Department of Primary Industries

Dairy Australia

Industry insights- Dairy production

Supporting document

NSW DPI Schools Program

Answer guide

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DPI in SCHOOLS

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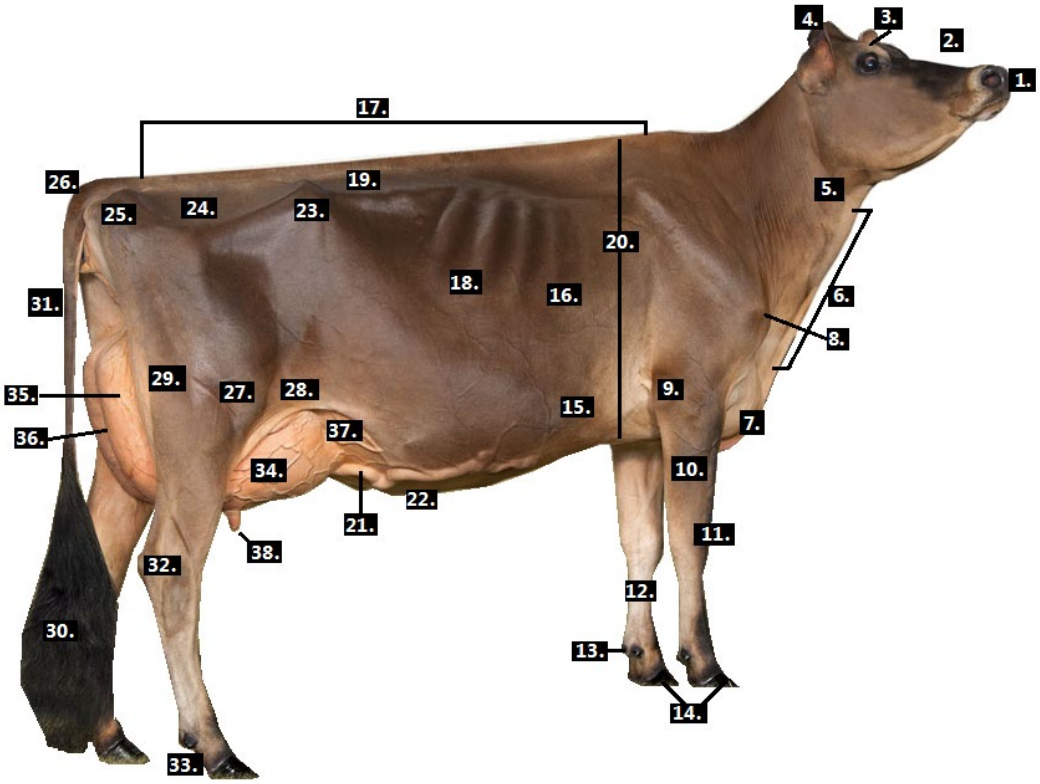
This resource is a collaboration between NSW Department of Primary Industries and Dairy Australia.

Dairy Production- Answer guide

Sample answers have been provided for learning activities where applicable for this document. The following suggested answers should be used as a guide. It should be noted that these sample answers are suggested answers and not necessarily the very best answer, nor are they the only possible answers.

Cow anatomy

Label the parts of the dairy cow using the NSW DPI 'Dairy Production' poster.



1. Muzzle
2. Face
3. Forehead
4. Poll
5. Throat
6. Dewlap
7. Brisket
8. Point of shoulder
9. Elbow
10. Forearm
11. Knee
12. Cannon
13. Dewclaw
14. Hoof
15. Lower fore rib, fore flank
16. Forerib
17. Back or top
18. Rib
19. Loin
20. Heart girth
21. Milk/mammary vein
22. Hip
23. Rump
24. Pin bone
25. Tailhead
26. Stifle
27. Rear flank
28. Quarter/thigh
29. Switch
30. Tail
31. Hock
32. Pastern
33. Udder
34. Rear udder
35. Suspensory ligament
36. Fore udder attachment
37. Teat

Dairy breeds

Use the 'Dairy Production' poster to identify common breeds of dairy cows. Research the origin and features of each breed pictured in the following table. Suggested references include: 'Australian Dairy Cows' (Dairy Australia) and 'Different breeds of cows' (Lactalis Australia).

Figure 1 Source Genetics Australia

Breed: Holstein-Friesian

Origin: Northern Europe. Holstein-Friesians were first imported into Australia in the mid 1800's.

Average production (L/day) in Australia: 35-45L/day

Cow characteristics:

- Frame size: Large frame. Cows can stand over 1.5 meters. Bulls can stand over 1.8 meters.
- Average mature cow weight: 600kg and bull weight over 1000kg
- Colour: Black and white, ranging from almost totally white to totally black.
- Holstein-Friesians are the most numerous dairy breed in Australia making up more than 60 % of commercial milking cows in Australia.

Milk quality and quantity characteristics:

- Medium milk composition and high milk yield.
- 3.62-4.8% milk fat; 3.2-3.7% milk protein; 4.6-4.9 % milk lactose.

