



JONDARYAN WOOLSHED

SCIENCE UNIT

Sheep, Wool and the Science of Jondaryan

TEACHER INFORMATION

SCIENCE YEARS 8 - 10

OVERVIEW

Sheep, Wool and the Science of Jondaryan aims to develop students' understandings about the reasons why the sheep industry, was and continues to be, so important to the prosperity of Australia. Students will investigate the properties of wool, and in particular the wool produced by the Merino sheep, make it such a valuable commodity.

Activities in this unit are developed around three themes:

- The physical properties of wool
- The applications of wool
- The challenges of the future

The pre-visit activities aim to develop student understandings about the scientific reasons the wool industry developed and familiarise students with the role of the Jondaryan Woolshed.

Activities during the visit offer the students the opportunity to see the industry 'close-up' and experience the various roles involved in the collection of this resource. Students view demonstrations and collect wool for later testing in the laboratory.

The post-visit activities draw upon students' experiences during their visit and are centred on the scientific testing of the wool fibre to see how its properties relate to the use of the wool.

The activities of this unit relate directly to the Science Syllabus. The following key concepts are addressed:

Strand: Science and Society

Key Concept: Science as a 'way of knowing' is shaped by the ways that humans construct understandings.

Strand: Energy and Change

Key Concepts:

The forces acting on objects influence their motion, shape, behaviour and energy.

Strand: Natural and Processed Materials

Key Concept:

The uses of materials are determined by their properties, some of which can be changed.

Extension Activities

If interested activities looking at breeding lines and possibly genetic engineering could easily be incorporated. Links to web sites of interest have been supplied.

These allow teachers to design an individualised program relating to the strand:

Life and Living and its ***Key Concept:***

Evolutionary processes have given rise to a diversity of living things which can be grouped according to their characteristics.

Integration into a classroom teaching module

Sheep, Wool and the Science of Jondaryan can easily be integrated into classroom units. The scientific investigation of the properties of the wool allows its use in modules on Working Scientifically, Forces, Energy Transfer or Properties of Materials. The trends in the development of the Senior Science syllabi are towards the introduction of themes into the delivery of the subjects. Clearly *Sheep, Wool and the Science of Jondaryan* offers ways the teacher can work effectively within a theme.

OUTLINE



PRE-VISIT ACTIVITIES

Introduce the students to three units of work focussed upon:
Introductory MS PowerPoint and then a pre-visit activity in each section

Unit 1: The structure of wool

Unit 2: Applications of wool

Unit 3: The work of the shearer



DURING THE VISIT TO THE WOOLSHED

• The students should not take large worksheets. It is important that students are carefully observing the demonstrations and listening to the volunteer guide. To aid their ability to acquire the necessary information for later tasks they are provided with the **JONDARYAN WOOLSHED PUZZLES**, a sheet containing a series of problems. This should not to be used as a question sheet to be answered and submitted.



POST-VISIT ACTIVITIES

UNIT 1: The students will investigate the physical properties of the wool fibre through a series of practical activities.

UNIT 2: Use their findings from UNIT 1 to explain the range of applications previously discovered uses discovered

UNIT 3: Research alternative methods of defleecing the sheep and evaluate their effectiveness



Sheep, Wool and the Science of Jondaryan

Information for volunteer staff

Sheep, Wool and the Science of Jondaryan aims to develop students' understandings about the reasons why the sheep industry was and continues to be, so important to the prosperity of Australia. Students will investigate the properties of wool, and in particular the wool produced by the Merino sheep, make it such a valuable commodity.

Activities in this program are developed around three themes:

- The physical properties of wool
- The applications of wool
- The challenges of the future

Before their visit to the woolshed, the classroom teacher should have helped their students to develop understandings of the structure of the wool fibre and how it is collected. Students should have researched how the wool industry developed in Queensland and know the historical significance of Jondaryan Station and the Jondaryan Woolshed.

Activities during the visit to the woolshed should allow students to appreciate how the sheep are handled and the processes they undergo to collect their wool.

Students should be able to view demonstrations and participate in activities that allow them to form an appreciation of the process of wool collection and the challenges of design faced in constructing the woolshed to be an effective mechanism to collect wool.

In addition the students should consider how the Woolshed interacted with the local society particularly with a view of how shearing techniques and position of markets have influenced the way the industry has developed since the Woolshed was founded.

