



Technology, Careers and Alpacas

TEACHER GUIDE

LESSON 4

YEAR 7–10

This resource has been developed by:



Primary Industries Education
Foundation Australia



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AgriFutures
Australia



Australian Alpaca
ASSOCIATION

LESSON 4

Technology, Careers and Alpacas

› LEARNING AREAS / YEAR LEVEL

Design and Technologies (Year 7–10)

› AUSTRALIAN CURRICULUM CONTENT

Analyse how people in design and technologies occupations consider ethical and sustainability factors to design and produce products, services and environments (**AC9TDE8K01**)

Analyse how food and fibre are produced in managed environments and how these can become sustainable (**AC9TDE8K04**)


Analyse how people in design and technologies occupations consider ethical, security and sustainability factors to innovate and improve products, services and environments (**AC9TDE10K01**)

Analyse and make judgements on the ethical, secure and sustainable production and marketing of food and fibre enterprises (**AC9TDE10K04**)



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> LESSON OBJECTIVE

Students learn about emerging technologies in the Australian alpaca industry, specifically the National Livestock Identification System and the application of genetic technologies to improve traceability, productivity and welfare outcomes for Australian producers and alpacas. They will also learn about some rewarding jobs and careers people can have throughout the alpaca supply chain.

> LESSON OVERVIEW

Activity 4.1 – Identification and Traceability Technology (40 minutes)

Activity 4.2 – Genetic Technology and Innovation (40-50 minutes)

Activity 4.3 – Alpaca Careers and Technologies (60 minutes)

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Resources and Equipment

▶ ACTIVITY 4.1 – Identification and Traceability Technology

1. [Tips from our Team – the National Livestock Identification System](#) (0:00–2:05)
2. [Worksheet 4.1a – NLIS, Traceability Technology](#) (Literacy activity)
3. Access to computer/digital devices and headphones
4. [How the National Livestock Identification System \(NLIS\) works](#) (2:53)
5. [NLIS – Australian Alpaca Association](#)
6. [The Future of Farming Robots – 13 High Tech Examples \(Compilation\)](#) (8:32)

▶ ACTIVITY 4.2 – Genetic Technology and Innovation

1. [What makes Australia a great home for the Alpaca](#) (1:17)
2. [Worksheet 4.2a – Introduction to Genetics](#) (Video activity)
3. Butchers paper, markers
4. [Prime lamb rams: Can you pick the performer?](#) (0:51)
5. [Improving prime lamb productivity using genetic selection – Philip Gough](#) (6:52)
6. [Worksheet 4.2b – Focus on Genetics](#) (Literacy activity)
7. [Worksheet 4.2c – Gene Technology and Innovation](#) (Case study activity)
8. [Alpaca breeders learn colour genetics to achieve better breeding outcomes](#) and included audio link (2:07)

▶ ACTIVITY 4.3 – Alpaca Careers and Technologies

1. [PIEFA Food and Fibre Card Game | Australian Alpaca Association Supply Chain Game Cards](#) (printed, cut into individual cards and preferably laminated). If using for the first time, laminator and scissors
2. [Instructions PIEFA Food and Fibre Card Game | Australian Alpaca Association Supply Chain](#)
3. [Australian Alpaca Association](#)
4. [Job Boards for Agriculture](#)
5. Access to computer/digital devices, design software (e.g. Canva), printer, scissors OR coloured markers and scissors

(Resources and Equipment continued following page...)

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> Additional Reading

1. [Alpaca biosecurity](#)
2. <https://www.camelidconnections.com.au/Camelid%20Connections%20Issue%2013%20WEB.pdf> (pages 38-39)
3. [Breeding Programs – Review of approaches in Australia](#)
4. <https://www.camelidconnections.com.au/Gorgeous%20Greys%20-%20A%20Guide%20To%20Breeding%20Grey%20Alpacas.pdf>

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Lesson Guide

> ACTIVITY 4.1 – Identification and Traceability Technology

Students learn about the National Livestock Identification System (NLIS) and its importance for disease control, biosecurity, food safety, market access and other industry-related purposes. They will learn about the implementation of NLIS in the alpaca industry. Students will also learn about emerging production technologies in the wider agricultural industry.