Figure 2 Source Genetics Australia

Breed: Jersey

Origin: Originally came from the island of Jersey (in the English Channel between England and France) and were brought to Australia in 1829

Average production (L/day) in Australia: 15-20L/day

Cow characteristics:

- Frame size: Small frame.
- Average mature cow weight: Cows can weigh up to 500kg
- Colour: dark to light fawn colour, with black tips on their muzzles, ears, feet and tails.
- Second most popular dairy breed in Australia due to their milk quality characteristics of high butterfat % and milk protein % content.

Milk quality and quantity characteristics:

- High milk composition (protein and butterfat percentage) and medium milk yield
- 4.8-4.95% milk fat; 3.15-3.9% milk protein; 4.8-4.9 % milk lactose.

Figure 3 Source Genetics Australia

Breed: Aussie Red

Origin: Bred in Australia by combining Scandinavian Red genetic lines with other Australian Red breeds such as the Illawarra and Ayrshire.

Average production (L/day) in Australia: 35-40L/day

Cow characteristics:

- Frame size: Medium frame.
- Average mature cow weight: 550kg
- Colour: mainly red in colour, though some cattle are either roam or red with white

Milk quality and quantity characteristics:

- Medium too high milk yield and high milk protein content and medium milk fat content.
- 4.0-4.7% milk fat; 3.5-3.8% milk protein

Figure 4 Source Genetics Australia

Breed: Ayrshire

Origin: Originally from the County of Ayr in Scotland and imported to Australia in the 1850's.

Average production (L/day) in Australia: 30-35L/day

Cow characteristics:

- Frame size: Medium frame
- Average mature cow weight: 550kg
- Colour: varies from light to deep cherry red, mahogany, brown, or a combination of these colours with white. Some are all white.
- There are only few whole Ayrshire herds being commercially milked in Australia.

Milk quality and quantity characteristics:

- Ayrshire milk characteristics, medium to high milk composition and medium to high milk yield.
- 4.0-4.2% milk fat; 3.35% milk protein; 4.5-4.9% milk lactose

Figure 5 Source Genetics Australia

Breed: Illawarra

Origin: Developed in the Illawarra region of New South Wales by crossbreeding several breeds (Jersey, Guernsey, Kerri Dexter, Longhorn Durhams, Shorthorn Durhams, Red Lincolns, Friesian, Shorthorn and Ayrshire). They were recognised as a new Australian cow breed in 1910.

Average production (L/day) in Australia: 35-40L/day

Cow characteristics:

- Frame size: medium frame
- Average mature cow weight: 550kg
- Colour: Rich red or roan in colour with a little white on the flank.

Milk quality and quantity characteristics:

- Illawarra cows produce large quantities of milk; with moderate fat and protein %
- 3.6-3.97% milk fat; 3.2-3.31% milk protein; 4.61 milk lactose

Figure 6 Source Genetics Australia

Breed: Guernsey

Origin: Originally from the Isle of Guernsey, a tiny island in the English Channel.

Average production (L/day) in Australia: 25 litres of milk per day.

Cow characteristics:

- Frame size: Medium frame.
- Average mature cow weight: Average mature cow weight is 450-500kg.
- Colour: fawn or red in colouring with white markings.

Milk quality and quantity characteristics:

- Guernsey cows produce moderate quantities of milk; with moderate fat and protein %
- 4.26-4.75% milk fat; 3.6-3.75% milk protein; 4.76% milk lactose
- 96% of Guernsey cows carry the protein Beta Casein A2 in their milk
- Milk is a distinctive golden colour.

Figure 7 Source Genetics Australia

Breed: Brown Swiss

Origin: developed in North-Eastern Switzerland 1000 years ago. The oldest dairy breed.

Average production (L/day) in Australia: 35-40L/day

Cow characteristics:

- Frame size: Large frame
- Average mature cow weight: 600kg
- Colour: Solid brown in colour, varying from very light to dark with a white muzzle and black nose.
- Second most common breed in the world.
- The fat to protein ratio in Brown Swiss milk is ideal for cheese, thus making them one of the most popular breeds around the world for cheese making.

Milk quality and quantity characteristics:

- High volume of milk with high fat% and moderate protein%
- 4.18% milk fat; 3.43% milk protein

Milk processing, marketing and value adding

Use the 'Dairy Production' poster to answer the following.

1. **List the three processes used to treat milk in its raw state to reduce potentially harmful bacteria present and make it safe for the consumer.**
   Refrigeration, pasteurisation and homogenisation.
2. **Describe the process of pasteurisation.**
   Pasteurisation is the process whereby milk is partially sterilised to kill harmful by heating it to about 71°C for 15 seconds then rapidly cooled to 4ºC or below. This extends the shelf life of milk and makes it safe to drink. It is then cooled down and refrigerated.
3. **Describe the process of homogenisation.**
   Milk is an emulsified colloid which means that microscopic liquid fat (cream) components are dispersed throughout the water component of milk. The cream is not soluble, so if left to sit, it separates and rises to the top of the milk. Homogenisation is a process which evenly distributes the cream throughout the milk so it can't separate out. It is a mechanical process where milk is passed through fine nozzles under high pressure. Homogenisation is carried out to create a consistent tasting high-quality product for consumers.