The guided tour and demonstrations should be built around the design considerations of the Woolshed. In particular, the handling of the sheep (floors to allow droppings disposal), wool sorting tables, separation of wool types, and the shearing station.

Students should be able to appreciate each step of the sheep's journey through the woolshed and what happens to the wool from the moment of collection to it is transported to market.

During a tour the volunteer staff can:

On the way to the Woolshed -

- Explain how both the natural environment and the job being performed in that area has affected building design (discuss the design considerations of the smithy e.g. protection from sun and rain and the position of the local creek e.g. the needs of washing the wool prior to shearing).
- Identify other occupations in the vicinity of the Woolshed and how they impacted on its effective running (eg transport, blacksmith, cook, etc). Are these occupations still required in a modern wool producing area?
- Identify the tools used in these occupations. If the occupations still exist have the tools used changed?

At the Woolshed -

- Discuss the structure of the woolshed floor
- Discuss the design of the pens and the roles required to get the sheep to the shearers.
- Explain why the shearers set the pace of the woolshed. What are the techniques required to be a good shearer.
- Include a demonstration of shearing with emphasis on separation of wool types and the physical process used in shearing.
- Discuss the behaviour of the sheep when being sheared.
- Discuss methods of shearing, including how the combs and cutters were used.
- Discuss the variety of shears, including original hand shears, different sizes of mechanical shears, chemical shearing. Students may have to research new methods of shearing after visit. Students should be encouraged to ask questions of the guides regarding how these changes affected the workers in the woolshed and how their tasks have changed. Were these changes always welcomed or were there conflicts?

About the wool -

- Allow students to collect samples of wool. They will need samples for later testing.
- Discuss the thickness of the fleece, the length of the fibres and the crimp.
- Encourage the students to feel the wool and try to identify factors that affect the quality of the wool.
- Discuss the oil in the wool and how Lanolin was used.

Outside the Woolshed/General -

- Include a sheep dog demonstration to demonstrate the control of the flocks.
- Help students to gain an appreciation of the physicality of the work.
Wherever possible, have students lifting, handling, and using, and so on, the various tools and artefacts.



Sheep, Wool and the Science of Jondaryan

USEFUL WEBSITES

Sheep and Wool

<http://www.dpi.qld.gov.au/sheep/>

The Queensland Department of Primary Industry's excellent website. It contains a huge amount of information and articles about the wool industry in Queensland.

<http://www.woolfurnishings.com/inforoom/woolmark/austmerino.html>

The Woolfurnishings site, containing useful information on the Australian Merino sheep.

<http://www.woolmark.com/twc/aboutwool01.htm>

The woolmark company discussing the wool fibre and its history.

<http://www.childrenswoolens.com/aboutwoolbody.htm#merino>

Site about wool and how it is used in children's woollens

www.wool.com.au/education/100.shtml

The Australian Wool Producers education website. These pages cover fibre history, sheep, wool processing and environmental impacts.

Students should be able to work through most of the information themselves.

<http://www.aussiesheep.com/ozsheep.htm#THE%20AUSTRALIAN%20MERINO>

The history of the Merino Sheep in Australia

Applications of Wool

<http://www.rochedaless.qld.edu.au/wool.htm>

Uses of wool and history of sheep in Australia (student project site)

<http://www.ecoconstruct.com/htmlpdf/crwool.htm>

Using wool for insulation

http://sheepskinexpress.com/sheepskin_seat_covers.htm

Uses of Merino Wool

<http://www.wool.com/olympics/innovation.stm>

Olympic uniforms

<http://www.leeds.ac.uk/media/current/nonwoven.htm>

The University of Leeds Press Release on new techniques of using non-woven wool

http://www.belstaff.com/usa_news.html

A press release from Belstaff motorcycle clothing company

<http://www.madeinitalygarment.com/wool.htm>

An Italian garment manufacturer discussing the use of Australian Wool

Shearing Sheep

<http://www.shearoutback.com.au/>

The Australian Shearers' Hall of Fame website.

<http://www.mech.uwa.edu.au/jpt/shearmagic/tour.html>

Robot Sheep Shearing - the future?

[http://www.culvenor.com/Download%20Files/The%20Ergonomics%20of%20Sheep%20Shearing%20\(Conference%20Paper\).pdf](http://www.culvenor.com/Download%20Files/The%20Ergonomics%20of%20Sheep%20Shearing%20(Conference%20Paper).pdf)

Sheep Shearing Ergonomics

<http://www.abc.net.au/7.30/s466834.htm>

ABC 7.30 Report - interview about shearers.

http://ntp-server.niehs.nih.gov/htdocs/8_RoC/KC/Cyclophosphamide.html

The chemical used in Chemical Shearing of Sheep?

