Key*

Facilitation Steps:

Note: It is helpful to review the reproductive anatomy of a cow prior to this lesson.

1. Explain to students that it's important to know the stages of calving in order to monitor both the cow and the calf's health, and intervene if necessary.

Slide 2

The term “calving” is the process of a cow giving birth and is used to describe the entire process, making sure to include all of the stages.

Some other key terms to look at are cow, heifer, and calf. Each of these are frequently used when talking about calving. For our purposes, we will often use the term “cow” when talking about the stages of calving, but please know that these stages apply to both cows and heifers.

Slide 3

There are three stages of calving from the time a cow's cervix begins to dilate until the placenta is delivered. The process is continuous, but broken into three key stages to identify what specifically is happening with the calving, and to assess whether any assistance may be needed.

The three stages of calving are broken up by three key actions: cervical dilation, fetal delivery, and placental delivery.

Note that delivery of a fetus is a separate action from the delivery of the placenta.

Slide 4

Stage 1 of calving refers to the time between a cow's uterus beginning to contract, when the uterine muscles begin to tighten, until the time that the cervix is fully dilated to allow the fetus through. This typically lasts 4-6 hours.

Because these events are happening inside of the cow and not visible to us, we will have to look for signs that the cow is in stage 1.

Slide 5

A cow will not always have visible signs of stage 1 calving, especially early on. Visible signs that may be seen include:

- Restlessness: the cow seeming to be uncomfortable and constantly moving or switching positions
- A tendency to lie down and get back up frequently
- A raised tail head
- Mucus discharge
- Full udder
- Increased urination and defecation
- Vocalization

Because these signs are subtle, it is helpful to know the cow's typical behavior in order to use it as a comparison.

Slide 6

The transition from Stage 1 to stage 2 of calving is marked by the movement of the fetus. Stage 2 begins when the feet and nose of the fetus enter the birth canal. This movement will stimulate an abdominal press (when the abdomen of the cow begins to strain). Stage 2 ends when the calf is fully delivered and typically lasts between 30 minutes and 4 hours.

While the end of stage 2 is apparent with the delivery of a calf, it is important to know the other signs of stage 2, to know when it is occurring.

Slide 7

Common signs of stage 2 and how to monitor them include:

- Cervical dilation
- The first water bag rupturing (chorioallantoic sac), marked by fluid expelling from the vulva
- The second water bag (amniotic sac) is forced through the vulva and becomes visible; this sac contains the fetus and is noted when the fetal parts are visible
- The calf moving through the birth canal, such as the feet and nose becoming visible
- Abdominal contractions are evident and force the calf's legs to become visible

Slides 9-10

Stage 3 of calving starts when the calf is delivered and ends when the placenta is expelled from the cow. It typically takes 8-12 hours following delivery of a calf. While 12 hours is the standard amount of time to determine if a placenta is retained, some guidance suggests waiting up to 36 hours.

Slide 11

Calving can typically be done unassisted.

However, monitoring must be done to ensure that assistance is provided if needed. Future lessons will cover how to provide assistance to the cow. Times when assistance should be provided include:

- Stage 1 of calving continues for 6 or more hours without abdominal press (strain of the abdomen) starting
- Stage 2 of labor continues for 2 or more hours without feet or nose presenting, or if a calf is not delivered within 2 hours of a water sac becoming visible
- If stage 3 does not progress normally, it is considered a "retained placenta" and a veterinarian should be consulted, as a retained placenta can cause an infection and antibiotics are often needed

As long as calving proceeds normally, a cow simply needs to be monitored hourly once the feet and nose of the calf protrude.

If no progress is made in an hour, or if the nose protrudes further than the feet, assistance is needed.

Slide 12

Following calving, there are some basic steps to take to minimize any potential health issues for the cow and calf.

- The first thing to do is check for an additional fetus; if an ultrasound was done, it should have detected a second fetus, but it is beneficial to check in the event of an error
- Ensure that the cow has a clean area after calving to minimize her risk of an infection
- Examine the cow's birth canal for tearing or bruising; large tears, or severe bruising that does not heal, may require veterinary care
- It's important to allow the placenta to be naturally expelled; do not pull on the placenta to try and remove it, as this can cause permanent damage to the cow's reproductive tract
- Monitor the cow for any major health changes; this may require intervention depending on the change

Slide 13

For additional information on caring for a calf (including step-by-step instructions) see the Calf Simulator curriculum. Basic steps for caring for a "fresh" (newly born) calf include checking for a heartbeat, providing an open airway by laying the calf on its side with its head and neck stretched forward, cleaning the navel, and ensuring that colostrum is consumed within 6 hours of delivery.

Name: _____ Class: _____

Calving Stages and Care Note Sheet

1. Define calving:
2. Mature female cattle (has had a calf): _____
Young female cattle (has not had a calf yet): _____
Young cattle (general term): _____
3. Three Stages of Calving
 - a.
 - b.
 - c.
4. Calving Stage 1
 - a. Start: _____ contracts
 - b. End: _____ is fully dilated
 - c. Time: Approximately ____ to ____ hours
 - d. List three visible signs that an animal might show:
 - i.
 - ii.
 - iii.
5. Calving Stage 2
 - a. Start: _____ and _____ enter birth canal
 - b. End: Calf is _____
 - c. Time: Approximately ____ to ____ hours
 - d. What happens with the two water bags (chorioallantoic sac and amniotic sac)?
6. Calving Stage 3
 - a. Start: Calf is _____
 - b. End: Fetal membranes are _____
 - c. Time: Approximately ____ to ____ hours after delivery

Introduction to Bovine Birthing and Ultrasound

7. When should you assist with calving?
 - a. A cow or heifer has been in stage 1 for ____ hours or more without abdominal press starting
 - b. A cow or heifer has been in stage 2 labor for ____ hours without the fetal parts presenting
 - c. A cow or heifer has a visible water sac, but has not delivered the fetus within ____ hours
8. Steps to care for a fresh calf:
 - a. Check for _____
 - b. Provide open _____
 - c. Clean _____
 - d. Ensure _____ is consumed within 6 hours

Calving Stages & Care Note Sheet – Answer Key

1. Define calving: **Act of parturition (giving birth) in cattle**
2. Mature female cattle (has had a calf): **Cow**
Young female cattle (has not had a calf yet): **Heifer**
Young cattle (general term): **Calf**
3. Three Stages of Calving
 - a. **Cervical dilation**
 - b. **Fetal delivery**
 - c. **Placental delivery**
4. Calving Stage 1
 - a. Start: **uterus** contracts
 - b. End: **cervix** is fully dilated
 - c. Time: Approximately **2** to **6** hours
 - d. List three visible signs that an animal might show:
 - i. **Restlessness**
 - ii. **Tendency to lie down and get back up frequently**
 - iii. **Raised tail head****Other answers include: mucus discharge, full udder, increased urination, and defecation, vocalization**
5. Calving Stage 2
 - a. Start: **feet** and **nose** enter birth canal
 - b. End: Calf is **delivered**
 - c. Time: Approximately **30 minutes** to **4** hours
 - d. What happens with the two water bags (chorioallantoic sac and amniotic sac)?
The first water bag ruptures. The second water bag is forced through vulva and becomes visible
6. Calving Stage 3
 - a. Start: Calf is **delivered**
 - b. End: Fetal membranes are **expelled**
 - c. Time: Approximately **8** to **12** hours after delivery
7. When should you assist with calving?
 - a. A cow or heifer has been in stage 1 for **6** hours or more without abdominal press starting
 - b. A cow or heifer has been in stage 2 labor for **2** hours without the fetal parts presenting
 - c. A cow or heifer has a visible water sac, but has not delivered the fetus within **2** hours
8. Steps to care for a fresh calf:
 - a. Check for **heartbeat**
 - b. Provide open **airway**
 - c. Clean **navel**
 - d. Ensure **colostrum** is consumed within 6 hours

Lesson One – Calving Stages and Care

REVIEW: Signs of Calving and Care

25 minutes

Purpose:

Students will identify the stages of labor based on provided signs. Students will list and demonstrate the proper care needed for a cow and calf during calving and immediately following it.