Background Information

The National Livestock Identification System (NLIS) provides permanent identification and lifetime traceability for all of Australia's cattle, sheep and goats. All animals are identified with an accredited NLIS tag or device from their property (PIC) of birth. As animals are purchased, sold and moved along the supply chain, each movement is recorded centrally on the NLIS database to provide a lifetime history of an animal's movements. NLIS reflects Australia's commitment to biosecurity and food safety and provides a competitive advantage in a global market (Integrity Systems, n.d.).

The Australian alpaca and llama industries are currently transitioning to the NLIS database requirements for biosecurity purposes with the integrity systems company. NLIS eartags for alpacas are currently being used, whilst the brass international alpaca registry (IAR) tags are phased out. At present either of the tags can be used with the alpaca industry moving towards completely utilising the NLIS in the near future.

1. As a class, brainstorm any technologies that students are familiar with that could be associated with farming alpacas or any step in the farm-to-end product supply chain (garment, meat, hide, etc.). Areas to be discussed may include:
 - On-farm technologies
 - Fibre processing technologies
 - Meat processing and packaging technologies
2. View [Tips from our Team – the National Livestock Identification System](#) (0:00–2:05) to learn about Australia's NLIS and what it is used for.

(Activity 4.1 continued following page...)

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3. Distribute **Worksheet 4.1a – NLIS, Traceability Technology** (Literacy activity). Students read and highlight the information about Australia’s use of the NLIS for livestock and the progress the Alpaca industry is making towards implementing this technology. Students watch the video [How the National Livestock Identification System \(NLIS\) works](#) (2:53), view the source [NLIS – Australian Alpaca Association](#) and answer the questions provided on the worksheet.

Answers 

4. As a class, view the video [The Future of Farming Robots – 13 High Tech Examples \(Compilation\)](#) (8:32) to give students a glimpse into some areas of advancing innovations in technology and agriculture.

ACTIVITY 4.2 – Genetic Technology and Innovation

Students will learn about genetic management, technology and innovation in the Australian Alpaca industry. Using secondary sources, they will understand how genetic testing technology advances productivity and welfare outcomes for Australian producers and alpacas.

1. As a class, view the video [What makes Australia a great home for the Alpaca](#) (1:17) and complete **Worksheet 4.2a – Introduction to Genetics** (Video activity).

Answers 

2. Explain to students that analysing the genetic worth of a productive animal is significant to a producer. If an animal’s genome is known for a particular trait, producers can target and have more control over the quality of offspring produced. Over time, this will increase the economic return from the enterprise.
3. In a central area, record the names of the following animals: layer hen, beef cattle, sheep and alpacas. Allocate students into groups of four and provide each group with butchers paper and markers. Students copy the names of the animals onto their butchers paper, and under each heading, record the desirable traits that farmers want these animals to have. (*Large eggs, fine wool, muscling, soft fleece, etc.*). Ask groups to contribute their ideas and record responses in the central area.
4. As a class, view the video [Prime lamb rams: Can you pick the performer?](#) (0:51) to show students how producers may use genetic information to select high-performing animals. If requiring extension, also show students [Improving prime lamb productivity using genetic selection – Philip Gough](#) (6:52).

(Activity 4.2 continued following page...)

5. Achieving targeted genetic improvements in alpaca herds is similar to sheep. Distribute **Worksheet 4.2b – Focus on Genetics** (Literacy activity) and allow students to read the information on genetic improvements in alpaca enterprises. Students highlight the main points in the reading material.
6. Allocate students into pairs and distribute **Worksheet 4.2c – Gene Technology and Innovation** (Case study activity). Provide pairs with digital devices and headphones and allow them to access the source material [Alpaca breeders learn colour genetics to achieve better breeding outcomes](#). Students read the article and listen to the 2:07 recorded audio interview focused on colour genetics, DNA testing and genetic defects in alpacas, and answer the provided questions.

Answers 

> ACTIVITY 4.3 – Alpaca Careers and Technologies

Students will research and learn about some rewarding jobs and careers people have throughout the alpaca supply chain. They will revise the process of converting alpaca fibre into a product suitable for retail sale and integrate each career into the supply chain at the appropriate step in the process.

1. Divide students into groups of two or three and distribute butchers paper and markers to each group. Revise the marketing and supply chain for alpacas by asking the students to recall the flowchart from Lesson 3. Students record the sequence starting with ‘alpaca on a farm’ and ending with the ‘consumer’ in a flowchart.