<http://www.wvu.edu/~agexten/farmman2/shepwool/bioclclip.htm>

Using proteins to shed wool without shearing

<http://www.debweb.lisp.com.au/woolindustrytraining/woolhand.htm>

Certification courses in shearing and related trades.

<http://www.fao.org/docrep/v9384e/v9384e08.htm>

New Zealand Wool Board methods of shearing Merino sheep



Sheep, Wool and the Science of Jondaryan
Unit 1: The Physical Properties of Wool

Outline

Pre-visit Activity:

The structure of wool

At the Woolshed:

JONDARYAN WOOLSHED PUZZLES

Follow the guide listening for clues to solve the sheet of puzzles. This is to focus your attention onto the important information that you can see and hear.

Collect a sample of the wool for post-visit laboratory tests

Post-visit work:

Activity 1: The fibre under a microscope

Activity 2: The unique properties of the wool fibre

- a) Dimensions
- b) Water absorbency
- c) Fire resistance
- d) Thermal insulation

Pre-Visit Activity: The Structure of Wool

The Australian merino sheep first arrived at Jondaryan in October 1843. During the next fifty years considerable development of the breed occurred turning the Australian Merino into a larger, more productive sheep. Distinct regional types, adapted to specific regional environments were developed as a result of flock selection by breeders with large flocks who bred from their most productive animals.



A small flock of Merino sheep at Jondaryan

The desire of all the breeders was to develop a sheep that gave a large yield of wool of a good quality.

Wool has a number of unique qualities that even in the 1850s meant there was demand for the product in overseas markets.

The structure of the wool fibre allows wool to easily trap air between the fibres, absorb large amounts of water and be naturally elastic. This meant as a fibre for clothing it would hold its shape, give excellent insulation and readily accept dyes.

Examination through a microscope shows that the fibre comprises of two parts:

- an outer layer of scales, the cuticle, allowing the fibres interlock with other fibres
- an inside core, the cortex, giving strength.



Wool fibres are mostly made of protein with a small amount of fat, calcium and sodium. The fibres naturally group together as they grow from the sheep's skin. The fibres have a natural wave, the crimp, which leads to the elastic nature of the wool. The groups of fibres are called staples.

The strength of a staple (force needed to break the staple), colour of the wool and the yield (percentage of clean wool after removal of grease and dirt) will affect the price of wool but the most important factor is the diameter of the fibre. The diameter of the fibre is measured in microns (or micrometres - one thousandth of a millimetre). A good fibre has a small diameter to maximise the lightness of the garment made from the wool.

Notice how **water** and **air** get held on the fibre.



INITIAL RESEARCH:

Locate a picture of the structure of a wool fibre from the web site:

<http://www.dpi.qld.gov.au/sheep/6571.html>.

Carefully draw a labelled diagram of the fibre in the space below:



Make sure you have labelled the scales, the cuticle and the cortex.

- 1. What is the crimp of a wool sample and why is it important?**
- 2. What is a staple?**
- 3. How many times can the fibre be bent without damage?**
- 4. Why is the fact that the fibres interlock important to the success of wool compared to other fibres?**



Post-visit work:

Activity 1: The fibre under a microscope

Risk Assessment: Low

Warnings:

General care with handling glassware

Use of Microscope - Always carefully position objective lens close to sample then focus by winding away from glass

Select a few fibres from your wool sample.



Place between two microscope slides.

Starting with the lowest power objective centre a fibre in your view.

Change objective and Focus and centre again.