   Milk is refrigerated, pasteurised and homogenised.
4. **Define value-adding and include an example of a value-added dairy product.**
   Value-adding involves processing a raw product to make it of greater value to the consumer. The price is determined by what customers are willing to pay based on their perceived added value. For example, ice cream, or lite milk.
5. **Milk is processed to create a range of value-added products. The processes are either physical or microbial.**
   - **Physical processing:** includes separation, churning and dehydration but does not use microbes or chemicals**.**
   - **Microbial processing:** involves altering the chemical composition of the milk through fermentation and coagulation to create a new product.

   Complete the table by describing how each value-added product is created and identifying whether it is a result of physical or microbial processing.

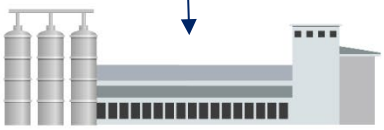
Processing dairy products		
Dairy Product	Description of process	Physical/microbial
Skim/lite milk	Skim and lite milk are the products left after cream has been skimmed from the full cream milk. The products are classified on the fat content of the final product (amount of cream removed). A centrifugal separator spins full cream milk at high speed resulting in the cream separating from the other milk components and creating skim milk.	Physical-separation
Yoghurt	Yoghurt is made by fermenting milk with beneficial bacteria. The bacteria convert lactose (sugar present in milk) to lactic acid, thickening the milk and giving it the tangy taste characteristic of yogurt. The yogurt is then cooled and can be flavoured with fruit, sugar, sweeteners or flavourings.	Microbial-fermentation
Powdered milk	The solids left behind when water is removed from milk through evaporation. Powdered milk has a longer shelf life and can be easily transported.	Physical-dehydration
Cream	Cream is produced by spinning pasteurised, non-homogenised milk at high speed. Centrifugal forces cause the fat globules (cream) to separate from the other milk components.	Physical-separation
Cheese	Cheese is made when starter culture (bacteria) is added to pasteurised milk. This causes the milk to coagulate and form curd. Once the curd is separated from the remaining liquid (whey) it can be salted, moulded and aged. Different cheeses	Microbial-coagulation

	are made by changing the processing method used, for example: Soft cheeses: Brie, Camembert, Feta Hard cheeses: Cheddar, Gouda, Parmesan Blue cheeses (ripened with green moulds): Gorgonzola, Roquefort, Stilton	
Butter	Butter is made by churning (agitating) cream until it thickens into the product we buy at the supermarket. Buttermilk is the by-product of making butter.	Physical-separation

6. **Use the following images to create a milk production and marketing chain. Use the 'Dairy Production' poster for assistance.**
   Include:
   - **A title and description at each step of the chain, explaining what is occurring**
   - **Arrows linking each step to the next**

Milking

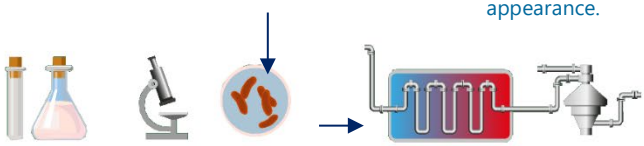
Milk is harvested from cow and stored in a refrigerated vat on farm.



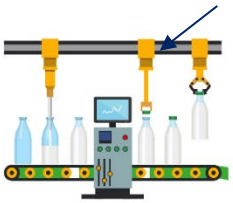
Transportation of chilled milk

Refrigerated tankers collect the milk from the dairy and transport it to the processing plant.

The driver assesses the milk volume, taste, smell and appearance.

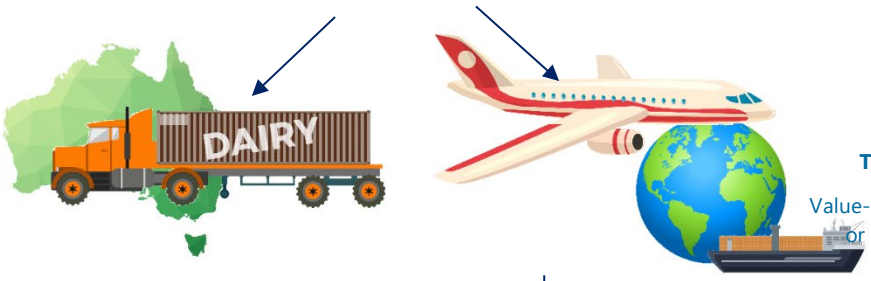


Primary processing: pasteurisation and homogenisation.



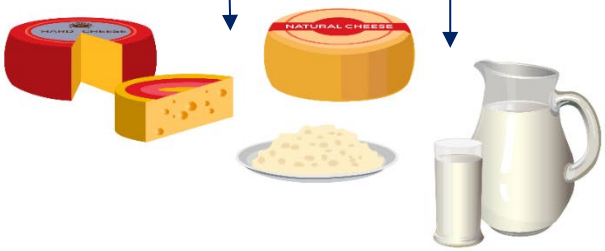
Secondary processing: manufacturing of value-added products e.g. fat reduced milk, cheese, yoghurt, ice-cream, powdered milk etc.

Final products are packaged for distribution.



