

Introduction to Reproduction

Meranda Small, Extension Educator

Goal (learning objective)

Youth will learn about beginning concepts of reproduction and puberty in livestock.

Supplies

- Poster displaying a flow chart to summarize the age of puberty onset along with influencing factors (see diagram below), created by you as an example
- Poster paper (for your demonstration poster and enough for team posters)
- Colored markers

Pre-lesson preparation

- Be prepared to discuss general reproduction. Some information is provided in this lesson and does not vary from species to species
- Research puberty for each species along with physical factors that influence onset of puberty as well as factors unique to species. For example:
 - Beef heifers with a higher fatness will go into puberty earlier than low weight heifers, likely due to metabolic signals effecting hormone production
 - Gilts in a larger group or fenced in a pen next to a male will go into puberty sooner than gilts in small groups or with no male exposure. This is the result of the presence of pheromones and the animals detecting them, initiating a hormonal response
 - The month/season a lamb is born in influences when it will reach puberty, this is in relation to sheep being short day breeders
 - Breed and genetics influence provide a couple examples within a species

See Supplement attached at end of lesson

Lesson directions and outline

Reproduction is a sequence of events resulting in new life and beginning with development of the reproductive system in the embryo, or unborn animal. After an animal is born, it must grow and achieve puberty, a stage of maturity, by developing the ability to produce fertile gametes, or reproductive cells. This ability must be accompanied by reproductive behavior and copulation or mating. After copulation, the sperm and egg meet, fertilization occurs and development of the embryo follows. The embryo attaches to the inside of the uterus by the placenta, which is where the embryo develops and grows. The fully developed embryo will then be born and the female will begin to lactate or produce milk as nourishment for the newborn. After a time of recovery, the process will happen all over again.

But wait a minute... puberty must take place before any animal is able to reproduce.

Conducting the activity (DO)

1. Do a discussion with youth participants. Ask: What is reproduction? What is taking place?
2. Share with the group the prepared poster.
3. Discuss common terms (keep your audience in mind). Discuss ages at which each livestock species reaches puberty (male and female) and influencing factors.
4. After the discussion, break individuals up into groups by species. Have the teams create a poster for their species based on your example and the discussion.
5. Ask teams to share their poster with the group.

What did we learn? (REFLECT)

- Ask: What is reproduction?
- Ask: What does reaching puberty allow for?
- Ask: Can we influence puberty in our 4-H animal? How?

Why is that important? (APPLY)

- Ask: Why is successful reproduction important?
- Ask: How is reproduction affected by the onset of puberty in an animal?
- Ask: How is the industry impacted by the ability to influence puberty?

Resources

- Ohio State University Extension. (2011). Reproduction and Genetics. *Beef resource handbook* (pages 6-1 through 6-6).
- Ohio State University Extension. (2011). Reproduction. *Goat resource handbook* (pages 35-41).
- Ohio State University Extension. (2011). Reproduction and Genetics. *Sheep resource handbook for market and breeding projects* (pages 119-123).
- Ohio State University Extension. (2000). Selection of Breeding Stock. *Swine resource handbook for market and breeding projects* (pages 15-4 through 15-16).
- Senger, P.L., (2003). *Pathways to Pregnancy and Parturition*. Second revised edition. Chapter 1 (page 1) and Chapter 6 (pages 132-141).

REPRODUCTION: INTRODUCTION TO REPRODUCTION – SUPPLEMENT 1

Beef	Sheep	Swine
Male = 11 mo. (7-18) Female = 11 mo. (9-24)	Male = 7 mo. (6-9) Female = 7 mo. (4-14)	Male = 7 mo. (5-8) Female = 6 mo. (5-7)

- Breed is a general factor that influences onset of puberty in all species for both male and female
- General factors in females in all species that influence onset of puberty include fatness and environmental/social cues
- Hormonal shift is a general factor in males in all species that influences onset of puberty

(Discuss the specifics for the species you are teaching about and any other specific breed factors within that species).

-Exposure to bulls prior to puberty

-season during which animal is born
-amount of daylight during onset of puberty

-exposure to boars prior to puberty
-size of group being housed together

Goats - Doelings that are healthy and well managed nutritionally can be bred at 7 to 10 months of age. Bucklings can reach puberty as early as 4 months but 6 to 8 months is typical. As with the other species, the season the animal is born has an effect on puberty onset. Exposure to bucks prior to puberty can affect the onset of puberty.

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Senger, P.L., (2003). Pathways to Pregnancy and Parturition. Second revised edition. Chapter 1 (page 1) and Chapter 6 (pages 132-141).