Answers 

2. Check answers and fill in any missing stages.
3. In groups, brainstorm and discuss any careers or jobs that people might perform or be responsible for at each step of the supply chain.
4. Distribute [PIEFA Food and Fibre Card Game | Australian Alpaca Association Supply Chain Game Cards](#). Students cut out each card using scissors. Skip this step if the cards have already been made for Lesson 3.
5. Players play the card game from the [Instructions PIEFA Food and Fibre Card Game | Australian Alpaca Association Supply Chain](#).

Answers 

(Activity 4.3 continued following page...)

6. Students play **Extension 1 – Careers** using [Instructions PIEFA Food and Fibre Card Game | Australian Alpaca Association Supply Chain](#).
 - a) Take the **careers** cards from the reserved cards.
 - b) Use the completed flowchart, and place the career game cards adjacent to (next to) the associated step on the completed flowcharts.
 - c) Research careers and jobs that occur along the supply chain. Use the [Australian Alpaca Association](#) website, [Job Boards for Agriculture](#) or an internet search engine.
 - d) Design a card for another career related to the alpaca supply chain by filling in the provided areas of the blank template. Use the other career game cards as a model for design. (*Suggestions include: fashion designer, textile mechanic, marketing executive, merchandiser, etc.*)
 - e) Place the designed card adjacent to the step associated with the career on the flowchart.

7. Students play **Extension 2 – Technology**
 - a) Take the **technology** card from the reserved cards in step 4. Using the completed flowchart, place the technology game card adjacent (next to) to the step it is associated with on the completed flowcharts.
 - b) Research a technology used in any part of the supply chain to improve productivity, speed up a job, produce higher quality fibre, etc.
 - c) Use the supplied technology card as a model to design three or more technology cards and cut them out. Include a description of the technology, a picture, and an explanation of how the technology is advantageous on each card template. Use design software, such as Canva, if available.
 - c) Using the completed flowchart, place the **technology** game card adjacent to (next to) the step associated with the technology on the flowchart.

8. Allow students to move to other groups and discuss their careers and technologies and where they fit in the supply chain.

Student Resources

➤ ACTIVITY 4.1 – Identification and Traceability Technology

Worksheet 4.1a – NLIS, Traceability Technology (Literacy activity)

➤ ACTIVITY 4.2 – Genetic Technology and Innovation

Worksheet 4.2a – Introduction to Genetics (Video activity)

Worksheet 4.2b – Focus on Genetics (Literacy activity)

Worksheet 4.2c – Gene Technology and Innovation (Case study activity)

➤ ACTIVITY 4.3 – Alpaca Careers and Technologies

[PIEFA Food and Fibre Card Game | Australian Alpaca Association Supply Chain Game Cards](#)

[Instructions PIEFA Food and Fibre Card Game | Australian Alpaca Association Supply Chain](#)

Acknowledgments

- Gayle Herring, Fibre Naturally Alpaca Woollen Mill
- Waratah Alpaca Fibre
- Mulberry Park Alpaca Stud
- Coolawarra Storybook Alpaca Stud
- Ambersun Alpaca Stud
- EP Cambridge Alpaca Stud
- Mllduck Alpaca Stud
- Dairy Road Alpaca Stud
- Wedgetail Rise Alpaca Stud
- Barrooka Alpaca Stud
- Precision Alpaca Stud
- Australian Alpaca Association
- Tirrikee Alpaca Stud
- Fleurieu Prime Alpaca
- Malakai Alpaca Stud
- Yaringa Alpaca stud

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Answers

➤ ACTIVITY 4.1 – Identification and Traceability Technology

Worksheet 4.1a – NLIS, Traceability Technology (Literacy activity)

1. **Is the NLIS considered a technology? Explain your answer.**

- Yes. It is a system of animal identification technologies – Australia’s system for livestock’s permanent identification and lifetime traceability.

2. **Outline the three elements or technologies that the NLIS combines.**

- Livestock are identified through a visual or electronic (radio frequency identification, RFID) tag, known as a ‘device’.
- Identification of a physical location for the animal—known as the ‘property identification code’ (PIC).
- A centralised database tracks all movements along the supply chain. It is a web-accessible database where data is stored.

