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Introduction

The **Teacher’s Resource Kit** is free for Australian schools (and other learning institutes) and includes poultry-related educational resources developed by the Poultry CRC, the Australian Chicken Meat Federation, the Australian Egg Corporation Limited and the Rural Industries Research and Development Corporation (RIRDC) Chicken Meat Program.

This folder of lesson plans and worksheets for teachers forms part of this kit. The information and worksheets provided within can also be used as a resource for schools wishing to participate in the World’s Poultry Science Association (WPSA) Schools Poultry Competition. For more information about this competition go to


and search under the Education button.

**Useful Websites**

- [www.poultryhub.org](http://www.poultryhub.org) - Poultry Hub
- [www.virtualchicken.org](http://www.virtualchicken.org) – explores the reproductive system of a hen, showing the formation of an egg
- [www.chicken.org.au](http://www.chicken.org.au) - Australian Chicken Meat Federation (ACMF)
- [www.aecl.org](http://www.aecl.org) - Australian Egg Corporation Limited (AECL)
- [http://eggs.org.au](http://eggs.org.au) - The home of eggs online (AECL)
- [www.incredibleegg.org](http://www.incredibleegg.org) – Home of the incredible edible egg (US)
- [http://thinkegg.com](http://thinkegg.com) – Egg facts and recipes
- [www.aecgc.org.au](http://www.aecgc.org.au) - Australian Chicken Growers Council
- [www.farmissues.com/virtualTour](http://www.farmissues.com/virtualTour) - includes virtual tours of Canadian poultry farms
- [www.wikipedia.org](http://www.wikipedia.org) – offers many poultry related articles

**Additional Resources (Not in Kit)**

**Building the Poultry Penthouse**  
Book - Published by NSW Department of Primary Industries (ISBN: 073130604-X)  

**Getting started in free range poultry**  
Book - Published by NSW Department of Primary Industries (ISBN: 978-0 7313 0623-7)  

**The Chicken Health Handbook**  
Book - Published by Storey (ISBN: 0-88266-611-8)  
Available from [www.storey.com](http://www.storey.com)

**Storey’s Guide to Raising Ducks**  
Book - Published by Storey (ISBN-13: 978-1-58017-258-5)  
Available from [www.storey.com](http://www.storey.com)
Anatomy and Physiology
Anatomy of the chicken: COMPUTER INTERACTIVE ACTIVITY  Use the CD *Anatomy of the Chicken* to label the following diagram:

**Avian eye**

![Lateral aspect of chicken](image)

1. 
2. 
3. 
4. 
5. 
6. 
7. 
8. 
9. 
10. 
11.
Anatomy of the chicken: COMPUTER INTERACTIVE ACTIVITY Use the CD Anatomy of the Chicken to label the following diagram:

**Skeletal system and brain**

![Skeletal system and brain diagram]

<table>
<thead>
<tr>
<th>12</th>
<th>25</th>
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</thead>
<tbody>
<tr>
<td>13</td>
<td>26</td>
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<td>14</td>
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<td>23</td>
<td>36</td>
</tr>
<tr>
<td>24</td>
<td>37</td>
</tr>
</tbody>
</table>
Anatomy of the chicken: COMPUTER INTERACTIVE ACTIVITY Use the CD Anatomy of the Chicken to label the following diagram:

**Pulmonary system and air sacs**

| 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 55 | 62 | 63 |
Anatomy of the chicken: COMPUTER INTERACTIVE ACTIVITY  Use the CD *Anatomy of the Chicken* to label the following diagram:

**Pulmonary system (left half) plus heart**

```
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
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<td>31</td>
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<td>29</td>
<td>52</td>
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<tr>
<td>30</td>
<td>53</td>
</tr>
</tbody>
</table>
```
### Anatomy of the chicken: COMPUTER INTERACTIVE ACTIVITY

Use the CD *Anatomy of the Chicken* to label the following diagram:

**Gastrointestinal tract (left half)**

<table>
<thead>
<tr>
<th>54</th>
<th>55</th>
<th>56</th>
<th>57</th>
<th>58</th>
<th>59</th>
<th>60</th>
<th>61</th>
<th>62</th>
<th>63</th>
<th>64</th>
<th>65</th>
</tr>
</thead>
</table>
Anatomy of the chicken: COMPUTER INTERACTIVE ACTIVITY  Use the CD *Anatomy of the Chicken* to label the following diagram:

Gastrointestinal tract (right half)
Anatomy of the chicken: COMPUTER INTERACTIVE ACTIVITY  Use the CD Anatomy of the Chicken to label the following diagram:

Genitourinary system and right half of skeleton

[Diagram of chicken with numbered areas]
Anatomy of the chicken: COMPUTER INTERACTIVE ACTIVITY  Use the CD Anatomy of the Chicken to label the following diagram:

Musculature system and nephron

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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</thead>
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<td>76</td>
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<td>78</td>
<td>79</td>
<td>80</td>
<td>81</td>
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<tr>
<td>82</td>
<td>83</td>
<td>84</td>
<td>85</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Anatomy of a Chicken

Using the following words, label the parts of the chicken below:

Heart, ovary, proventriculus, cloaca, gall bladder, nostril, larynx, liver, pancreas, small intestine, large intestine, gizzard, oviduct, kidney, caeca, lungs, brain, nostril, duodenal loop, trachea, oesophagus, crop, spleen, eye
The Physiology of a Chicken

Use the website [http://www.poultryhub.org/](http://www.poultryhub.org/) and links under the button labelled Physiology to research the function of each of the following body parts of a chicken.

<table>
<thead>
<tr>
<th>Body Part</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin</td>
<td></td>
</tr>
<tr>
<td>Feathers</td>
<td></td>
</tr>
<tr>
<td>Skeleton</td>
<td></td>
</tr>
<tr>
<td>Muscles</td>
<td></td>
</tr>
<tr>
<td>Eye</td>
<td></td>
</tr>
<tr>
<td>Brain</td>
<td></td>
</tr>
<tr>
<td>Lungs</td>
<td></td>
</tr>
<tr>
<td>Liver</td>
<td></td>
</tr>
<tr>
<td>Anatomy</td>
<td></td>
</tr>
<tr>
<td>-------------</td>
<td>---</td>
</tr>
<tr>
<td>Kidney</td>
<td></td>
</tr>
<tr>
<td>Ovary</td>
<td></td>
</tr>
<tr>
<td>Oviduct</td>
<td></td>
</tr>
<tr>
<td>Heart</td>
<td></td>
</tr>
<tr>
<td>Beak</td>
<td></td>
</tr>
<tr>
<td>Crop</td>
<td></td>
</tr>
<tr>
<td>Proventriculus</td>
<td></td>
</tr>
<tr>
<td>Gizzard</td>
<td></td>
</tr>
<tr>
<td>Small Intestine</td>
<td></td>
</tr>
<tr>
<td>Large Intestine</td>
<td></td>
</tr>
<tr>
<td>Caeca</td>
<td></td>
</tr>
<tr>
<td>Cloaca</td>
<td></td>
</tr>
</tbody>
</table>
Comparison of Body Parts of High and Low-Producing Egg-Type Hens

Use the images below or the *High and Low-Producing Egg-Type Hens* Powerpoint presentation on the Teachers Resource Kit CD to outline the visual differences between high and low-producing egg-type hens.

<table>
<thead>
<tr>
<th>HIGH-PRODUCING HENS</th>
<th>LOW-PRODUCING HEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vents</td>
<td></td>
</tr>
<tr>
<td>Head</td>
<td></td>
</tr>
<tr>
<td>Bottoms of feet</td>
<td></td>
</tr>
<tr>
<td>Fronts of shanks &amp; tops of toes</td>
<td></td>
</tr>
<tr>
<td>Backs of shanks</td>
<td></td>
</tr>
<tr>
<td>Variations in Plumage Condition</td>
<td></td>
</tr>
</tbody>
</table>
## Anatomy

Comparison of high and low-producing hens

<table>
<thead>
<tr>
<th>HIGH-PRODUCING HENS</th>
<th>LOW-PRODUCING HEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vents</td>
<td>Vents</td>
</tr>
<tr>
<td>Head</td>
<td>Head</td>
</tr>
<tr>
<td>Bottoms of feet</td>
<td>Bottoms of feet</td>
</tr>
<tr>
<td>Fronts of shanks &amp; tops of toes</td>
<td>Fronts of shanks &amp; tops of toes</td>
</tr>
<tr>
<td>Backs of shanks</td>
<td>Backs of shanks</td>
</tr>
<tr>
<td>Variations in Plumage Condition</td>
<td>Variations in Plumage Condition</td>
</tr>
</tbody>
</table>
Animal Health and Welfare
### Definitions used in Health Management