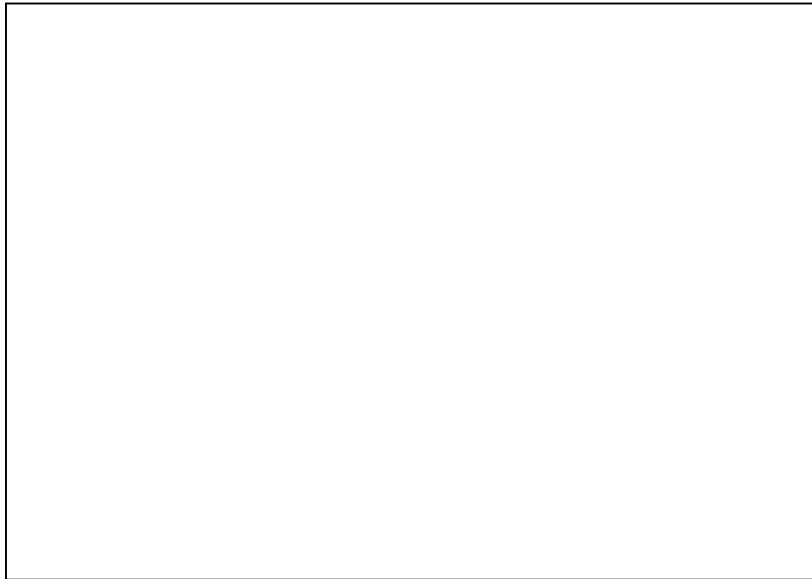
Draw what you see and identify the parts of the fibre.

Repeat the process with a wet mount - observe how air bubbles become attached to the fibre.

Can you determine the thickness of the fibre?

Activity 1: The fibre under a microscope

Fibre viewed on a dry mount:



Fibre viewed on a wet mount:



Extension: If other fibres are available (eg. Nylon, Cotton) Compare and Contrast the structures of the fibres.

Activity 2: The unique properties of the wool fibre

Risk Assessment: Low

Warnings:

General care with handling glassware

Use of Bunsen - Only work with a small yellow flame. Keep use to a short time only.

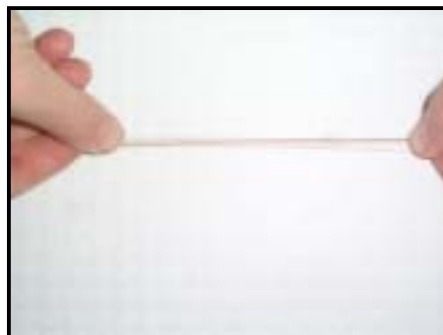
The aim of this activity is to collect information from your gathered wool.

a) Size - Select a small sample from your wool

Measure its **length** both when relaxed and when stretched (pull strongly).

Relaxed = _____

Stretched = _____



Measure its **diameter** (if you have access to a micrometer measure the thickness of a number of fibres) or record your value from Activity 1

Diameter = _____

Comment on the elasticity of the fibre:

b) Water absorbency

Select a quantity of wool and use an electronic balance to determine its mass.

Place it in a beaker of water. Leave for five minutes

Using tweezers or tongs lift the wool out of the water. Hold to let excess water run off. Determine the mass now.

Dry mass: _____

Wet mass: _____

c) Fire resistance

Set a Bunsen burner to a small yellow flame. Select a quantity of wool and using a pair of tongs hold the fibre briefly in the flame.

If you have access to a magnifying glass or hand lens look at the wool closely.

Comment on the fibre's fire resistance:

d) Thermal insulation

Design an experiment to investigate the insulation properties of wool.

Remember to set up suitable controls so that you can compare the effectiveness of using the fibre.

A simple situation might include using thermometers with stands, the Sun, boxes or bags and ofcourse wool.

Make it a fair test and use the thermometers to take temperatures at regular intervals (not just start and finish).

Finally:

Prepare suitable tables and graphs to present your findings



Unit 2: Applications of Wool

Outline

Pre-visit Activity:

Using Wool

At the Woolshed:

JONDARYAN WOOLSHED PUZZLES

Follow the guide listening for clues to solve the sheet of puzzles. This is to focus your attention onto the important information that you can see and hear.

Post-visit work:

Using the unique properties of the wool fibre:

Water absorbency, Strength, Fire resistance, Thermal insulation in the home

Pre-visit Activity: **Using Wool**

These activities would find internet access useful. If that is a problem then copies of some of the pages would do and let the class work in groups.

We are all aware that wool is used to make woollen jumpers, suits and hats. Wool is a soft, lightweight material that has been used for clothing for thousands of years but it is now used in many more ways than that. The physical properties of wool allow it to be used for many more uses than clothing alone.