3. **Why is the technology valuable to the livestock industry?**

- Being able to track NLIS devices and livestock movements helps trace every animal – from its birthplace through the supply chain to its end product, e.g. a cut of beef. Being able to trace every animal is extremely valuable when there is an issue, e.g. disease outbreak or a food safety issue. The animal can be traced back to the source of the ‘issue’ or problem and where it occurred in the supply chain so that other animals which might have similar issues can be identified and the ‘issue’ rectified.

NLIS is extremely useful for disease control, biosecurity, food safety, domestic and international market access and other industry-related purposes.

4. **Outline why the alpaca industry is working towards having an alpaca NLIS.**

- Alpaca owners and the Australian Alpaca Association are looking for the same benefits offered to the cattle, sheep and goat industries.

Being able to track NLIS devices and livestock movements helps trace every individual animal from its birthplace all the way through the supply chain to its end product. Being able to trace every animal is extremely valuable when there is an issue, e.g. disease outbreak or a food safety issue. The animal can be traced back to the source of the ‘issue’ or problem and where it occurred in the supply chain so that other animals which might have similar issues can be identified and the ‘issue’ rectified.

NLIS is extremely useful for disease control, biosecurity, food safety, domestic and international market access and other industry-related purposes.

➤ ACTIVITY 4.2 – Genetic Technology and Innovation

1. Worksheet 4.2a – Introduction to Genetics (Video activity)

Selective breeding: selecting for the qualities of fineness and density.

Reputation for: producing top quality agricultural products.

Suited to the environment: used to the conditions due to the place of origin.

Types of testing available: DNA testing for verification of parentage

6. Worksheet 4.2c – Gene Technology and Innovation (Case study activity)

Question 1: Identify the number of colours recognised in alpacas.

- Twenty different colours and four or five different colour patterns are recognised in alpacas. which is important for growth).

Question 2: What pigments are mixed to produce genetic brown fibre?

- A mixture of yellow and black.

Question 3: Describe an advantage to breeders in accessing a DNA test.

- To better predict breeding outcomes.

Question 4: Describe the effect of inheriting two copies of the 'grey' genome

- The fetus dies in utero.

Question 5: What does the genetic disorder blue eyed white lead to?

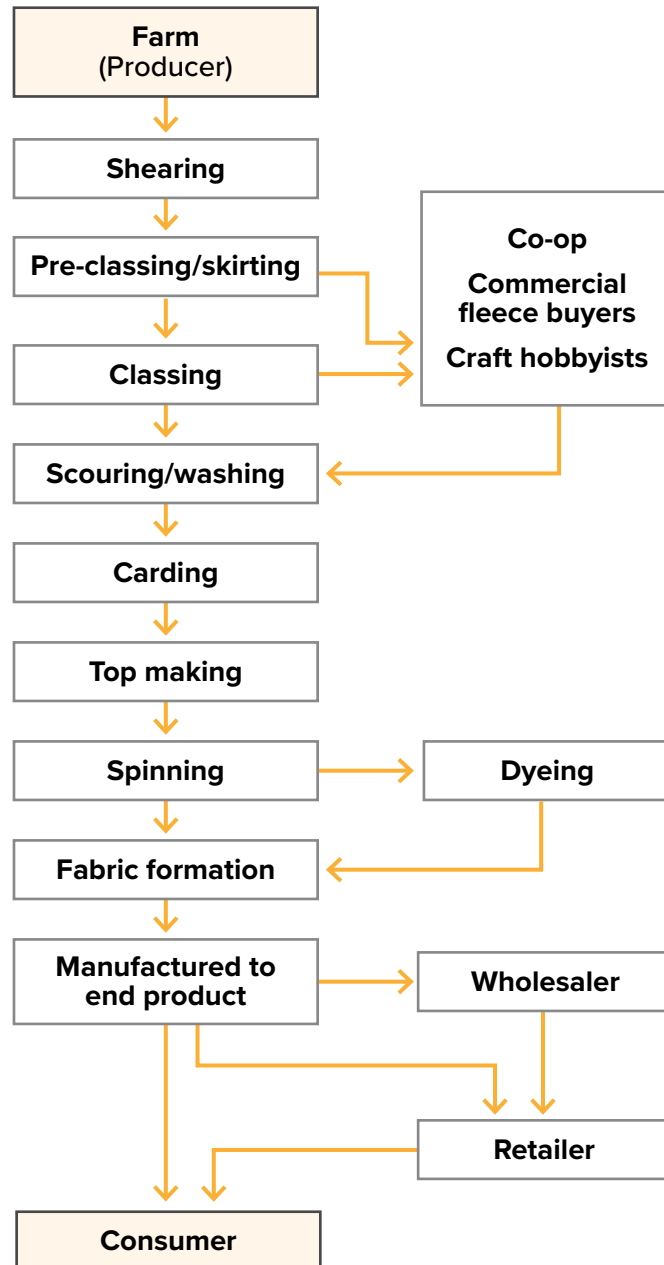
- Animals are deaf and can experience reproductive and breeding issues.