<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disease</td>
<td></td>
</tr>
<tr>
<td>Agent of disease</td>
<td></td>
</tr>
<tr>
<td>Infectious agents</td>
<td></td>
</tr>
<tr>
<td>Contagious disease</td>
<td></td>
</tr>
<tr>
<td>Infective organism</td>
<td></td>
</tr>
<tr>
<td>Host</td>
<td></td>
</tr>
<tr>
<td>Pathogen</td>
<td></td>
</tr>
<tr>
<td>Parasite</td>
<td></td>
</tr>
<tr>
<td>Vector</td>
<td></td>
</tr>
<tr>
<td>Intermediate host</td>
<td></td>
</tr>
<tr>
<td>Endemic</td>
<td></td>
</tr>
<tr>
<td>Notifiable diseases</td>
<td></td>
</tr>
<tr>
<td>Biosecurity</td>
<td></td>
</tr>
</tbody>
</table>
Poultry Health

Use the website http://www.poultryhub.org/ to complete this activity.

List five causes of disease in poultry.

___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________

List three non-infectious causes of diseases in poultry.

___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________

List eight infectious causes of diseases in poultry.

___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________

What are internal parasites and name three that are harmful to poultry?

___________________________________________________________________________
___________________________________________________________________________

What are external parasites and how can they harm poultry?

___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________

List five management practices that help in the prevention of disease.

___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
Common Pathogens and Parasites of Poultry

Research the **symptoms and treatments** for each of the common pathogens and parasites of poultry. Look at pages under the Health button in [http://www.poultryhub.org/](http://www.poultryhub.org/)

<table>
<thead>
<tr>
<th>Internal parasite – Caecal worm</th>
<th>SYMPTOMS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Internal parasite – Coccidia</th>
<th>SYMPTOMS</th>
</tr>
</thead>
<tbody>
<tr>
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</table>

<table>
<thead>
<tr>
<th>TREATMENTS</th>
<th>SYMPTOMS</th>
<th>TREATMENTS</th>
</tr>
</thead>
<tbody>
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<td></td>
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</tbody>
</table>

**Internal parasite – Roundworm**

**Symptoms**

**Treatments**

**Pathogen – bacteria**

**Symptoms**

**Treatments**

### External parasite – Lice

**Symptoms**

**Treatments**

---

### External parasite – Mites

**Symptoms**

**Treatments**

---

Poultry Health Management

Read [http://www.poultryhub.org/health/health-management/](http://www.poultryhub.org/health/health-management/) to find out about the principles and causes of infectious diseases. For each of the eight main categories of infective organisms, find examples of each that affects poultry. You can find more information about the categories of disease at [http://www.poultryhub.org/health/disease/types-of-disease/](http://www.poultryhub.org/health/disease/types-of-disease/)

<table>
<thead>
<tr>
<th>Categories of infective organisms</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacteria</td>
<td></td>
</tr>
<tr>
<td>Viruses</td>
<td></td>
</tr>
<tr>
<td>Chlamidia</td>
<td></td>
</tr>
<tr>
<td>Fungi</td>
<td></td>
</tr>
<tr>
<td>Mycoplasmas</td>
<td></td>
</tr>
<tr>
<td>Protozoa</td>
<td></td>
</tr>
<tr>
<td>Internal parasites</td>
<td></td>
</tr>
<tr>
<td>External parasites</td>
<td></td>
</tr>
</tbody>
</table>

Using the information above, answer the following questions:

1. **Bacteria**
   - What are the two ways that Pathogenic bacteria can harm the body systems?
     __________________________________________________________
     __________________________________________________________
   - What class of drugs is commonly used to treat bacteria?
     __________________________________________________________
     __________________________________________________________

2. **Viruses**
   - What are viruses reliant upon to live and reproduce?
     __________________________________________________________
     __________________________________________________________
Poultry Industry Teaching Resource

How can the threat of viruses be managed in a poultry flock?

3. **Fungi**
   Fungi absorb nutrients from living or dead organic matter that they grow on. What are the two ways fungi infections cause harm to poultry?

4. **Protozoa**
   What part of a chicken’s body is affected by diseases caused by protozoa?

   What are two ways that diseases caused by protozoa are usually treated?

5. **What is the usual treatment of diseases caused by Chlamidia and Mycoplasmas?**

6. **List five management practices and how they help maintain a healthy flock?**

7. **Make a list of things to look for that indicates that a bird is unhealthy.**
Disease

The spread of infection

The extent to which an infection will spread throughout a population depends upon its size and density, the number of individuals in the population who are susceptible, the environmental conditions and the virulence of the infection. We can reduce the risk of disease spreading by changing any of these factors. Examples of this would be vaccinating to boost immunity in the host, isolating diseased stock to make it more difficult for disease to spread, and spraying for biting insects that carry disease.