1. Brainstorm a list of at least ten uses for wool.

2. The following word search contains ten ideas you may, or may not have brainstormed. Can you find them?

C	A	R	P	E	T	S	M	C	T	Y
P	Y	P		M	A	U	E	P	C	T
T	D	X	Y	B	T	I	D	U	Y	C
I	N	S	U	L	A	T	I	O	N	A
T	A	K	P	A	Y	S	C		M	R
M	S	C	H	N	I	B	A	U	X	S
S	O	O	O	K	I	A	L	A	N	E
C	S	S	L	E	U	U	S	B	P	A
U	R	Y	S	T	D	Z	H	C	T	T
I	E	T	T	S	U	D	E	X	U	C
Y	P	X	E	X	T	F	E	T	C	O
M	M	A	R	C	I	C	P	A	P	V
I	U	P	Y	U	X	E	S	M	U	E
B	J	D	A	L	O	C	K	Y	T	R
D	Z	O	I	L	S	P	I	L	L	S
U	M	B	M	P	T	D	N	T	P	Y

Hidden Words/Phrases in Word search

C	A	R	P	E	T	S	M			
						U	E			
				B		I	D			C
I	N	S	U	L	A	T	I	O	N	A
		K	P	A		S	C			R
		C	H	N			A			S
		O	O	K			L			E
	S	S	L	E			S			A
	R		S	T			H			T
	E		T	S			E			C
	P		E				E			O
	M		R				P			V
	U		Y				S			E
	J						K			R
		O	I	L	S	P	I	L	L	S
							N			

- Carpets
- Suits
- Insulation
- Jumpers
- Oil spills
- Medical sheepskin
- Upholstery
- Car seat covers
- Socks
- Blankets

Post-visit work: Other uses of Wool

These activities would find internet access useful. If that is a problem then copies of some of the pages would do and let the class work in groups.

The physical properties of wool allow it to be used for many more uses than clothing alone.

1. a) Its thermal insulation properties make it an excellent material for making home insulation:

<http://www.ecoconstruct.com/htmlpdf/crwool.htm>

<http://www.higginsinsulation.com.au/residential.html>

<http://www.secondnatureuk.com/spec.htm>

<http://www.wronz.org.nz/wronz-main/media-4.shtm>

b) Wool has a natural crimp which gives it bounce, body, and soft support characteristics. Add to this its ability to insulate and its moisture absorbency and wool seems a natural material for bedding:

<http://www.wools.com/>

<http://www.crestell.com.au/>

http://www.joma.co.nz/index.cfm/Joma_Wool

Use the sites listed in a) or b) to research the advantages of using wool as insulation in the home, or as a bedding material.

Either i. Design a web page of your findings

Or ii. Design a poster to advertise the product

You should clearly show how the physical properties of the wool fibre contribute to the use.

2. OIL SPILL CLEAN-UP

Test the effectiveness of wool in separating oil from water.

NB. Did your list of uses for wool include penguin lifesaving?

<http://www.infoplease.com/spot/penguinsweater.html>

Unit 3: The challenges of the future

Outline

Pre-visit Activity:

The Shearers Role

At the Woolshed:

JONDARYAN WOOLSHED PUZZLES

Follow the guide listening for clues to solve the sheet of puzzles. This is to focus your attention onto the important information that you can see and hear.

Post-visit work:

New Methods of Shearing

Pre-visit Activity:

The Shearers Role

The Australian merino sheep originated in the Spanish merino and first arrived at Jondaryan in October 1843.



The Jondaryan Woolshed

The Jondaryan Woolshed was commissioned in 1861.

To this day the industry has worked to improve the wool collected from the Merino sheep. Breeding programs have been utilised to improve the breed and enhance the amount and quality of the wool collected.

In contrast the methods of harvesting the wool used at the Jondaryan Woolshed, or in the commercial wool industry in general, have not changed dramatically since 1861. At that time shearers use hand held blades and these were replaced in 1890 by shearing machines. These have changed little since that time except for a change in the width of the blade.

The wool on a Merino sheep grows about 7 to 10 cm a year and most sheep are sheared once a year until around five years old. The quality of the wool after that time deteriorates and makes it not worth collecting. Shearing sheds were a necessity in Queensland due to the weather conditions.

The Jondaryan Woolshed was designed to operate with 52 shearers (although during its heyday, the 300-foot long Woolshed accommodated up to 88 blade shearers) and numerous other workers in order to process up to 3,000 sheep at a time. These workers were not permanent employees of the Woolshed. Teams containing shearers, the expert, roustabouts, penner-ups, shed hands, wool classers, pressers, cooks and a pick-up boy would travel from area to area to provide the shearing service. Originally hand shearing was done by blades and shearers needed to become very efficient at removing the fleece. This process continues today although now the hand shearing has been replaced with shearing machines.