Question 6: Identify the obstacles in developing a DNA test

- Funding and time.

ACTIVITY 4.3 – Alpaca Careers and Technologies

1 & 5.



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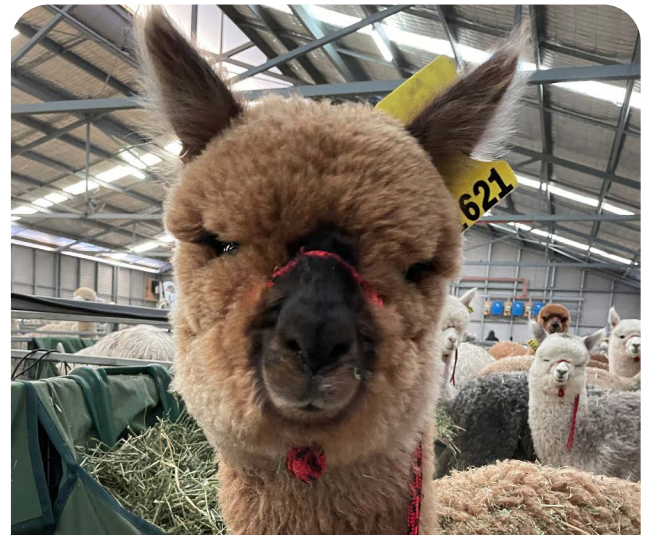
LITERACY ACTIVITY

NLIS, Traceability Technology

The National Livestock Identification System (NLIS) provides permanent identification and lifetime traceability for all of Australia's cattle, sheep and goats. All animals are identified with an accredited NLIS tag or device from their property (PIC) of birth. As animals are bought, sold and moved along the supply chain, each movement is recorded centrally on the NLIS database to provide a life history of an animal's movements. The implementation of NLIS technology shows Australia's commitment to biosecurity and food safety and provides a competitive advantage in a global market (Integrity Systems, n.d.).

The Australian alpaca and llama industries are currently transitioning to the NLIS database requirements for biosecurity purposes with the integrity systems company. NLIS eartags for alpacas are currently being used, whilst the brass international alpaca registry (IAR) tags are phased out. At present, either of the tags can be used, with the alpaca industry moving towards completely utilising the NLIS in the near future.

Ear tags are currently used to identify alpacas. All Australian Alpaca Association registered alpacas must have brass IAR tags or plastic NLIS tags. These display the animal's unique number and are used for traceability in all aspects.



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LITERACY ACTIVITY

NLIS, Traceability Technology (cont.)



Scan the QR code or click on the [link](#) to view the source material.

▶ How the National Livestock Identification System (NLIS) works (2:53)
<https://www.youtube.com/watch?v=pITHOXixPCI>

Answer the questions below.

1. Is the NLIS considered a technology? Explain your answer.

2. Outline the three elements or technologies that the NLIS combines.

3. Why is the technology valuable to the livestock industry?

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LITERACY ACTIVITY

NLIS, Traceability Technology (cont.)



Scan the QR code or click on the [link](#) to view the source material.

▶ NLIS – Australian Alpaca Association <https://alpaca.asn.au/nlis/>

Answer the question below.

4. Outline why the alpaca industry is working towards having an alpaca NLIS.

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VIDEO ACTIVITY

Introduction to Genetics

Genetics is the study of genes and how they are inherited. Understanding genes is essential to producers and impacts how they manage their plants and animals. Genes control the characteristics and traits of organisms and therefore are linked to the quality of agricultural products. Sometimes a single gene (and its copy) work to control a character in an organism, other times, it is the work of a combination of genes causing a particular trait.



Watch the video and record at least one point under each subheading focused on genetics.