Where a disease spreads rapidly through a population it is called an epidemic. A disease may stay in a population at very low (or endemic) levels and only flare up occasionally.

How infection takes hold

Pathogens can gain entry to the body by direct contact, airborne organisms, ingestion of contaminated food, biting insects, cuts and abrasions and inheritance from parent to offspring.

A convenient way of thinking about diseases is by using a concept called the "Disease Triangle". Disease represents the interaction between three factors (the three corners of the triangle): a susceptible host, a pathogen (disease causing organism) and a favorable environment. If all of these factors are present, disease results; if one or more of the factors are not present, then disease does not occur.

The Disease Triangle
Methods of disease control can be thought of as modifying the disease triangle by reducing or eliminating one of the corners of the triangle. For example, if you vaccinate animals against clostridial diseases you are eliminating the "susceptible host" and can thus reduce or prevent disease. Similarly, for bacterial infections, by using antibiotics, you can reduce or eliminate disease because you are eliminating the pathogen. Finally, you can reduce or eliminate a "favorable environment" for something like internal parasites by removing the habitat that the parasite needs to complete its lifecycle.


Use the information about the Disease Triangle and the websites above to answer the following questions for coccidiosis in poultry:

1. Favorable environment

What are the factors that affect poultry health (and make them susceptible to disease)?

_________________________________________________________________
_________________________________________________________________
_________________________________________________________________

What are the factors that affect coccidiosis viability?

_________________________________________________________________
_________________________________________________________________
_________________________________________________________________

2. Pathogen

What is the coccidiosis cycle?

_________________________________________________________________
_________________________________________________________________
_________________________________________________________________

How is it transmitted host to host?

_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
How would you assess the level of coccidiosis in the host and in the environment?


3. Susceptible host

What are the symptoms of coccidiosis?


How do affected poultry help to complete the coccidiosis cycle and spread the disease?


What influences the level of immunity to coccidiosis in poultry?


Vaccination

Read how vaccines work then research a definition for the following:

1. Immunity: ____________________________________________
   ______________________________________________________
   ______________________________________________________
   ______________________________________________________

2. Antibodies: __________________________________________
   ______________________________________________________
   ______________________________________________________
   ______________________________________________________

3. Infectious bronchitis: _________________________________
   ______________________________________________________
   ______________________________________________________
   ______________________________________________________

4. Marek’s disease: ________________________________
   ______________________________________________________
   ______________________________________________________
   ______________________________________________________

5. Newcastle disease: __________________________
   ______________________________________________________
   ______________________________________________________
   ______________________________________________________


**Biosecurity**

Answer the following questions:

1. Outline a definition of biosecurity. ____________________________________________
   __________________________________________________________________________

2. What effect can diseases have on a poultry operation? _____________________________
   __________________________________________________________________________

3. What do you think is meant by “managing risk”? _________________________________
   __________________________________________________________________________

4. What do you think is meant by “risk assessment”? ______________________________
   __________________________________________________________________________

5. Compare various answers from class members for questions 3 and 4. Write these responses on a whiteboard or similar. As a class, make a list of suggestions as to how a meat chicken farmer might go about controlling the major routes of disease transmission. There are many ideas that could come from watching the ‘From Hatchery to Home’ DVD. When compiling the list, consideration should be given to measures that could realistically be taken to protect against disease entering a flock because of: transfer of birds from farm to farm, wild birds or their droppings, domestic pets, insects, rodents, people and their clothing or shoes, vehicles and other equipment, transmission by air, birds drinking contaminated water.

6. Write an extended response (100 – 200 words) to the statement: “The most compelling reason for a livestock farmer to comply with all biosecurity regulations is the economic one. Disease can not only wipe out stock, but can also wipe out the considerable investment made into breeding and rearing.”
   __________________________________________________________________________
   __________________________________________________________________________
   __________________________________________________________________________
Major Exercise

Take a close look at pages 9 to 15 of the National Farm Biosecurity Manual, as well as the documentation records in the appendices. Divide the class into three groups. Have each group take one of the following areas relating to a poultry farm:

- Facilities on the farm
- Personnel on the farm
- Operational standards

Using the resource material from the ACMF document and the ‘From Hatchery to Home’ DVD, each group is required to focus on their area and carry out the following tasks:

1. Make a list of:
   - routine procedures that should be incorporated into the everyday running of the poultry farm to minimise the risk of infection;
   - emergency procedures that should be implemented on a poultry farm, in addition to routine procedures, if there is a disease outbreak.