Materials:

- Bovine Birthing Simulator
- *Stage Identification Quiz*
- *Stage Identification Quiz – Answer Key*
- *Calving Care Demonstration Checklist*

Facilitation Steps:

1. Students will rotate through tasks. Some can complete the *Stage Identification Quiz* while others complete the calving care demonstration.
2. For the demonstration, have a copy of the *Calving Care Demonstration Checklist* for each student. Have students come up to the calf simulator one at a time and ask them to demonstrate and/or talk through how they would care for a cow and calf during and immediately after calving. Use the *Calving Care Demonstration Checklist* to confirm students' mastery of the material.
3. Review the checklists and quizzes at the conclusion of class to determine what may need to be clarified for students at the beginning of the next class period.

Name: _____ Class: _____

Calving Care Demonstration Checklist

Internal Care	☐ Reached into the birthing canal to feel for an additional fetus and declared findings. ☐ Checked if tearing or bruising of the birthing canal is present and declared findings. ☐ Explained that you have to wait for the placenta to be expelled naturally. Comments:
External Care/Environment	☐ Explained the need for a clean area for post calving to minimize risk for infection. ☐ Monitored cow/heifer for any health changes. Comments:

Name: _____ Class: _____

Stage Identification Quiz

Matching: Write the letter of the description on the right that corresponds with the term on the left.

- | | |
|------------------|---|
| 1. _____ Calving | A. General term for young cattle |
| 2. _____ Calf | B. Mature female cattle that have had a calf |
| 3. _____ Cow | C. Act of parturition (giving birth) in cattle |
| 4. _____ Heifer | D. Young female cattle that have not had a calf yet |

Short Answer: Read the questions and provide your best answer.

5. What are the three stages of calving?

6. What are three visible signs that an animal might show during stage 1 of calving?

7. How do we know when stage 3 of calving is complete?

8. What are two steps to complete when taking care of a fresh calf?

Scenarios:

9. As a local veterinarian, you have been called by a local farmer to come check on a cow that appears to be giving birth. You discover the cow laying down while giving birth. Upon examining the cow, it appears as though the cervix is fully dilated, but you don't see a calf yet. It has been 8 hours since the uterus started contracting. Which stage of calving is the cow in? Support your answer with at least two reasons.

10. When monitoring cattle in the pasture, you notice that a cow has started to have a raised tail head and appears to have mucus discharge. You are now alerted that the birthing process has started, so you decide to leave and come back to check on the cow in 7 hours. Upon arrival, you do not see a calf yet. While monitoring the cow, you do not see any abdominal pressing. Is this normal or not? And should you assist? Support your answer.

Stage Identification Quiz – Answer Key

Matching: Using the definitions from the right column, write the letter that corresponds with the term in the left column.

- | | |
|---------------------|---|
| 1. C Calving | A. General term for young cattle |
| 2. A Calf | B. Mature female cattle that have had a calf |
| 3. B Cow | C. Act of parturition (giving birth) in cattle |
| 4. D Heifer | D. Young female cattle that have not had a calf yet |

Short Answer: Read the questions and provide your best answer.

5. What are the three stages of calving?

Cervical dilation, fetal delivery, placental delivery.

6. What are three visible signs that an animal might show during stage 1 of calving?

Restlessness, tendency to lie down and get back up frequently, raised tail head.

Other possible answers: Mucus discharge, full udder, increased urination and defecation, vocalization

7. How do we know when stage 3 of calving is complete?

Fetal membranes (placenta) are expelled.

8. What are two steps to complete when taking care of a fresh calf?

Check for heartbeat and provide open airway.

Other possible answers: Clean navel, ensure colostrum is consumed within 6 hours.

Scenarios:

9. As a local veterinarian, you have been called by a local farmer to come check on a cow that appears to be giving birth. You discover the cow laying down while giving birth. Upon examining the cow, it appears as though the cervix is fully dilated, but you don't see a calf yet. It has been 8 hours since the uterus started contracting. Which stage of calving is the cow in? Support your answer with at least two reasons.

The cow would appear to be in stage 3. This is based on the fact that stage 1 should've been completed within 6 hours. Knowing the cervix is fully dilated tells us that stage 1 is complete. With the calf not being delivered yet, we know it can't be stage 3.

10. When monitoring cattle in the pasture, you notice that a cow has started to have a raised tail head and appears to have mucus discharge. You are now alerted that the birthing process has started, so you decide to leave and come back to check on the cow in 7 hours. Upon arrival, you do not see a calf yet. While monitoring the cow, you do not see any abdominal pressing. Is this normal or not? And should you assist? Support your answer.

This would not be a normal situation and your assistance may be warranted. Assistance is recommended as the animal has been in stage 1 for at least 7 hours and should have proceeded to stage 2 in 6 hours.

Sources

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Lesson Two – Common Calving Problems

Lesson Overview

There are times during calving when assistance may be required to ensure the safety of the calf and the cow. Assistance can come in the form of correcting an abnormal presentation, providing traction, or even using a calf puller. In this lesson, students will identify common calving problems and provide assistance, if necessary, with calving.

Lesson Objectives

After completing this lesson, participants will be able to:

- Identify calf abnormalities that may cause problems during calving
- List and demonstrate the proper technique of pulling a calf using straps or chains
- List and demonstrate the proper technique of correcting a calf's presentation

Lesson at a Glance

Activity	Materials	Preparation	Approximate class time
FOCUS	• Whiteboard, blackboard, or projector • <i>Calving Stages and Care</i> slide presentation • <i>Signs of Calving Cards</i> • <i>Stage Cards</i> • <i>Typical Time Cards</i> • •<i>Calving Cards</i> – Answer Key	1. Prepare <i>Common Calving Problems</i> slide presentation for viewing. 2. Print/photocopy <i>Signs of Calving Cards</i>, <i>Stage Cards</i>, and <i>Typical Time Cards</i> (one set per group).	10 minutes
LEARN	• Whiteboard, blackboard, or projector • Bovine Birthing Simulator • <i>Calving Stages and Care</i> slide presentation • <i>Common Calving Problems Note Sheet</i> • <i>Common Calving Problems Note Sheet</i> – Answer Key	1. Print/photocopy <i>Common Calving Problems Note Sheet</i> (one per participant). 2. Prepare <i>Common Calving Problems</i> slide presentation for viewing.	45 minutes
REVIEW	• <i>Abnormal Calf Presentation Correction Demonstration Checklists</i> • <i>Calf Traction (Calf Pulling) Checklist</i> • Bovine Birthing Simulator	1. Print/photocopy <i>Abnormal Calf Presentation Correction Demonstration Checklists</i> and <i>Calf Traction (Calf Pulling) Demonstration Checklist</i> (one per participant).	30 minutes

Lesson Two – Calving Stages and Care

FOCUS: Signs of Calving

10 minutes

Purpose:

Students will identify the stages of calving based on their common signs and typical times.

Materials:

- Whiteboard, blackboard, or projector
- Bovine Birthing Simulator
- *Signs of Calving Cards*
- *Stage Number Cards*
- *Typical Time Cards*
- *Calving Cards – Answer Key*
- *Common Calving Problems* slide presentation

Facilitation Steps:

1. Split students into groups of 2-4 and provide each group with a set of the three cards.
2. Display slide 2 of the *Common Calving Problems* slide presentation.
3. Have each group match the stages with the typical time they take and the signs that indicate the stage.
4. After the groups have finished, go through the stages to ensure all groups have matched the cards correctly.
5. Inform students that this lesson will look at common calving problems, and it is important to know what a normal calving process looks like in order to do so.