Transportation of packaged dairy products

Value-added dairy products are transported to domestic or export consumer markets and distributors e.g. wholesalers, retailers and food services.



Sales and retail

Branding and marketing campaigns affect sales to final consumers and the creation of markets. Consumer requirements affect all stages of production and processing.

Use the extract from Dairy Australia, '[In Focus 2019- A world competitive industry',](#) to answer questions 7-12.

7. **When did deregulation in the Australian dairy industry occur?**
   2000-2001

8. **What is deregulation and what impact did it have on Australian dairy production? Suggested reference: '[History of Australian dairy industry deregulation'](#)(Dairy Australia).**
   Deregulation refers to the removal of both state and federal influence, intervention and legislation specific to the dairy industry. In Australia this meant the discontinuation of regulated sourcing and pricing of drinking milk within the states. On a Federal level, it stopped regulating manufacturing milk prices. The overall impact of deregulation in Australia was a decrease in the number of small farms. Australian dairy farms now operate in a completely deregulated industry environment, where international prices are the major factor in determining the price received by farmers for their milk. Australian dairy farmers receive a low price by world standards and therefore run very efficient production systems.

9. **In other countries around the world, governments intervene in dairy production by regulating milk prices and providing subsidies to producers. From the reading, list some of the countries where this occurs.**
   Canada, United States of America, European Union and New Zealand.

10. **What was the average Australian farm gate price of milk/100kg in 2018-2019?**
    US$37/100kg

11. **According to the International Farm Comparison Network (IFCN) Dairy Research Network, the cost of milk production in Australia in 2018 fluctuated between US$35-40 per 100 kg.**
    A) **Calculate the profit US$/100kg of milk in Australia (2018-2019).**
       US+$2 to -$3/100kg

    B) **What are some of the factors which might have contributed to these production costs in 2018-2019?**
       - Costs associated with drought for example, agistment, buying water and supplementary feed, reduced irrigation water allocation.
       - Supermarket influence of setting market price of milk.
       - Overseas owned milk processing plants (e.g. Fonterra) influence through setting milk farmgate price for producers.

12. **Compare milk farmgate price (US$/100kg) trends between Australia and other countries between 2017-2018 in Figure 2.**
    Between 2017-2018 Australia farmgate price increased from US$32-$37/100kg.

    In 2017 the farmgate price of milk US$/100kg for Australian producers was well below all other countries listed (New Zealand, European Union, USA and Canada). By 2018 all countries farmgate price of milk is closer, ranging between approximately US$35-$39/100kg. With the exception of Canada which didn't change price over the time period and remained at approximately US$57/100kg.

13. **Over the last thirty years there has been a gradual decline in the number of owner-operated, small, non-corporate Australian dairy farms. Identify social and economic implications to Australian consumers if we lost dairy production in Australia?**
    Answers will vary. Ideas could include:
    - Dairy products would need to be imported from other countries.
    - Loss of our export markets would negatively impact the Australian economy.
    - Dairy products are perishable, so the freshness, quality, availability and food safety of products could be negatively impacted.

- Rural communities would be disrupted as local businesses (dairy producers) leave. This could have negative secondary impacts on communities in education, health services, local businesses, employment opportunities, economy etc.

14. As a consumer, what can you do to support the Australian dairy industry?

Answers will vary. Ideas could include:

Make sure you only buy Australian owned and produced dairy products, even if they cost more than the 'home brand' or imported products. Check the product label for Australian grown and produced signage.

15. The Australian dairy industry is a very efficient industry and a net exporter. Most of the milk produced supplies the domestic market with the excess going overseas to export markets. Access the NSW DPI '2018 Performance Data Insights, Milk' information and use the interactive graph, 'NSW milk export value by market,' to complete the table below on Australia's 5 main milk export markets.

Export market (country)	Value of exports ($)
China	$3.96 million
Singapore	$2.74 million
Hong Kong	$1.87 million
Taiwan	$345,000
Other	$676,000

16. Identify the continent that consumes the most of Australia's dairy exports. Explain why that area is our major Australian dairy export market destination?

Asia. The Asian continent contains our major export markets for Australian dairy products. The export markets have been secured for a variety of reasons, including:

- Milk is a perishable product, meaning it can decay quickly. Australia is geographically close to these destinations, which reduces costs involved with transport and reduces time in transit which allows for fresh, high quality produce to be available quickly.
- NSW and Australian agriculture produce consistent, high-quality products that are free from pests and diseases and are therefore highly sought after in global markets.
- The Australian government has developed trade agreements to secure export markets with countries in this region to assist our farmers and the Australian economy.

Cattle reproduction and reproductive technologies

17. Use the internet to define the following terms

A. Gestation period including the average gestation period of a cow.

Gestation period is the time of foetal growth between conception and birth. The gestation period for a cow is 283 days.

B. Oestrous period including the average oestrous period of a cow.

The oestrous period is the length of the cycle between ovulation of eggs (ova) in females (unless fertilisation has occurred). The average oestrous period of a cow is 21 days.

C. Standing heat including the average standing heat length of a cow.

Standing heat also described as when an animal is 'in oestrous' refers to the time period that a female animal is receptive to mate. Standing heat is linked to time of ovulation. The average standing heat length of a cow is 15 hours.