A shearing machine works on the same principle as a barber's hair clippers.



The images show the typical structure of the modern cutting implement (handpiece) used by a shearer. The mechanically driven handpiece is powered by an electric or diesel motor. The shearer moves the handpiece through the



wool and the fibres are cut near skin level by the action of a comb and cutter.



The use of these handpieces in the hands of a skilled shearer allows the fleece to fall away from the sheep in one piece. It takes around three minutes for a shearer to shear a sheep.

Shearing at Jondaryan Woolshed



A Shearing Handpiece

Back in the 1860s, when a team of shearers were working a fleece was removed every eight seconds at the Jondaryan Woolshed . Approximately 10 million sheep have been shorn in this shed yielding approximately 500,000 bales of wool.

DID YOU KNOW?

1. An experienced shearer using a shearing machine shears around 150 sheep in a day. In 1892 Jackie Howe sheared 321 sheep in 7 hours forty minutes using hand held blades.
2. There are nearly ten million sheep in Queensland.

Questions:

1. Why were shearing sheds a necessity in Queensland?
2. How many people work in a shearing gang?
3. What part of the fleece is cut away first?
4. Jackie Howe sheared 321 sheep in 7 hours forty minutes using hand held blades. How long did it take him to shear a single sheep?
5. How long would it take to shear all the sheep in Queensland?

Any questions you are unsure about - ASK at the Jondaryan Woolshed

Post-visit work: **New Methods of Shearing**

The role of the shearer has not changed much in the last two hundred years. It is still a very physical job and the skill of the shearer in wielding a cutting implement is still the crucial factor.

Will it never change?

The wool industry is second only to mining in its annual turnover. One figure recently quoted was nearly \$6,000,000,000 per year. It is "big business" and as such people will continue to look for ways to simplify the processes involved. Anyone finding a way to make the labour intensive process of shearing cheaper will become rich.

Two major alternatives have been researched in recent years.

1. Using robots

The Department of Engineering at the University of Western Australia has tried to develop a robot that could replace the shearer with a machine. It started back in the late seventies and had some success in its early days, but after twenty years the shearer is still in business so it shows that this is not a simple solution.

2. Using Chemicals

CYCLOPHOSPHAMIDE was a chemical put forward as providing a way of defleecing sheep without shearing but the chemical is carcinogenic and quickly fell into disuse.

3. Using Proteins

The CSIRO announced a breakthrough in 1998 with the development of Bioclip. (<http://www.wvu.edu/~agexten/farmman2/shepwool/bioclip.htm>) This is a protein that can be administered to the sheep to make its hair fall out. The protein causes a natural break to form in the wool fibre and several days after treatment the fleece drops off. The animals need to be fitted with a net to capture the discarded fleece. This has been in development for over twenty years and extensively trialled.

The Australian Wool Industry still uses Shearers with very few farmers considering Bioclip.

Discuss the possible reasons for the continued use of shearers.



JONDARYAN WOOLSHED PUZZLES

*Science, Trivia and Oddities to focus your attention
For use at the Jondaryan Woolshed*

Don't forget to collect a sample of wool after the shearing demonstration.

1

*Click go the shears boys, click, click, click
Wide is his blow and his hands move quick,
The ringer looks around and is beaten by a blow,
And curses the old snagger with the bare-bellied yoe.*

'Click Go the Shears' does capture the mood of the Australian woolshed. The shearer's 'blow' refers to his arm movement. The 'ringer' is the shearer who shears the most sheep in that shed and he is being beaten by one 'blow'. He is cursing the old 'snagger' who is the eldest shearer in the shed and the 'bare-bellied yoe' is a ewe with a completely-bare belly.

So what is wrong with the poem?

2 Volunteer, Jim Cuskelly, demonstrating shearing



How does Jim control the sheep?

3 What does this photograph show and why was it important?



4. On entry to the Woolshed you should notice the floor:



What job connected to this floor would the young boys at the woolshed have had?

5. "In New South Wales they shot at me, in Victoria they mobbed me, but in Queensland they sent me to Jondaryan and inflicted me with over zealous officials."

Why did Queen Victoria receive this message about Jondaryan?

6. What is a "chaffer"?

7. It comes in the form of a cake of soap that has to be wet before it's applied but now they just use a marking pen.

What is being talked about and why did the owners consider this to be part of a very important task?