Signs of Calving Cards

Signs of Calving Card A Start: Feet and nose enter birth canal to stimulate abdominal press End: Calf is delivered	Signs of Calving Card B Expulsion of fetal membranes
Signs of Calving Card C Start: Uterus contracts End: Cervix is fully dilated, fetal parts (feet, nose) enter birth canal	Signs of Calving Card D Start: Calf is delivered End: Fetal membranes (placenta) expelled
Signs of Calving Card E 1 st water bag ruptures 2 nd water bag forced through vulva and becomes visible Calf moves through birth canal Abdominal contractions evident	Signs of Calving Card F Visible signs of this stage: Restlessness, tendency to lie down and get back up frequently, raised tail head, mucus discharge, full udder, increased urination and defecation, vocalization

Stage Cards

Stage Card G Stage 1 Cervical Dilation	Stage Card H Stage 2 Fetal Delivery
Stage Card I Stage 3 Placental Delivery	

Typical Time Cards

Typical Time Card J Approximately 8-12 hours	Typical Time Card K 0.5-4 hours
Typical Time Card L 2-6 hours	

Calving Cards – Answer Key

The following cards should match up with Stage 1 Card G:

- C, F, L

The following cards should match up with Stage 2 Card H:

- E, A, K

The following cards should match up with Stage 3 Card I:

- B, D, J

Lesson Two– Common Calving Problems

LEARN: Common Calving Problems

30 minutes

Purpose:

Students will identify calf abnormalities that may cause problems during calving.
Students will list the proper technique for pulling a calf using straps or chains.
Students will list the proper technique of correcting a calf's presentation.

Materials:

- Whiteboard, blackboard, or projector
- Bovine Birthing Simulator
- *Common Calving Problems Care* slide presentation
- *Common Calving Problems Note Sheet*
- *Common Calving Problems Note Sheet – Answer Key*

Facilitation Steps:

1. Begin the lesson by explaining to students that while most calf deliveries occur unassisted with no complications, there are times when providing assistance is necessary to ensure the health and safety of the calf and cow. Individual farms will have their own set of protocols for calving and providing assistance when necessary. Collaboration with a veterinarian is important in creating these protocols.

Slide 2: The term dystocia is used to refer to any difficulties or obstruction during labor. In cattle, common causes of dystocia are: Maternal/fetal disproportion, abnormal position of a calf during delivery, incomplete dilation of the cervix, uterine inertia, uterine torsion, or abnormal fetuses.

This lesson will focus on maternal/fetal disproportion and abnormal position of a calf, as these are causes that we can often work to prevent or correct. The others often require veterinarian assistance.

Slide 4: When a calf is too large for the cow's birth canal, it is referred to as maternal/fetal

disproportion. This is influenced by two factors, the size of the cow and the size of the calf.

- The weight of a calf is the most important factor influencing the ease of calving, and it is something farmers will consider when looking at genetic lines
- Heifers are at a higher risk for dystocia because they are smaller than a fully grown calf
- Because we know these two factors are involved, there are a few preventative steps we can take to maintain a normal maternal/fetal proportion

Slide 5: We are focusing on heifer nutrition in particular because of their generally smaller size when calving. This does not mean nutrition is not important for all cows, but simply that heifers are our focus because they often have the most problems.

When looking at heifer nutrition, it is important to consider size at the time of breeding. The target weight for a heifer at breeding should be about 60% of her mature weight based on her breed. A specific weight is not used, since it varies by the breed of the heifer.

Once bred, the goal weight for a heifer by the time of calving is for her to be 90% of her mature weight plus 100 pounds. The reason for the extra 100 pounds is to account for the weight of the calf and placenta. To achieve this weight gain, it requires a rate of gain of about 1.5-1.75 pounds per day.

While weight gain is an important focus of heifer nutrition, there also needs to be close attention paid to the nutrient quality of the feed given to heifers.

Slide 6: While our goal is to maximize the size of heifers during calving, calves are the opposite. The goal for producers is to decrease calf size as much as possible without a great impact on finishing size.

In order to decrease calf size, it is important to look at the genetics of both the sire and dam of a calf, as they both play about a 50/50 role in determining the size.

To do this, EPDs (expected progeny differences) are used to compare the likelihood of specific traits based on a sire's and dam's parents, siblings, and current offspring.

EPDs are calculated by comparing an animal to others of the same breed.

To decrease calf size, the EPD for "calving ease" should be monitored. This EPD compares the ease of calving of an offspring of the sire and dam to other sires and dams of the same breed. The better the calving ease EPD, the more likely a calf is to be smaller.

Slide 8: When prevention is no longer an option, we need to look at times when assistance may be needed. We looked briefly at these when going through the Calving Stages and Care Power Point. Determining when to provide assistance is often based on the time a cow is in a specific stage of labor.

The other time assistance is needed is when a calf has an abnormal presentation.

Slide 9: While it's important to know when to provide assistance, it is also crucial to know when a veterinarian's consultation is needed. These situations include when a presentation can't be corrected, when a calf is too large to be delivered, or if you are uncertain that a safe delivery will be possible.

Slide 11: Calf presentation is looking at how a calf is oriented within the birth canal.

A normal presentation for delivery has a calf's nose and front legs first, pointed in line to exit the cow.

Slide 12: In order to determine the presentation of the calf, it is necessary to distinguish between the front and back legs of the calf within the cow. When palpating the cow, you will feel for the legs that are coming through the birth canal first.

The hock and the elbow will feel very similar while inside the cow, so you will need to feel for joints.

If you have a front leg, you will feel two bendable joints before the elbow. This will feel different than the back leg as you will only feel one bendable joint before the hock. Once you determine what legs are in line to exit the cow first, you can determine the presentation of the calf.

Slide 13: A posterior presentation refers to when the calf is oriented head down with the back legs in line to exit first.

This presentation can often be delivered unassisted, but close monitoring is important.

A fast delivery is essential because the calf can asphyxiate if not delivered soon after the umbilical cord breaks. Some farmers will choose to assist all deliveries in this presentation to ensure the calf is delivered quickly enough.

Slide 14: A transverse presentation refers to a calf that has all four feet and its head presented.

In this presentation, assistance is necessary. The first step is to correct the calf's position. Inform students that we will walk through how to correct positions later in the lesson.

Once the presentation is corrected, traction can be applied.

Slide 15: A posterior presentation without feet, often referred to as a breech position, is going to require assistance.

The first step is to correct the calf's position. Inform students that we will walk through how to correct positions later in the lesson.

Once the presentation is corrected, traction can be applied, but veterinarian assistance is often required in this position.

Slide 16: "Head back" refers to a calf whose feet are presented with its head turned back.

This presentation will also require assistance. The first step will be to correct the position. Once the position is corrected, traction can be applied.

Slide 18: Common presentation corrections often include correcting a leg flexion.

To correct this, the first step is to push the calf forward further into the cow.

From here, the legs can be grasped one by one and brought into the birth canal. Make sure the hock is pointed toward the cow's flank, while the hoof is toward the cow's midline.

Slide 19: In order to correct a head/neck deviation, you will again have to push the calf forward first.

Once the calf is pushed forward, the muzzle can be grasped quickly and gently pulled to be in line with the birth canal.

The fetus's jaw is extremely fragile, so excessive pressure must be avoided.

One way to avoid excessive pressure being applied to the jaw is by using OB chains (obstetric chains) to create a halter-like hold on the calf.

If using chains, they must be placed under the ears and through the mouth. You will need to use your hand to guide the jaw out to avoid the lower teeth causing damage to the cow.