D. Nonseasonal breeder

Nonseasonal breeders or continuous breeders have the ability to breed and mate throughout the year irrespective to environmental factors such as season, daylength (photoperiod) and temperature.

E. Polyestrous

Polyestrous refers to an animal's ability to have several oestrous cycles per year.

F. Artificial insemination (A.I.)

A.I. is a technique used in artificial breeding programs in livestock, which involves the delivery of sperm directly to the ovum when the animal is in oestrous or has ovulated. Different species have specific locations for sperm delivery dependant on their reproductive tract anatomy. For example:

- the body of the uterus (cattle, pigs)
- uterine horns using laparoscopic surgical A.I. procedure in sheep
- the cervix or vagina (horses)

A.I. uses either fresh or frozen semen.

G. Embryo transfer (E.T.)

E.T. is a technique used in artificial breeding programs in livestock, which involves transferring a fertilised embryo or multiple embryos in multiple ovulation embryo transfer programs (M.O.E.T); from a genetically superior donor animal to a recipient or surrogate animal.

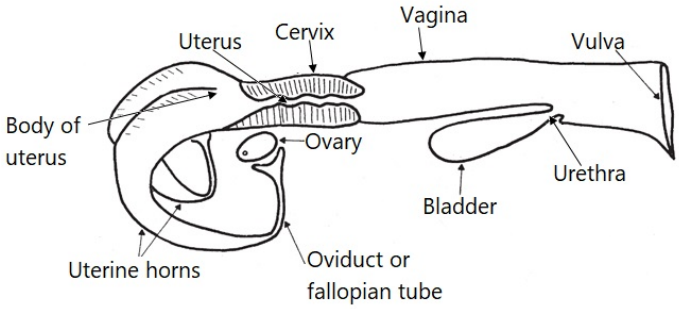
The embryos can be either frozen for transferring later or transferred directly into recipient animals. Recipient animals must be synchronised to be at the same stage of the oestrous cycle as the donor animal when the embryos were flushed.

H. Oestrous synchronisation

Oestrous synchronisation is a reproductive management technique used in livestock, which involves manipulating the female's oestrous cycle and timing of ovulation using hormones. Oestrous synchronisation is often used in A.I. and E.T. programs, as well as synchronising mating and calving periods in groups of females.

Reproductive anatomy in females

18. Use Figure 8 to label the missing parts of the lateral view of a cows' reproductive tract.



Reproductive physiology in females

19. Use figure 9 to label the steps in follicle development in the ovary.

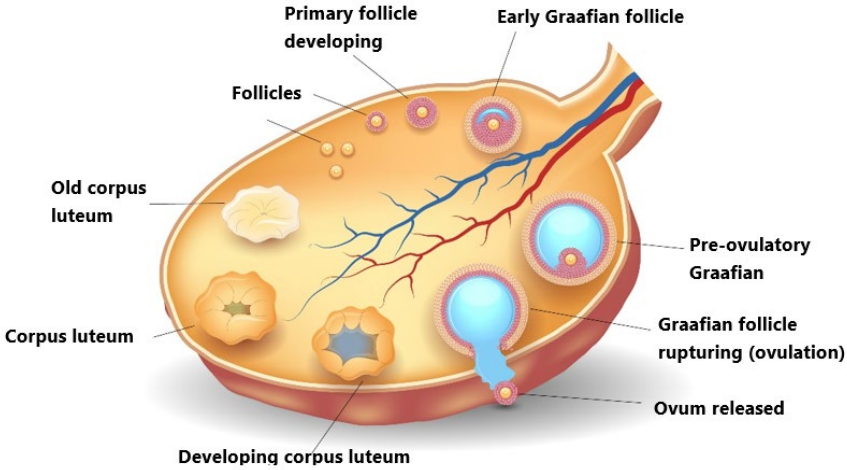


Figure 9 Follicle development in the ovary

20. Complete the table by matching the organ to the function

Organ	Function
Oviduct	Carry ova. The upper part of this is the site of fertilisation
Uterus	Made up of two parts. Provides a suitable environment for foetal development.
Ovaries	Primary organs in a cow's reproductive tract. They have two functions: to produce ova (eggs) and to produce hormones.
Uterine horns	Connect the body of the uterus to the oviducts
Vulva	The external opening of the reproductive system. Protects against contamination and provides the passage of urine
Infundibulum	Funnel-like structure which surrounds the ovary and catches ova.
Vagina	About six inches in length, extends from the urethral opening to the cervix. During natural mating, semen is deposited here. Also serves as part of the birth canal at the time of calving.
Uterine body	The site where semen is deposited during artificial insemination in cattle.
Cervix	A series of muscular ridges of folds forming a protective block between the uterus (and the developing foetus) and the exterior.

21. Distinguish between the corpus luteum and Graafian follicle.

The Graafian follicle is the primary follicle which ruptures releasing an ovum. The corpus luteum (CL) is the site where ovulation occurred during the previous cycle.

22. When would you find multiple corpus lutea on ovaries?

You would find multiple corpus lutea if there were multiple ovulations, such as with twins or from multiple ovulation in an embryo transfer program.