8. What was "fineness" and how many microns applied to the sheep you saw sheared?

9.



The wool classer has to assess the physical quality of the wool.
What does he look for?

Puzzles and Quiz's are often a useful exercise to help familiarise students with vocabulary. Two puzzles are supplied that were written for this site. If you would like to set your own puzzles quickly for use on paper or online try visiting the website: <http://puzzlemaker.school.discovery.com/>



1. Hidden Word search
2. Double Puzzle

Sheep, Wool and the Science of Jondaryan



Jondaryan Woolshed

Australian Wool - Word Search with a Hidden Message

T T H E P R C H O S P R E
R N T I E E T U N S E O L
S F A R S G C O T T W L O
O C B T N H R O A I E L D
R I A E S C E W R C C Y F
F E R L I I S A L T W L F
B T T M E B S A R E E G E
S L W E R S C E C I D X L
V L A O M I S E R X N Y P
U T S D T A E V K E F G A
I B R R E L I G W D R H T
A M O Z F S M D O C B I S
E C E I P D N A H W S B F

Hidden Words:

ABSORBS WATER
BLADES
CORTEX
CORTICAL CELL
CUTICLE
DIAMETER
FIBRE
FIRE RESISTANT
FLEECE

HANDPIECE
MICRONS
SCALES
SHEARING
STAPLE
STRENGTH

What is the hidden phrase?

Sheep, Wool and the Science of Jondaryan



Jondaryan Woolshed

Australian Wool - Word Search with a Hidden Message

Solution:

```
T T H E P R C H O S P R E
R N T I E E T U N S E O L
S F A R S G C O T T W L O
O C B T N H R O A I E L +
R I A E S C E W R C C + +
F E R L I I S A L T + L +
B T T M E B S A R E E + E
S L + E R S C E C I + X L
+ + A O M I + E R + N + P
+ + S D T A E + + E + G A
+ B + R E L I + + + R + T
A + O + F S + D + + + I S
E C E I P D N A H + + + F
```

(Over,Down,Direction)

ABSORBSWATER(1,12,NE)

BLADES(1,7,SE)

CORTEX(7,3,SE)

CORTICALCELL(2,13,NE)

CUTICLE(7,1,SE)

DIAMETER(8,12,NW)

FIBRE(1,6,NE)

FIRERESISTANT(13,13,NW)

FLEECE(5,12,NE)

HANDPIECE(9,13,W)

MICRONS(4,7,NE)

SCALES(1,3,SE)

SHEARING(5,3,SE)

STAPLE(13,12,N)

STRENGTH(1,8,NE)

Phrase:

The properties of wool

Sheep, Wool and the Science of Jondaryan



Jondaryan Woolshed

Australian Wool - Double Puzzle

Solve the clues with one word answers to determine the word revealed in the shaded squares

Solution

Clues

- 9. process prior to shearing
- 10. what is removed
- 11. automated process
- 12. the removal of the wool
- 13. wool removal process
- 14. the modern shearing tool
- 15. a new method of defleecing
- 16. the old shearing tool

1				w	a	s	h	i	n	g	
2			w	o	o	l					
3			r	o	b	o	t				
4	d	e	f	l	e	e	c	i	n	g	
5				s	h	e	a	r	i	n	g
6	m	a	c	h	i	n	e				
7		c	h	e	m	i	c	a	l		
8	b	l	a	d	e	s					

What is the word in the shaded column?

Extension Activities

Improving the quality of the Merino fleece

The need to improve the fibre

If interested activities looking at breeding lines and possibly genetic engineering could easily be incorporated. Links to web sites of interest have been supplied.

These allow teachers to design an individualised program relating to the strand: **Life and Living** and its **Key Concept**:

Evolutionary processes have given rise to a diversity of living things which can be grouped according to their characteristics.

Links:

<http://www.dpi.qld.gov.au/sheep/5019.html>

Queensland Government

<http://www.severnparkmerinos.com.au/system/>

The Soft Rolling Skin Breeding System

<http://www.wool.com.au/corporate/downloads/WelsmanReportPart1.pdf>

Genetics in Australia - Report

<http://www.woolwise.com/resources.html>

Educational resources

<http://www.merinos.com.au/Default.htm>

The Australian Association of Stud Merino Breeders

<http://www.library.usyd.edu.au/VEIN/links/readinglist.html#Sheep>

University of Sydney links