Slide 21: Often, when assistance is required during calving, it involves providing traction, often referred to as "pulling a calf," which involves providing the cow with additional force to remove the calf from the birth canal.

This can be done using straps, chains, or a "calf jack" (fetal extractor). If using a fetal extractor, it is vital to avoid using too much force as this can cause damage to both the cow and the calf.

Slide 22: When pulling a calf, there is a choice between using OB chains or straps. Both will work effectively at pulling a calf, but each has its own pros and cons.

The benefit of chains is that they can be easily and effectively sterilized by boiling. The con is they can be harder on joints.

The benefit of straps is that they are easier on joints, but their downfall is that the nature of cloth makes them harder to clean and sterilize.

Slide 23: Once you've selected your chain or strap (from here forward referred to as chains, but indicating both chains and straps), you will need to attach the chains to the calf.

First, you need to loop the chains around the calf's leg above the fetlock.

Next, you will secure the chain at the back of the leg.

From here, you will wrap the chain around the calf's leg again as a half hitch knot below the fetlock.

To tie a half hitch, wrap the chain around the leg, then pass the end of the chain through the loop and tighten.

This process can then be repeated on the second leg.

Slide 24: Once the chains are knotted on the calf's legs, it is time to pull the calf. The key to pulling a calf is that you are simply assisting a cow, not forcing the calf out.

To do this, be sure to only provide traction when the cow pushes.

Attach OB handles to the chains and pull both sides evenly.

Slide 25: Because pulling a calf means assisting the cow, it is likely that you will need to move with the cow if she transitions from standing to laying down. Try to move with the cow as much as possible.

To mimic the calf's movements through the birth canal, pull the calf in an arc towards the cow's hock.

Pulling horizontally or straight down can cause damage to the calf's spine.

Slide 26: Providing constant force to the calf does not allow the cow or calf to rest during calving. A lack of rest can lead to asphyxiation if the calf tries to breathe while force is being applied.

There are three key points to provide at least 30 seconds of rest during calving.

Slide 27: The three key intervals are considered resting intervals.

- The first resting interval should occur when the calf is normally positioned in the pelvic canal, just prior to the nose becoming visible
- The second resting interval should occur after a calf's head is completely past the vulva
- The third resting interval should occur once the shoulders are completely exposed; at this

point, it is often also helpful to rotate the calf 90° to better fit the calf's hips through the birth canal

Remember that at least 30 seconds of rest should be provided at each resting interval.

Slide 29: A calf extractor or calf jack is a mechanism to help provide additional pull for a calf, which can be very useful when pulling a calf by yourself or if facing a difficult pull.

Though calf extractors can be very useful, caution is key when using them. Because they are capable of providing thousands of pounds of force, inappropriate use can lead to loss of the calf and/or injury to the cow.

Slide 30: Steps to using a calf extractor include:

- Place chains on calf's legs (same steps as if pulling by hand)
- Place calf extractor strap over top of cow's hips
- Place base plate just below cow's vulva
- Hook chains to the extractor
- Begin ratcheting with normal labor rhythm (just as you would when pulling by hand)

Tension should be released corresponding to typical rest intervals, possibly more if necessary (especially during difficult pulls).

Again, be sure to pull in a downward arc just as you would when pulling by hand.

Name: _____ Class: _____

Common Calving Problems Note Sheet

1. Define dystocia:
2. Two main causes of dystocia:
 - a. _____
 - b. _____
3. Maternal/fetal disproportion: _____

4. Disproportion is affected by two factors:
 - a. _____
 - b. _____
5. Preventing disproportion in heifers:
 - a. At breeding, heifers should be _____ % of their mature weight.
 - b. Nutrition goal: _____ % mature weight + 100 pounds at time of calving.
 - c. Focus needs to be on _____ AND _____.
6. Preventing disproportion in calves:
 - a. _____ calf size.
 - i. Genetics are dependent on both _____ and _____.
 - ii. Focus on EPDs: _____
 1. EPDs compare genetic value of animals as parents.
 2. Focus on _____ to achieve small calf sizes.
7. Calving assistance should be provided if:
 - a. Cow is restless for more than _____ hours but doesn't begin straining.
 - b. Cow is straining for _____ hours with no part of calf showing.
 - c. Calf's feed and/or nose is showing, but calf is not delivered after _____ hours.
 - d. Calf has an abnormal presentation.
8. When to call the veterinarian?
 - a. _____
 - b. _____
 - c. _____

9. Calf presentation: _____

10. Normal calf presentation: _____

11. The hock and elbow of a calf feel similar inside a cow. The difference between them are:

- a. Front leg: _____ bendable joints before the elbow.
- b. Rear leg: _____ bendable joint before the hock.

12. Abnormal calf presentations:

- a. Posterior: _____

- b. Transverse: _____

- c. Posterior without feet: _____

- d. Feet presented, head turned back: _____

13. Presentation corrections

- a. Leg flexion:
 - i. Push the _____ forward.
 - ii. Grasp _____ one by one.
 - 1. Hocks pointed toward cow's _____.
 - 2. Hoof pointed toward cow's _____.
- b. Head/neck deviation
 - i. Push the _____ forward.
 - ii. Grasp calf's _____.
 - 1. Gently pull head around and _____ with birth canal.
 - 2. Avoid excessive _____.

14. Traction is often referred to as: _____.

15. Traction tools:

Chains	Straps
Pros:	Pros:
Cons:	Cons:
How to attach:	How to attach:

16. Tips for pulling a calf:

- a. Only provide traction when the cow _____.
- b. Use OB handles with chains or straps and pull both sides _____.
- c. Move with the cow as much as possible between laying down and standing up.
- d. Pull in an _____ towards the cow's hock.
- e. Provide rest at least _____ seconds after each stopping interval.
 - i. Three key resting intervals:
 1. First:
 - a. Just prior to the _____ becoming visible.
 2. Second:
 - a. Calf's _____ is completely past the vulva.
 3. Third:
 - a. _____ completely exposed.
 - b. Rotate calf's hips _____ % to better fit through birth canal.

17. Using a fetal extractor

- a. Use to _____ in pulling a calf.
- b. _____ is key.
- c. Steps to using a fetal extractor:
 - i.
 - ii.
 - iii.
 - iv.
 - v.

Common Calving Problems Note Sheet – Answer Key

1. Define dystocia: Difficult or obstructed labor
2. Two main causes of dystocia:
 - a. Maternal/fetal disproportion
 - b. Abnormal position of a calf during delivery
3. Maternal/fetal disproportion: term used to describe when a calf is too large for the birth canal
4. Disproportion is affected by two factors:
 - a. Size of cow
 - b. Size of calf
5. Preventing disproportion in heifers:
 - a. At breeding, heifers should be 60 % of their mature weight
 - b. Nutrition goal: 90 % mature weight + 100 pounds at time of calving
 - c. Focus needs to be on rate of gain AND nutrient quality
6. Preventing disproportion in calves:
 - a. Decreasing calf size
 - i. Genetics are dependent on both sire and dam
 - ii. Focus on EPDs: Expected Progeny Differences
 1. EPDs compare genetic value of animals as parents
 2. Focus on calving ease to achieve small calf sizes
7. Calving assistance should be provided if:
 - a. Cow is restless for more than 6 hours but doesn't begin straining
 - b. Cow is straining for 2 hours with no part of calf showing
 - c. Calf's feed and/or nose is showing, but calf is not delivered after 2 hours
 - d. Calf has an abnormal presentation
8. When to call the veterinarian?
 - a. Presentation can't be corrected
 - b. Calf is too large to be delivered
 - c. Uncertain of a safe delivery
9. Calf presentation: Refers to the position of the calf as it is moving through the birth canal
10. Normal calf presentation: Nose and front legs first (in line to exit the cow first)
11. The hock and elbow of a calf feel similar inside a cow. The difference between them are:
 - a. Front leg: Two bendable joints before the elbow