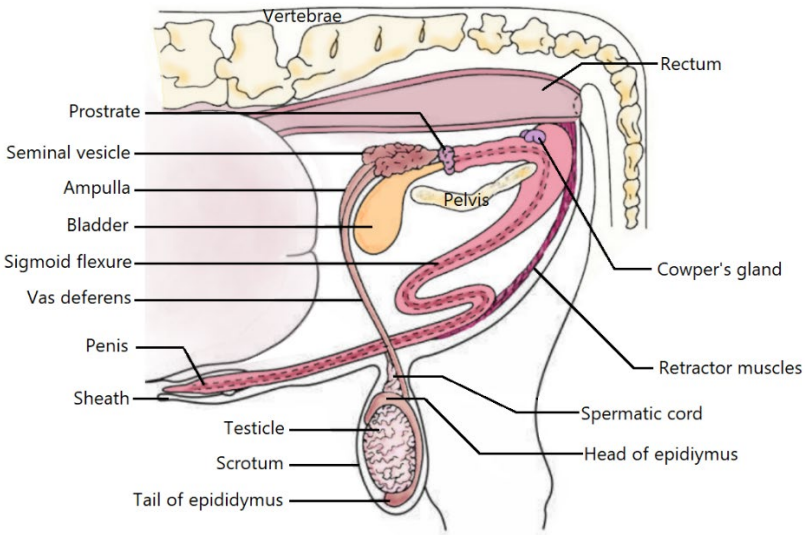
Hormones and the cow's oestrous cycle

23. Complete the table describing the hormones controlling the oestrous cycle.

Hormone	Where is it produced?	What does it control?
Oestrogen	Cells in follicles within the ovaries	Oestrogen controls: • The cow is coming into oestrus (standing heat). • Increased blood flow to the genital organs. • The cervix being sensitive to insemination and secreting mucous lubrication. • The muscles in the uterus to contract to aid in the transport of sperm cells to the oviducts • Behaviour of the female when she is coming into oestrous such as bellowing, pacing, standing to be mounted and mounting others.
Progesterone	Corpus luteum	Progesterone: • Prepares the uterus for pregnancy • Prevents the animal from returning to oestrous by regulating the release of hormones from the pituitary gland. • Regulates FSH and LH throughout pregnancy, stopping the animal coming back into oestrous.
Luteinising hormone (LH)	Pituitary gland	Stimulates oestrogen production in the Graafian follicle causing it to rupture. Stimulates the formation of the corpus luteum.
Follicle stimulating hormone (FSH)	Pituitary gland	Stimulates the growth of follicles in the ovary.
Prostaglandin	Uterus	Prostaglandin breaks down the corpus luteum which disrupts the production of progesterone.

Reproductive anatomy in males

24. Use Figure 11 to label the missing parts of the lateral view of a bulls' reproductive tract.



Reproductive physiology in bulls

25. Complete the table by matching the organ to the function

Organ	Function
Epididymis	Has four major functions: • Transport developing sperm cells from the testicle to the vas deferens • Concentrate sperm by absorbing surplus fluids • Allow for the maturation of the developing sperm • Stores mature and of viable sperm cells
Ampulla	Widenings at the end of the vas deferens. They collect fluid from the seminal vesicles and empty it into the urethra to mix with sperm.
Seminiferous tubules	Tubules in the testicles, which join up into larger tubules that pass out of the testicle into the head of the epididymis.
Penis	Organ of insemination
Prostate	Accessory gland, which is located on the neck of the bladder, where it empties into the urethra. The liquid contains nutrients which activate the sperm, making them become motile (moving).
Testis	Produce spermatozoa (sperm) and contains the cells of Leydig which produce testosterone
Vas deferens	Two cords which connect the epididymis to the urethra
Cowper's glands	Accessory glands which are located on either side of the urethra. These glands produce pre-ejaculate fluid which provides lubrication when the bull mates. The fluid also neutralises the acidity of the urethra in preparation for the passage of sperm cells.
Retractor muscles	Muscles which hold the S-shaped structure in the penis in place prior to mating
Spermatic cord	Supplies blood and nerves to the testicle, supporting muscles and connective tissue.
Seminal vesicles	Accessory glands consisting of two lobes found at the top part of the vas deferens. They provide the ejaculate liquid portion which combines with sperm to make semen. The liquid contains nutrients which activate the sperm, making them become motile (moving).
Scrotum	A supportive and protective pouch of skin located outside the body cavity between the hind legs of the bull.
Sigmoid flexure	S-shaped structure in the penis

26. What is a cryptorchid?

A cryptorchid is a male animal whose testicle/s have not descendant from the abdominal cavity. They usually have reduced fertility.

27. Describe the process of castration which makes an animal sterile.

Surgical vasectomy. This is where the vas deferens and spermatic cord are cut, shutting off the blood supply. This stops the testicles functioning and will make the bulla steer. The testicles will eventually degenerate or more often are removed from the scrotal sac at the time of the procedure.