2. Present your lists to the rest of the class in a 10 – 15 minute oral presentation, supplemented by a handout or other visual aid(s) – eg, a PowerPoint presentation.
   You should also emphasise the importance of keeping accurate records, with reference to examples of documentation, such as those found in the appendices of the ACMF document.

3. Prepare a 5 minute question and answer quiz, or short test, to give to your audience immediately after the presentation. This will give your group a means of evaluating the effectiveness of your presentation.

4. Prepare a poster for display in the classroom that outlines the procedures for both routine and emergency situations.
Animal Health and Welfare

The Use of Antibiotics


1. What are antibiotics?

2. In chicken meat production, two types of antibiotics are used – therapeutic agents and prophylactic agents. What is the difference between them?

3. What is the industry’s position in relation to antibiotics?

4. What does it mean when bacteria become resistant to antibiotics?

5. What does JETACAR stand for? Why was it established?

6. Which organisations are involved in implementing the strategies for the responsible use of antibiotics in animals?

7. Summarise the six guiding principles for the chicken meat industry to ensure that the development of antibiotic resistance is minimised.

8. To what does a withholding period refer? Why are withholding periods so important in chicken meat production?

9. What is the chicken meat industry’s view on alternative methods of treatment to antibiotics? Why does it take this view?

10. Are hormones used in chicken meat production in Australia?
Avian Influenza


Cover some or all of the following aspects:

• What is Avian Influenza?
• How is it carried and passed on to birds?
• Is it the same disease as human influenza?
• Has Avian Influenza ever appeared in this country?
• Have people in Australia ever been affected by Avian Influenza?
• Which strain is the one commonly referred to as ‘bird flu’?
• Have we ever had this strain of Avian Influenza in Australia?
• In which parts of the world has this strain been identified since 2003, and what has been its impact on birds and humans in these parts of the world?
• Does this strain only affect chickens?
• Are wild birds affected?
• Can this strain ever be passed on to humans? If so, by what means?
• Has anyone around the world ever caught this strain from eating properly cooked chicken products?
• What evidence is there that Australia is well prepared to prevent any outbreak of Avian Influenza (bird flu)? What safeguards are in place?
• How can consumers be confident that the chicken meat they purchase is safe?

Present your findings in one of the following ways:

• a written assignment
• a radio or television documentary
• a PowerPoint demonstration
• a webpage, complete with links to other useful websites
• an information brochure for chicken meat consumers
In the Resource Kit you will find a DVD entitled From Hatchery to Home produced by the Australian Chicken Meat Federation Inc.

AFTER viewing the DVD write your responses to the following.

Animal Welfare

1. After viewing the ‘From Hatchery to Home’ DVD make a sketch of a shed used to house meat chickens on a commercial rearing farm. Show the typical dimensions of the shed and the location of feed silos. (You may need to view this section of the program again).

2. Make a list of the equipment/materials used for the following purposes in chicken sheds.
   • flooring
   • ventilation and temperature control
   • feed and water provision

3. Visit www.chicken.org.au/page.php?id=44 on the ACMF website. Read through the information on this webpage and answer the following questions.
   a) What is meant by a Code of Practice?

   b) In what ways do high standards of bird welfare, high levels of flock performance and economic performance go hand in hand?

   c) There are three strong motives listed for industry to look after the birds in its care in a welfare-friendly manner. Write each of these in your own words.
4. Visit [www.chicken.org.au](http://www.chicken.org.au) and locate the section where conventional free range and organic production systems are compared. What is the difference between free range chickens, organic chickens and conventionally farmed commercial meat chickens?

_________________________________________________________________________

_________________________________________________________________________


a) The CSIRO published the Code of Practice, but which government body was responsible for compiling it? ___________________________________________________________

b) Using the contents page as a reference, outline the areas covered by this Code of Practice. ________________________________________________________________

_________________________________________________________________________

_________________________________________________________________________

c) In the section on ‘Housing’, two systems of housing for chicken meat production are defined – what are they? ________________________________________________________________

_________________________________________________________________________

_________________________________________________________________________

d) Read the section on ‘Equipment’. How often must feed and water equipment be checked? Why do you think there is the requirement for back-up systems for environmental control equipment? ________________________________________________________________

_________________________________________________________________________

_________________________________________________________________________

e) Read the section on ‘Ventilation’. What type of gas is described as an indicator of a build-up of noxious gases? What level of this gas (parts per million) in enclosed buildings requires immediate attention? ________________________________________________________________

_________________________________________________________________________

_________________________________________________________________________
Food Production
The Structure of an Egg

Research the structure of an egg and label the following diagram using the list below.