- b. Rear leg: **One** bendable joint before the hock

12. Abnormal calf presentations:

- a. Posterior: **Feet come out first, often no complications**
- b. Transverse: **All four feet and head presented, assistance needed, position correction needed**
- c. Posterior without feet: **Feet tucked under animal, assistance needed, position correction needed**
- d. Feet presented, head turned back: **Head is tucked back, assistance needed, head position correction needed**

13. Presentation corrections

- a. Leg flexion:
 - i. Push the **calf** forward
 - ii. Grasp **legs** one by one
 1. Hocks pointed toward cow's **flank**
 2. Hoof pointed toward cow's **hoof**
- b. Head/neck deviation
 - i. Push the **calf** forward
 - ii. Grasp calf's **muzzle**
 1. Gently pull head around and **in line** with birth canal
 2. Avoid excessive **pressure**

14. Traction is often referred to as: **pulling a calf**

15. Traction tools:

Chains	Straps
Pros: • <u>Can be easily and effectively sterilized</u>	Pros: • <u>Easier on joints</u>
Cons: • <u>Harder on joints</u>	Cons: • <u>Harder to sterilize effectively</u>
How to attach: • <u>Place first loop above the fetlock</u> • <u>Secure the chain at the back of leg</u> • <u>Place second loop below fetlock</u> • <u>Repeat on second leg</u>	How to attach: • <u>Place first loop above the fetlock</u> • <u>Secure the chain at the back of leg</u> • <u>Place second loop below fetlock</u> • <u>Repeat on second leg</u>

16. Tips for pulling a calf:

- a. Only provide traction when the cow **pushes**

Introduction to Bovine Birthing and Ultrasound

- b. Use OB handles with chains or straps and pull both sides **evenly**
 - c. Move with the cow as much as possible between laying down and standing up
 - d. Pull in an **arc** towards the cow's hock
 - e. Provide rest at least **30** seconds after each stopping interval
 - i. Three key resting intervals:
 - 1. First:
 - a. Just prior to the **nose** becoming visible
 - 2. Second:
 - a. Calf's **head** is completely past the vulva
 - 3. Third:
 - a. **Shoulders** completely exposed
 - b. Rotate calf's hips **90** % to better fit through birth canal
17. Using a fetal extractor
- a. Use to **assist** in pulling a calf
 - b. **Caution** is key
 - c. Steps to using a fetal extractor:
 - i. **Inappropriate use can lead to loss of calf and or cow injury**
 - ii. **Place chains on calf's legs**
 - iii. **Place extractor strap over cow's hips**
 - iv. **Place base plate just below cow's vulva**
 - v. **Hook chains extractor**
 - vi. **Begin ratcheting with normal labor rhythm**

Lesson Two – Common Calving Problems

REVIEW: Providing Assistance

25 minutes

Purpose:

Students will demonstrate the proper ways to provide assistance to a cow during calving.

Materials:

- Bovine Birthing Simulator
- *Abnormal Calf Presentation Correction Demonstration Checklists*
- *Calf Traction (Calf Pulling) Demonstration Checklists*

Facilitation Steps:

1. Students will demonstrate their ability to pull a calf during calving. To modify this assessment or provide variation between students, you can set up a variety of scenarios using different calf presentations that would need to be corrected. This would allow students to demonstrate their ability to correct an abnormal presentation.
2. For the demonstration, have a copy of the Calf Pulling Demonstration Checklist for each student. Have students come up to the calf simulator one at a time and ask them to demonstrate calf pulling (possibly correction of abnormal presentations) to confirm students' mastery of the material.
3. Review the checklists at the conclusion of class to determine what may need to be clarified for students at the beginning of the next class period.

Name: _____ Class: _____

Abnormal Calf Presentation Correction Demonstration Checklists

Abnormal Calf Presentation Corrections Checklist	
Posterior Presentation	☐ Explained that assistance is not necessary in every situation. ☐ Monitored the animal closely. ☐ Prepared with equipment to assist if needed. ☐ Ensured quick delivery to prevent aspiration if umbilical cord breaks. Comments:
Transverse Presentation	☐ Using your hands, reach into the birthing canal and gently push the calf forward if blocking canal. ☐ Assess the presentation position of the calf. ☐ Feel the legs to determine which are the back legs; back leg has one bendable joint before the hock. ☐ Once back leg is found, gently position it underneath the calf. ☐ Upon exiting animal, ensure front legs are still in position. ☐ Monitor cow and continue assisting if needed with chains or straps. Comments:

Posterior Presentation without feet (breech)	☐ Using your hands, reach into the birthing canal and gently push the calf forward if blocking canal. ☐ Assess the presentation position of the calf. ☐ If calf is in a posterior position without feet, do not attempt to rotate calf into another position and call a veterinarian. Comments:
Feet presented, head turned back	☐ Secure the legs with chains/straps. ☐ Using your hands, reach into the birthing canal and gently push the calf forward if blocking canal. ☐ Assess the presentation position of the calf's head. ☐ If the head is turned back, you will need to correct the position. ☐ Try pushing the calf back into the canal to correct head positioning; if that doesn't, work gently grab the muzzle of the calf and pull it towards the birthing canal. ☐ Continue assisting cow with natural birthing rhythm. Comments:

Name: _____ Class: _____

Calf Traction (Calf Pulling) Demonstration Checklists

Calf Traction (Calf Pulling) Checklist	
Traction: Using Chains/Straps	☐ Identify which traction method you are using for pulling a calf from a cow. <i>The following steps will work for either chains or straps</i> ☐ Make a single loop and place above the fetlock joint. ☐ Secure equipment on the back of the leg. ☐ Place second loop using a half hitch method below the fetlock joint. ☐ Repeat this process on the second leg. ☐ Attach the obstetrical (OB) handle to the chain/strap and pull both sides evenly in an arc towards the hock. ☐ Move with the cow if she transitions from standing to laying. ☐ Follow cow's birthing rhythm to allow for cow and calf to rest for 30 seconds after each stopping interval. ☐ Identify first resting interval as when calf is positioned in the birthing canal; nose is not yet visible. ☐ Identify second resting interval as when the calf's head is completely past the vulva. ☐ Identify the third resting interval when shoulders are completely exposed. ☐ If calf isn't making progress, explain that you have to rotate calf 90° to get the hips to travel through the canal. Comments:

Traction: Fetal Extractor	☐ Explains that this is to only be used if birthing was not successful after using chains/straps because you may be alone. ☐ Explains that caution should be used as it can cause injury to the cow and/or calf. ☐ Place chains on calf's legs are previously demonstrated. ☐ Place extractor strap over top of the cow's hips. ☐ Place base plate just below cow's vulva. ☐ Hook chains to the extractor. ☐ Begin ratcheting with normal labor rhythm; remember to release tension with resting intervals and to pull in downward arc pattern. Comments:
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Lesson Three – Calf Embryology and Development

Lesson Overview

From the time an egg is fertilized to the delivery of a calf, there are several developmental milestones that occur. This lesson will outline the milestones that occur throughout the gestational period.