28. Explain why a bull might have reduced fertility approximately 45 days after a summer heat wave event.

Heat stress negatively impacts spermatogenesis resulting in reduced production of viable sperm. It takes approximately 45-50 days for sperm to be produced in the seminiferous tubules, mature and pass to the tail of the epididymis in preparation for mating. After a heat event the delayed time seen until reduced fertility is caused by the time it takes for sperm to be produced, mature and travel to the epididymis tail.

Hormones and the bull

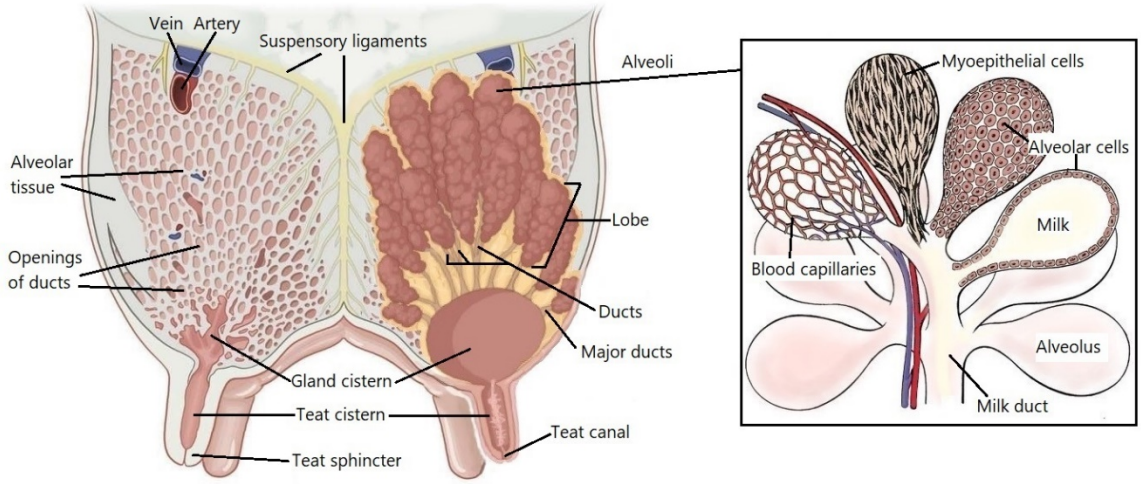
29. Complete the table to describe what each hormone controls in bull's reproduction and identify where it is produced.

Hormone	Where is it produced?	What does it control?
Testosterone	Cells of Leydig in the testicles	Testosterone has several major functions: • It is essential for normal sperm formation. • It is a major factor in the normal sex drive (libido) and behaviour of the male • It is largely responsible for the development and maintenance of the male reproductive tract • It causes the development and maintenance of the secondary sex characteristics associated with masculinity, such as the crest and muscular shoulders of a bull • It increases muscular and skeletal growth
FSH	Pituitary gland	FSH- stimulates the growth of the testis and spermatogenesis (sperm production).
LH	Pituitary gland	LH- stimulates sperm production and release. LH also stimulates the testis to produce testosterone.

Lactation anatomy and physiology

Mammary system anatomy

30. Use Figure 12 to label the missing parts of the cow's mammary system.



31. Use the internet to find definitions for the following dairy terms

A. Lactation period

Lactation period is the term we use to describe the time period when a cow (or mammal) produces milk. Milk quality changes throughout the cow's lactation period. The average lactation length for an Australian dairy cow is 305 days.

B. Colostrum

Colostrum is the 'first milk' produced by mammals after gestation. Colostrum differs from normal milk as it contains high levels of minerals, vitamins and antibodies which the mother produces for their young. Colostrum provides passive immunity to young. On dairies colostrum is not harvested for human consumption but fed to calves.

C. Parturition

The process of giving birth.

Mammary system physiology

32. Complete the table by matching the organ to the function

Organ	Function
Lobe	The milk-producing area of the gland. The lobe has many alveoli that are in groups called lobules.
Myoepithelial cells	A layer of cells on the outside of alveolar cells that contract to squeeze milk out into the duct.
Teat cistern	Storage area which holds milk before it leaves the teat.
Teat canal	Acts as an exit point for milk but can also be an entry point for bacteria which can cause mastitis.
Teat sphincter	Located at the bottom of the teat cistern just above the teat (streak) canal. This muscle constricts to prevent milk from leaking out when the udder is full. Milk is released upon suckling or machine milking.
Capillaries	Transport nutrients and blood to the alveoli cells to create milk.
Ducts	Tubes through which milk travels. Connect lobes to the gland cistern.

Gland cistern	Large storage area which holds milk until it exits through the teat canal.