▶ **What makes Australia a great home for the Alpaca** (1:17)

https://www.youtube.com/watch?v=7Xn0fIPE_jk

Selective breeding:

Reputation for:

Suited to the environment:

Types of testing available:

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LITERACY ACTIVITY

Focus on Genetics

In the past, producers would select animals to breed based on their phenotype (appearance) and then wait to observe if the desired traits were passed from the parents to the offspring. Genetic analysis of animals has significantly improved this process, and now animals are often selected based on quantifiable data – their genotype for particular traits.

Alpaca producers are interested in genes that control the traits of fleece micron, reproductive success, conformation, fleece density and weight, and uniformity of fleece characteristics. Superior animals with these traits are selected and used in breeding programs to increase the probability of their offspring also having these traits. Animals that perform poorly are culled from a herd.



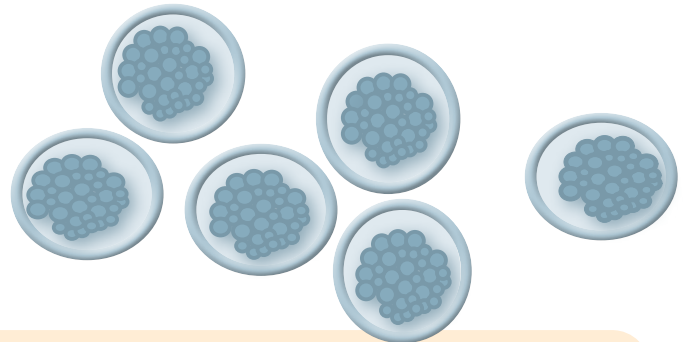
Examples of colour variation in alpaca fleece:



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LITERACY ACTIVITY

Focus on Genetics (cont.)



Embryo Transfer

What is it?

Embryos from a superior female are flushed (taken out) and inserted into a donor mother that will give birth to the offspring after the gestation period.

Use in the alpaca industry:

This is a successful innovation being used in the alpaca industry. This method increases the number of quality offspring to which a superior female can pass genetics over her lifespan (not just a single offspring per year).

Click on the [link](#) to watch how embryo transfer is performed in cattle. This is a similar process to how embryo transfer is achieved in alpacas.

▶ Improving bovine herd genetics with cutting edge embryo transfer (6:52)
<https://www.youtube.com/watch?v=YFMLxy4kjSQ&t=143s>

Across-herd Genetic Evaluation (Age) Program

What is it?

A genetic analysis uses objective measurements to create Breeding Values (BV) for particular traits.

Use in the alpaca industry:

This information provides the animal's ability to pass a particular trait on to offspring and compares animals to each other.

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CASE STUDY ACTIVITY

Gene Technology and Innovation



Colour Genetic Testing Desirable Colours and Genetic Defects

Scan the QR code or click on the [link](#) to view the source material. Read the text and listen to the recording focused on colour genetic testing.

▶ Alpaca breeders learn colour genetics to achieve better breeding outcomes
<https://www.abc.net.au/news/rural/2014-11-12/determining-colour-in-alpacas/5882552>

DNA tests are available for coat colour testing through the Australian Alpaca Association (current cost \$38.50).



The DNA test for identifying colour in alpacas helps breeders better predict breeding outcomes. This interests alpaca breeders as an alpaca may look like one colour, but it might be something else! Coat colour in alpacas is a complex trait involving two central genes responsible for base coat colour. Alpaca fleece has 22 natural shades that range from black to white, grey, and dark to light fawn. Breeding for a specific coat colour can be a complex process.

The ‘classic grey’ phenotype can be problematic in breeding due to its association with the blue-eye white phenotype and associated possible health defects. Classic grey can be hidden or cryptic on white or light backgrounds.

With the release of the Alpaca Coat test, breeders can test their white or light fawn animals, those with uncertain patterns or mutations, or animals they wish to determine the base coat colour, to deduce common progeny colours. (Australian Alpaca Association, nd).

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CASE STUDY ACTIVITY

Gene Technology and Innovation (cont.)



Answer the questions below.

1. Identify the number of colours recognised in alpacas.

2. What pigments are mixed to produce genetic brown fibre?

3. Describe an advantage to breeders in accessing a DNA test.

4. Describe the effect of inheriting two copies of the 'grey' genome.

5. What does the genetic disorder blue-eye white lead to?

6. Identify the obstacles in developing a DNA test.

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