Lesson Objectives

After completing this lesson, participants will be able to:

- Identify the stages of a calf's development

Lesson at a Glance

Activity	Materials	Preparation	Approximate class time
FOCUS	• Whiteboard, blackboard, or projector • <i>Calf Embryology and Development</i> slide presentation • <i>Stage Development Match-Up</i> • <i>Stage Development Match-Up – Answer Key</i>	1. Prepare <i>Calf Embryology and Development</i> slide presentation for viewing. 2. Print/photocopy <i>Stage Development Match Up</i> (one per participant).	10 minutes
LEARN	• Whiteboard, blackboard, or projector • Bovine Birthing Simulator • <i>Calf Embryology and Development</i> slide presentation • <i>Calf Embryology and Development Notes Sheet</i> • <i>Calf Embryology and Development Notes Sheet – Answer Key</i>	1. Print/photocopy <i>Calf Embryology and Development Notes Sheet</i> (one per participant). 2. Prepare <i>Calf Embryology and Development</i> slide presentation for viewing.	30 minutes
REVIEW	• <i>Stage Development Match Up</i> • <i>Stage Development Match Up – Answer Key</i> • Bovine Birthing Simulator	1. Use the already printed <i>Stage Development Match Up</i>.	25 minutes (may vary)

Lesson Three – Calf Embryology and Development

FOCUS: Signs of Calving

10 minutes

Purpose:

Students will be exposed to the different developmental milestones and predict the order in which they occur.

Materials:

- Whiteboard, blackboard, or projector
- *Stage Development Match-Up*
- *Stage Development Match-Up – Answer Key*

Facilitation Steps:

1. Have students work in groups to try and match the developmental milestones to their corresponding stage.
2. Have a discussion around why students match certain stages and milestones together. Example questions to use:
 - “What milestones do you think occur early on in fetal development?”
 - “What milestones do you think occur later in development?”
 - “Why do you think these milestones occur in this order?”
3. Inform students that this lesson will allow them to learn more about the different milestones and when they occur for a fetus.

Stage Development Match-Up

A. Day 18	B. Day 24
C. Day 26	D. Day 30
E. Day 38	F. Day 40
G. Day 50	H. Day 56
I. Day 60	J. Day 76

K. Day 100	L. Day 110
M. Day 150	N. Day 196
O. Day 230	P. Day 278-290
AA. – Eyelids fused – External genitalia differentiated – Hooves forming – 6-8 cm from crown to rump	II. – Delivery of fetus
BB. – Eyelids begin to cover eyes – 3.5-5.5 cm from crown to rump	JJ. – Primitive streak (gives rise to notochord) present – Amnion (membrane enclosing the embryo) complete
CC. – Eyelids forming – Ear forming as ridge	KK. – Ear begins to cover acoustic groove – 1-1.5 cm from crown to rump

DD. – Fourth brachial arch present – Mammary ridge present – Hind limb bud forming	LL. – Teeth begin to come in
EE. – Tactile hair (sensitive to touch) appears on face – 8-13 cm from crown to rump	MM. – Three brain vesicles visible – Forelimb bud present
FF. – Fine hair covering lower lip and chin – Eyelashes present – Tactile hairs on chin – Markings appear – Hooves harden – Teats well-formed – Testes descended – 30-45 cm from crown to rump	NN. – Palate fused
GG. – Hooves become firm and opaque – 15-20 cm from crown to rump	OO. – Eye sockets forming – Eyes pigmented – Hard palate forming – 0.8-1 cm from crown to rump
HH. – Eyelids separate	PP. – Hair fully covers body – 60-80 cm from crown to rump

Stage Development Match-Up– Answer Key

The following cards should match:

- A – JJ
- B – MM
- C – DD
- D – OO
- E – CC
- F – KK
- G – BB
- H – NN
- I – AA
- J – EE
- K – GG
- L – LL
- M – FF
- N – HH
- O – PP
- P – II

Lesson Three – Calf Embryology and Development

LEARN: Calf Embryology and Development

30 minutes

Purpose:

Students will identify the stages of a calf's development

Materials:

- Whiteboard, blackboard, or projector
- Bovine Birthing Simulator
- *Calf Embryology and Development* slide presentation
- *Calf Embryology and Development Note Sheet*
- *Calf Embryology and Development Note Sheet – Answer Key*

Facilitation Steps:

1. Begin the lesson by explaining to students that it's helpful to know the stages of calf development to understand how a calf transitions from a fertilized egg to the animal we recognize as a calf. Understanding developmental stages can be helpful in determining the age of a fetus.

Slide 2: Fertilization refers to the time when the two gametes (sperm and egg cells) come together to begin forming a new organism. This process is the first time in the development of a calf and, in reality, of all living things.

Fertilization allows for cell replication to take place and develop into a calf eventually.

Slide 3: Implantation is the process of an embryo burrowing into the lining of the uterine wall. This process occurs about 21 days following fertilization. While this process is important, it does not deal directly with the fetus itself, which is why we don't list it as a developmental milestone.

Slide 4: Now, we will dive into the developmental milestones of a calf.

Slide 5: A few things to note before looking at the specific milestones is that we will always reference the milestones based on their "days."

These refer to the number of days after fertilization. For example, when we say that something occurs at 24 days, it means that this milestone happens 24 days after fertilization.

Another key reminder is that the gestation period for cattle is 283 days. At that point, the calf should be fully developed and ready for delivery.

Slide 6: We will first look at days 18-26. Implantation will occur during this time frame. On day 18, the primitive streak will be present. This is what will eventually give rise to the notochord. The notochord is a skeletal rod made of cartilage that supports the body in all embryonic vertebrate animals.

This is also the time when the amnion will be completely formed. The amnion is the membrane that encloses the embryo.

On day 24, there will be three brain vesicles visible. There will also be a forelimb bud which will eventually give rise to the forelimbs.

On day 26, the fourth branchial arch is present. This will give way to the cervical sinus. The mammary ridge is also present, which will give rise to the mammary glands. The hind limb buds are beginning to form, which will eventually become the hind limbs.

Slide 7: Next, we will take a look at days 30-40.

Day 30 is when we begin to see eye sockets forming and the eyes becoming pigmented. The hard palate is also forming, which is the hard, bony part of the mouth that separates the mouth from the nasal cavity. At this point, the fetus is about 0.8-1 cm long.

On day 38, we see eyelids beginning to form, along with ears beginning to take shape in the form of a ridge.

On day 40, the ear begins to cover the acoustic canal. The fetus is approximately 1-1.5 cm long from crown to rump.

Introduction to Bovine Birthing and Ultrasound

Slide 8: Now, looking at days 50-60, we see the fetus growing in size.

On day 50, the eyelids are beginning to cover the eyes. The fetus is also 3.5-5.5 cm long.

On day 56, the palate is fused, meaning the roof of the mouth is formed.

On day 60, the eyelids are fused. External genitalia is differentiated, meaning you could determine the sex of the fetus. The hooves are also beginning to form, and the length of the fetus is now 6-8 cm long.

Slide 9: On days 76-110, we see some additional growth and features beginning to look more like a fully developed calf.

On day 76, the fetus has tactile hair appearing on its face. Tactile hair is hair that is sensitive to touch.

On day 100, the hooves become firm and opaque. The fetus is now measuring 15-20 cm long.

Day 110 is when teeth begin to come in for the fetus.

Slide 10: Day 150 has several milestones occurring. This includes the development of more hair, such as fine hair covering the lower lip and chin, eyelashes, and tactile hairs on the chin.

This is also the time when colored markings begin to appear on the fetus.

At this point, teats are well-formed and testes have descended. The total length of the fetus is 30-45 cm.

Slide 11: Days 196-290 mark the finishing touches of fetal development.

Day 196 is when we see the eyelids separating.

By day 230, hair is fully covering the body of the fetus, and it is now 60-80 cm long.

At day 278-290, fetal development should be complete as this is when we would expect the calf to be delivered.

For information on calving, see Lesson 2.