Reproduction & Puberty – Chapter 6, pages 132-141

Table 6.1 Average Ages (Range) of Puberty in the Male and Female of Various Species

<u>Species</u>	<u>Male</u>	<u>Female</u>
Cattle	11 mo (7-18)	11 mo (9-24)
Horse	14 mo (10-24)	18 mo (12-19)
Sheep	7 mo (6-9)	7 mo (4-14)
Swine	7 mo (5-8)	6 mo (5-7)

At least two general factors impact the onset of puberty in the female: development of a **threshold body size** (*body maturation and amount of body fat*) and/or composition and exposure to certain **environmental or social cues**. It is thought that the female must develop a certain degree of “**fatness**” before reproductive cycles can be initiated. Several external factors influence timing of puberty that vary among species including: season during which the animal is born (sheep), the amount of daylight during onset of puberty (sheep), the presence or absence of the opposite sex during the **pre-pubertal** period (swine & cattle) and the size of groups (within the same sex) in which the animals are housed (swine).

The breed of the animal has an important influence on the age at which puberty is attained in both the male and female.

Table 6.2 Influence of Breed on Age at Puberty in Domestic Animals

<u>Species</u>	<u>Average Age at Puberty (Months)</u>	
<i>Cattle</i>	<i>Female</i>	<i>Male</i>
Holstein	8	9
Brown Swiss	12	9
Angus	12	10
Hereford	13	11
Brahman	19	17
<i>Sheep</i>		
Rambouillet	9	---
Finnish Landrace	8	---
<i>Swine</i>		
Meishan	3	3
Large White	6	6
Yorkshire	7	7

In the male, the onset of puberty is brought about because of decreased **hypothalamic sensitivity** to negative feedback by **testosterone/estrogen**. *Essentially, in the male elevated levels of hormones are no longer being suppressed allowing him to go into puberty.* This is somewhat the same in the female.

Nutritional intake in a newborn is directed almost exclusively towards body maintenance. Nonessential processes such as reproduction are of low priority. As the animal begins to grow, nutritional needs increase, the animal grows first structurally to a point before fat begins depositing. At this point nutritional needs shift, allowing for more energy to go towards non-vital functions such as reproduction and the onset of puberty. It needs to be emphasized however that “**fatness**” alone does not promote the onset of puberty, both body maturation and amount of body fat are important in regulating the age of puberty onset. “**Fatness**” for puberty in the male is not well understood, though it is known that restriction of energy intake to 70% of recommended amounts delays the onset of puberty in the male.

Month of birth will influence the age of puberty, particularly in **seasonal breeders** such as sheep which begin their cycles in response to short day lengths. Spring-born (February-March) lambs receiving adequate nutrition attain puberty during the following fall (September-October). Age of puberty is about 5-6 months after birth. Fall born lambs do not reach puberty until about 10-12 months after birth. Fall born lambs require twice as much time to reach puberty than spring born. This is because of **seasonal cues** that delay cycling. This then synchronizes **ovulation** in ewes, young and old, which maximizes the chance they'll all get pregnant in the fall and lamb in the spring when nutrients are more readily available and weather conditions are favorable. Again, "fatness" is necessary before this **photoperiod cue** can have effect. In heifers there is evidence that age at puberty is influenced by the season of birth. Heifers born in the fall tend to reach puberty earlier than those born in spring. Exposure in the second six months of life to long days and warmer temps hastens the onset of puberty. Exposure to short days during the first six months of life (fall born) followed by increasing day lengths in the second six months (spring and summer) has been associated with earliest age of puberty in heifers. Spring born ram lambs begin reproductive development at about 10 weeks of age during midsummer while spring born ewe lambs do not reach puberty until 25-35 weeks after birth. Season of birth does not affect age of puberty in bull calves.

Social cues significantly impact the onset of puberty in many species. This is controlled by **olfactory** (*sense of smell*) recognition of **pheromones** (*bodily chemical*). Enhancement of the onset of puberty by the presence of a male has been demonstrated in the ewe, sow and cow. Females that reaching puberty in the presence of a male have greater opportunity to be bred. Certain social cues will inhibit the onset of puberty as well. Gilts (young female pigs) housed in small group have delayed puberty when compared to gilts housed in larger groups. Gilts housed in small groups but exposed to a boar (male pig) will enter puberty as an earlier age than either the large group or small group not exposed to a boar. The presence of the boar, either direct contact or just visual contact will accelerate the onset of puberty in the gilts. This observation is beneficial in the management of swine as age of puberty can then be reduced and breeding can begin earlier. Heifers with high or moderate growth rate and exposure to a bull reach puberty faster than heifers of the same growth rate not exposed to a bull.

Word Bank

uterus – part of the female reproductive tract that is responsible sperm transport, formation of the placenta and housing the fetus throughout gestation

placenta – organ that enable nutritional exchange between mother and fetus

environmental/social/seasonal cues – signals or stimuli that influence reproductive processes

fatness – level of body condition

pre-pubertal – stage of development prior to reaching puberty

testosterone/estrogen – hormones with reproductive influence

seasonal breeders – animals whose reproduction is influence by time of year; animals that breed only during certain times of year

ovulation – release of eggs to be available for fertilization

photoperiod cue – a reaction in an animal to the period of time during the day when there is daylight