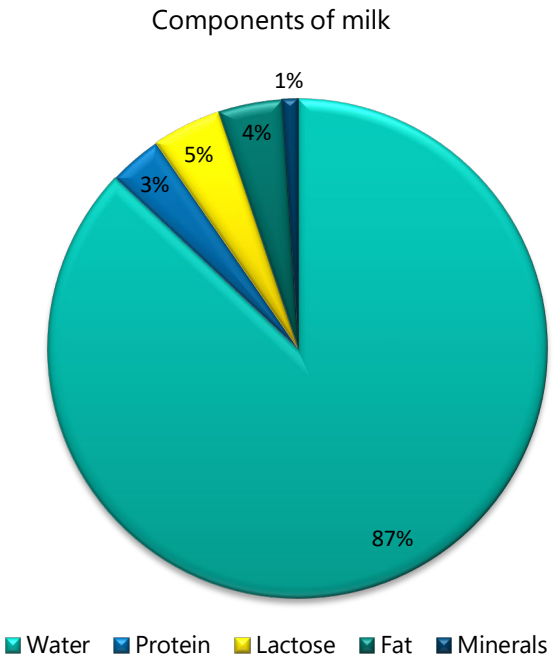
Udder development and lactation

33. **Identify the hormone and cycle which influence milk duct and milk secreting tissue development after puberty.**
    Oestrogen and the oestrous cycle.

34. **Why is it important to manage heifers to prevent them getting over-conditioned?**
    It is important to manage young heifer's nutrition so that they are not over-conditioned which leads to fat deposits in the udder. Udder fat takes up space for milk duct and the milk secreting tissue development, which decreases lifetime milk production. The effect is irreversible.

35. **Describe the trend of milk composition and yield throughout lactation in Figure 13.**
    Answers will vary- students may quote solids yield(kg) or yield (L) but must also describe trend as follows. Parturition occurs and milk yield, fat % and lactose % all gradually increase to peak between 40-80 days after parturition. After this peak they gradually decline until the cow is dried off at approximately 310 days after parturition. Protein % throughout lactation declines for the first 20 days after parturition, then slowly increases at approximately day 40, then slowly declines again until the cow is dried off, 310 day after parturition.

36. **Use the NSW DPI 'Dairy production' poster to create a pie graph showing average components of milk.**



Current and emerging technologies

37. Select a dairy industry-specific technology from the list above. Use the internet to compile a 1- 2 page report on your selected technology.
Your report should include:

- **Name of the technology**
- **Images of the technology**
- **Thorough description of how the technology works**
- **Description of how the technology is used to improve production efficiency**
- **A table contrasting the advantages and disadvantages associated with using the technology**

Answers will vary

Dairy careers

38. Use the internet and other sources to investigate a dairy industry-related career of your choosing. For this career find out the following:

- **Title of the career/job**
- **Role description**
- **Personal qualities**
- **Skills required (if formal courses or education is required, find out where you could train and the timeframe to complete the course)**
- **Salary or wage range**
- **Identify opportunities for job progression in the role**

Answers will vary.

Agricultural Technology Years 7-10 Syllabus, 2019

Outcomes	Content
AG5-1 explains why identified plant species and animal breeds have been used in agricultural enterprises and developed for the Australian environment and/or markets **AG5-3 explains the interactions within and between the agricultural sector and Australia's economy, culture and society** **AG5-4 investigates and implements responsible production systems for plant and animal enterprises** **AG5-5 investigates and applies responsible marketing principles and processes** **AG5-7 explains and evaluates the impact of management decisions on animal production enterprises**	**Core A: Introduction to Agriculture** • identify the characteristics of animal breeds and plant types specific to chosen enterprises, for example: – identify pasture types – associate plant growth patterns with local climate patterns • explain the significance of agricultural industries and products, and their intended markets, for example: (ACTDEK044) – create a market chain for a range of agricultural products – use the Australian Bureau of Statistics website to find data about agricultural industries • research a range of current and future employment opportunities in agriculture, for example: – agricultural practices employing Aboriginal knowledge – development of automation, eg irrigation, milking – operating unmanned aerial vehicles (UAV) – precision farming and Global Positioning Syst **Animal Production 1** • describe an animal enterprise, for example: – fresh cow's milk for the domestic market – fine wool from Merino sheep – bulls for the beef seedstock market • research the markets available for chosen animal agricultural products, for example: – chilled export lamb market – domestic fresh milk market – free-range egg market **Core B: Agricultural systems and management** • identify animal breeds and plant types specifically developed for a particular climate or market, for example: (ACTDEK044) – selection of pasture for the cold temperatures of winter, eg grazing oats – Bos indicus cattle for tropical regions – fine wool Merinos for hot and dry regions • identify opportunities provided by the agricultural sector, both as an employer and as a user of products • investigate information from secondary sources on agricultural production and Australian export trends in agricultural products, for example: – Australian Bureau of Statistics data regarding lamb and beef production and exports • investigate the role of value-adding in marketing agricultural products, for example: – potatoes, eg chips, potato bake, potato flour – milk products, eg cheese, butter, ice cream – bouquets of cut flowers for special occasions, eg Mother's Day **Core B- Animal Production 2** • identify some of the programs, techniques and tools used in animal breeding and analyse their impact on production, for example: (ACTDEK046) – crossbreeding, inbreeding, outbreeding, linebreeding – artificial insemination – embryo transfer – the use of estimated breed values for a particular enterprise • investigate timing and impact of relevant operations in an animal production cycle, for example: – shearing – breeding – drenching – culling • identify emerging technologies that affect sustainability, for example: (ACTDEK041) – genetic engineering, eg sex selection of embryos – electronic pasture meters – electronic monitoring of sheep