Name: _____ Class: _____

Calf Embryology and Development Note Sheet

1. Define fertilization:
2. Define implantation:
3. Developmental milestones:
 - a. Marked in _____ indicating time following fertilization
 - b. Gestation period of cattle is _____ days
4. Milestone marks:
 - a. Day 18
 - i. _____ streak present
 - ii. _____ complete
 - b. Day 24
 - i. _____ brain vesicles visible
 - ii. Forelimb _____ present
 - c. Day 26
 - i. Fourth _____ present
 - ii. _____ ridge present
 - iii. _____ bud forming
 - d. Day 30
 - i. Eye sockets forming
 - ii. Eyes _____
 - iii. Hard palate forming
 - iv. _____ - _____ cm from crown to rump
 - e. Day 38
 - i. _____ forming
 - ii. Ear forming as _____
 - f. Day 40
 - i. _____ begins to cover acoustic groove
 - g. _____ - _____ cm from crown to rump
 - h. Day 50

Introduction to Bovine Birthing and Ultrasound

- i. Eyelids begin to cover _____
- ii. _____ - _____ cm from crown to rump
- i. Day 56
 - i. _____ fused
- j. Day 60
 - i. Eyelids _____
 - ii. External genitalia differentiated
 - iii. _____ forming
 - iv. _____ - _____ cm from crown to rump
- k. Day 76
 - i. _____ appears on face
 - ii. _____ - _____ cm from crown to rump
- l. Day 100
 - i. Hooves become _____ and _____
 - ii. _____ - _____ cm from crown to rump
- m. Day 110
 - i. _____ begin to come in
- n. Day 150
 - i. Fine hair covering _____ and _____
 - ii. Eyelashes present
 - iii. _____ hairs on chin
 - iv. Markings appear
 - v. Hooves _____
 - vi. Teats well formed
 - vii. _____ descended
 - viii. _____ - _____ cm from crown to rump
- o. Day 196
 - i. Eyelids _____
- p. Day 230
 - i. Hair fully covers body
 - ii. _____ - _____ cm from crown to rump
- q. Day 278-290
 - i. _____ of fetus

Calf Embryology and Development Note Sheet – Answer Key

1. Define fertilization:
Gametes (sperm and egg cells) coming together to form a new organism
2. Define implantation
Process of an embryo (fertilized egg) burrowing into the lining of the uterine wall
3. Developmental milestones:
 - a. Marked in **days** indicating time following fertilization.
 - b. Gestation period of cattle is **283** days.
4. Milestone marks:
 - a. Day 18
 - i. **Primitive** streak present
 - ii. **Amnion** complete
 - b. Day 24
 - i. **Three** brain vesicles visible
 - ii. Forelimb **bud** present
 - c. Day 26
 - i. Fourth **branchial arch** present
 - ii. **Mammary** ridge present
 - iii. **Hind limb** bud forming
 - d. Day 30
 - i. Eye sockets forming
 - ii. Eyes **pigmented**
 - iii. Hard palate forming
 - iv. **0.8-1** cm from crown to rump
 - e. Day 38
 - i. **Eyelids** forming
 - ii. Ear forming as **ridge**
 - f. Day 40
 - i. **Ear** begins to cover acoustic groove
 - ii. **1-1.5** cm from crown to rump
 - g. Day 50
 - i. Eyelids begin to cover **eyes**
 - ii. **3.5 – 5.5** cm from crown to rump

Introduction to Bovine Birthing and Ultrasound

- h. Day 56
 - i. Palate fused
- i. Day 60
 - i. Eyelids fused
 - ii. External genitalia differentiated
 - iii. Hooves forming
 - iv. 6-8 cm from crown to rump
- j. Day 76
 - i. Tactile hair appears on face
 - ii. 8-13 cm from crown to rump
- k. Day 100
 - i. Hooves become firm and opaque
 - ii. 15-20 cm from crown to rump
- l. Day 110
 - i. Teeth begin to come in
- m. Day 150
 - i. Fine hair covering lower lip and chin
 - ii. Eyelashes present
 - iii. Tactile hairs on chin
 - iv. Markings appear
 - v. Hooves harden
 - vi. Teats well formed
 - vii. Testes descended
 - viii. 30-45 cm from crown to rump
- n. Day 196
 - i. Eyelids separate
- o. Day 230
 - i. Hair fully covers body
 - ii. 60-80 cm from crown to rump
- p. Day 278-290
 - i. Delivery of fetus

Lesson Three – Calf Embryology and Development

REVIEW: Signs of Calving and Care

15 minutes

Purpose:

Students will identify the stages of calf development.

Materials:

- *Stage Development Match-Up*
- *Stage Development Match-Up* – Answer Key

Facilitation Steps:

1. This review can be done in a variety of ways. The first would be to treat it as a group activity where students work with the *Stage Development Match-Up* to determine the order in which the different developmental milestones occur.
2. Another option would be to treat this as a quiz where the students are provided either the milestones or the list of days and complete the other portion.
3. A third option would be to assign students specific days to create visual representations of the milestones. This option may involve more time and should include a presentation for students to see the visuals. This could also have a display where students hang their visuals in order of development.

Sources

1. Dr. Lynae Schott, DVM; Sauk Prairie Veterinary Clinic
2. https://embryology.med.unsw.edu.au/embryology/index.php/Bovine_Development
3. <https://www.shsu.edu/dotAsset/ebabb52c-4099-4fe0-9ba9-dbf0634effb3.pdf>
4. http://gpvec.unl.edu/Elective_files/Pregnancy%20Examination/Pregnancy%20Examination%20Reference%20Material/1_Pregnancy%20Staging%20Aids.pdf

Lesson Four – Ultrasound

Lesson Overview

In order to confirm a pregnancy and its viability within cattle, ultrasound is a common technique used in the industry. This lesson will allow students to learn about ultrasound techniques and practice the steps to ultrasound a cow on the calving simulator.

Lesson Objectives

After completing this lesson, participants will be able to:

- Confirm a pregnancy and its viability within cattle

Lesson at a Glance

Activity	Materials	Preparation	Approximate class time
FOCUS	• Whiteboard, blackboard, or projector • <i>Ultrasound</i> slide presentation	1. Prepare <i>Ultrasound</i> slide presentation for viewing.	10 minutes
LEARN	• Whiteboard, blackboard, or projector • <i>Ultrasound</i> slide presentation • Bovine Ultrasound Simulator	1. Prepare <i>Ultrasound</i> slide presentation for viewing.	30 minutes
REVIEW	• <i>Ultrasound Demonstration Checklist</i> • Bovine Ultrasound Simulator	1. Print/photocopy <i>Ultrasound Demonstration Checklist</i> (one per participant).	25 minutes (may vary)

Lesson Four – Ultrasound

FOCUS: Pregnancy Scenario

10 minutes

Purpose:

Students will identify ways to determine if a cow is pregnant.

Materials:

- Whiteboard, blackboard, or projector
- *Ultrasound* slide presentation

Facilitation Steps:

1. Present participants with the following scenario: “You own a herd of dairy cattle and bred your cows about a month ago. Because you rely on milk production, it is vital that your cows are pregnant. How will you determine if your cows are pregnant?”
2. Have students discuss possible ways to determine if cows are pregnant.
3. Discussion should lead to identifying palpation, blood testing, and ultrasound as the primary ways to determine if a cow is pregnant.
4. Discuss why a farmer may choose to utilize one method over another. For example, palpating is cheaper, ultrasound is more accurate, etc.
5. Inform students that this lesson will help them learn how to use an ultrasound machine to monitor a fetus.

Lesson Four – Ultrasound

LEARN: Ultrasound

45 minutes

Purpose:

Students will identify the steps to use ultrasound and identify key structures within an ultrasound image.

Materials:

- Whiteboard, blackboard, or projector
- Bovine Ultrasound Simulator
- *Ultrasound* slide presentation

Facilitation Steps:

Note: Students will need to know some basic reproductive anatomy in order to complete this lesson.

1. Begin the lesson by explaining to students that ultrasound is a useful tool in confirming and monitoring pregnancy in bovines. You can also let students know that this same technology is also used for humans.

Slide 2: An ultrasound is a sound with an ultrasonic frequency that allows medical imaging to be created. In bovines, it is commonly used to diagnose, confirm, and/or monitor pregnancy, to monitor for twins, to examine the female reproductive tract, and to examine the lungs. This technology can also be used to evaluate meat quality, organ health, and potential foreign objects within the body.

Slide 3: Ultrasound is not the only way to detect a pregnancy. Other options include a blood test or palpating the cow to feel for a developing fetus.

Slide 4: In all ultrasound machines, there are three primary components. The transducer is the part that comes in contact with the animal. This is often referred to as the probe, and its job is to emit sound waves and detect them as they bounce back off the part being viewed.

The processor then takes the information from the transducer to create an image. This image is based on the sound waves and how they've been

bouncing off or going through parts of the viewing area.

The monitor then allows us to see the image the processor created. Many large animal veterinarians have goggles that act as the monitor showing them the images. Other times the monitor is a screen that can be viewed.

Slide 5: Because the ultrasound is using sound waves, only structures can be seen because of their ability to bounce the sound waves back to the transducer. Because of this, solids such as bone will appear to be white with the sound waves bouncing off them. Fluids will be black because the sound waves go right through them.

Slide 6: When thinking about the image, it is helpful to imagine the probe as if it were a knife slicing through the part we are viewing. The image then would be the slice that was cut. When looking at the transducer on the slide, you can see how it is oriented in relation to the ultrasound image. This is helpful to orient what is being viewed. Remember, this is a two-dimensional view of a three-dimensional animal. Also, as you move the transducer, the image can look very different as the angle can greatly impact how it looks.

Slide 7: Now that we know what an ultrasound is, we are going to take a look at how to use it.

Slide 8: First, we need to prepare the ultrasound machine. This includes ensuring the equipment is charged and functioning properly.

Depending on the machine, there is a variety of setting options. It is important to know the best settings for each machine and procedure.

Once the machinery is good to go, the probe and person using it need to be prepared. This involves covering your arm in veterinary-grade plastic, then putting a veterinary-grade latex glove over the hand of your sleeved arm. The probe and arm should then be lubricated.

Once everything is ready to go, ensure that the cow is properly restrained, either using a chute, gates, or headlock.

Slide 9: Now that you, the equipment, and the cow are ready, it is time to insert the probe. To do this, insert your hand holding the transducer gently into the rectum.

Apply firm but gentle pressure on the floor of the rectum. This will allow the transducer to contact the floor of the rectum to get a clearer picture.

Slowly sweep the transducer from side to side to obtain pictures of the uterus. You will also want to sweep to see the ovaries, depending on the stage of pregnancy.

Slide 10: Once the transducer is inserted, you can begin to view the image on the monitor. While viewing, it is important to note some key anatomical features.

It is common to see the bladder as a black mass on an ultrasound image of the uterus. The visual of the bladder is due to it being filled with liquid, allowing the sound waves to travel right through.

The bladder is not the only place where fluid will be seen. Pregnancy itself involves large amounts of fluid, such as the amniotic sac, to help protect the fetus. This will be evident during the ultrasound, and often the fetus will appear white in an area of black due to the fluid surrounding it.

Slide 11: When monitoring a pregnancy, there are a few times when ultrasounds are routinely used. The first time is roughly between 28 and 30 days after expected fertilization. This check is considered the primary pregnancy check to confirm that the cow is pregnant.

The next routine check is typically around the 60-day mark. This check is to ensure that the pregnancy is still viable. This is also when a fetus may be sexed if the producer is interested.

Other times may be monitored using ultrasounds based on individual farm protocols, but the 28- and 60-day marks are the most commonly used.

Slide 12: When checking a cow with ultrasound, look for a few key things depending on the day mark.

Slide 13: On day 28, the goal of an ultrasound is to confirm a pregnancy. To do this, you will look for a good CL (corpus luteum). The CL is a thick-walled cyst used to produce the hormone progesterone. This hormone helps to maintain pregnancy.

A good CL should be about 15 mm in size, measured by a grid that would appear on most monitors that has 1 cm by 1 cm squares. The CL should be about 1.5 squares in size.

To find the CL, scan the ovaries and check their edges.

Slide 14: In addition to looking for a good CL, you can also look for signs of a fetus.

At this point, the fetus will likely look like an elongated round structure, and a heartbeat can likely be observed, causing the fetus's structure to appear to have something in it that is pulsating.

Slide 15: At the 60-day check, the goal of an ultrasound is to ensure the pregnancy is still viable. Things that are looked for at this point are the fetus as well as "buttons." Buttons is a term that refers to placentomes, or sites of attachment from the cow to the fetus that will appear as dense round structures throughout the uterus.

Slide 16: Sexing a calf can be done at the 60-day viewing. It is crucial to find the Genital Tubercle and the Umbilical Cord. The genital tubercle, or GT, is what will eventually give rise to the penis in a male or the clitoris in a female.

To note the difference between the umbilical cord and the GT, look for the number of white lines. The umbilical cord will have one white line, while the GT will have 2.

If the GT is directly behind the umbilical cord, the fetus is a male. If the GT is under the tail of the fetus, it is a female.

Slide 17: Something that may be discovered during an ultrasound is the presence of a twin. If a cow is pregnant with twins, there will be two fetuses visible in the uterine body.

Regarding twins, if a twin is a female, she is likely to have an underdeveloped reproductive tract. If this occurs, she is considered a freemartin, indicating that she is unable to reproduce.

Lesson Four – Ultrasound

REVIEW: Ultrasound Demonstration

15 minutes

Purpose:

Students will demonstrate the steps to ultrasound a cow.

Materials:

- Bovine Ultrasound Simulator
- *Ultrasound Demonstration Checklist*

Facilitation Steps:

1. For the demonstration, have a copy of the checklist for each student. Have students come up to the Bovine Ultrasound Simulator one at a time and ask them to demonstrate how to ultrasound the cow.
2. As they are demonstrating, ask students what they are looking for and have them point it out on the ultrasound monitor. You can ask them based on a specific day they are assigned or have them explain all checks that would be done.
3. As they are completing the demonstration, mark steps as complete once the student has demonstrated them. Add comments to help students understand how to improve for the future.
4. A second assessment can be done with the same checklist after feedback has been given. This could be an opportunity for students to demonstrate growth in their knowledge of how to perform an ultrasound.

Name: _____ Class: _____

Ultrasound Demonstration Checklist

Ultrasound Demonstration Checklist	
Ultrasound Preparations	☐ Identify if this is a primary or secondary pregnancy check ☐ Identify how long it has been since the animal was bred (28-30 for primary check, 60 for secondary check) ☐ Equipment is fully charged and ready to go ☐ Settings are adjusted for the set preferences ☐ Arm is equipped with veterinary-grade plastic sleeve and veterinary-grade latex glove over the sleeve ☐ Probe is lubricated ☐ Cow is restrained in a chute, gate, or headlock Comments:
Inserting Ultrasound Probe	☐ Clean the rectum of feces ☐ The hand holding the transducer is gently inserted into the rectum ☐ Apply firm, but gentle pressure on the floor of the rectum ☐ Slowly sweep the transducer from one side to the other to obtain pictures of the uterus Comments:

Sources

1. Dr. Lynae Schott, DVM; Lodi Veterinary Care
2. http://gpvec.unl.edu/Elective_files/Pregnancy%20Examination/Pregnancy%20Diagnosis%20Resources/Extension%20Arm%20Ultrasound%20Training%20with%20Fetal%20Aging%20using%20a%204.0%20MHz%20Probe.pdf
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4. http://therio.vetmed.lsu.edu/bovine_pregnancy.htm