Air cell, Chalaza, Germinal disc, Shell membranes, Shell, Thick albumen, Thin albumen, Vitelline membrane, Yolk
Egg components

What percentage of the total egg weight is yolk? ____________________________

The yolk consists of _______ percent water, _______ percent fat, _______ percent protein.

What other nutritional elements are found in the yolk? ___________ and ___________

The colour of the yolk is determined by ________________________________

A round white spot called the germinal disc can be seen on the surface of the yolk. In
__________________ eggs this is where the chick starts to develop.

In eggs produced for human consumption, what happens to the germinal disc?

________________________________________________________________________

What is the purpose of the vitelline membrane? _________________________________

What is the purpose of the chalaza? ________________________________

The albumen is _____% of the egg. It consists of ______ % water and ______ % protein.

What is the purpose of the albumen? ________________________________

________________________________________________________________________

What role does the shell membrane play? ________________________________

________________________________________________________________________

What role does the shell play? ________________________________

________________________________________________________________________

The shell makes up _______% of the weight of an egg. About 98% of the shell is
____________________________. The other main elements found in the shell are
_____________________________ and ____________________.

How does the air cell form in an egg? ________________________________

________________________________________________________________________
It all starts with an Egg


Watch the DVD and answer the following questions:

How do eggs help us?

___________________________________________________________________________

___________________________________________________________________________

Where are eggs produced?

a. _____________________________________________________________________

b. _____________________________________________________________________

c. _____________________________________________________________________

How many eggs do Australians eat every year? ________________________________

What are the benefits of chickens being in cages?

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

What are the benefits of chickens being in barns?

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

What are the benefits of chickens being free-range?

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

What types of ingredients are in chicken feed?

___________________________________________________________________________

___________________________________________________________________________
What does a veterinarian do?

___________________________________________________________________________

___________________________________________________________________________

When visiting a farm how do you stop disease from spreading?

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

How long does it take chickens to hatch?______________________________

How old is a chicken when it first lays an egg?_________________________________

How often does a chicken lay an egg?________________________________________

Draw a farm where the chickens are kept in cages.
Draw a farm where chickens are kept in a barn.

Draw a farm where chickens are kept free-range.
**Chicken Layer Industry**

**Resources:** [http://www.poultryhub.org/](http://www.poultryhub.org/)

**Using the above web site and others, research the chicken layer industry.**

Approximately, how many layer hens are in Australia? __________________________

How many eggs are produced each year? ________________________________

On average how many eggs does every Australian eat in a year? __________________

What are the main reasons that eggs are discarded?__________________________

Outline the main differences between extensive, semi-intensive and intensive egg production? ________________________________

List the many ways that eggs are marketed in supermarkets. __________________

Cage layer hens produce approximately _____ % of the eggs produced in Australia. Is this percentage increasing or decreasing? __________ Why? __________________

What are the differences in the eggs produced by cage layers, barn layers and free-range layers? ________________________________

What are the benefits of eating chickens eggs? ________________________________

Why should people be careful about eating eggs? ____________________________
Research the history of the egg production industry. Write a short (200 - 250 words) report on the industry?

What are the requirements for eggs to be certified organic?

What is the average cost of producing a dozen eggs?

What are the main factors that affect the cost of production?
Production of Chicken Meat

When you eat chicken do you ever wonder how it was produced?

Use the following words to label the diagram.

Breeder farms, Consumer, Distributor, Feed mill, Food service, Processing plant, Hatchery, Meat chicken rearing farms, Processing plant, Quarantine facility, Retail outlet

Chicken Meat Production

To produce chicken meat there are many stages involved. Draw a line to match the stage in production, the picture and the description.


1. BREEDER FARM

Fertile eggs are incubated under carefully controlled conditions or maintain a constant temperature and humidity.

2. HATCHERY

When target sizes and weights are reached, the meat chickens are transported to a processing plant.

3. HATCHERY

Parent hens are mated with cockerels to produce fertilised eggs.

4. REARING FARM

Fertile eggs are sent to a hatchery.

5. REARING FARM

Growing chickens remain in the rearing sheds until they reach market weight and are then harvested.

6. PROCESSOR

Day old chicks are housed in large well-ventilated sheds. The chicks run on the floor which is covered with a comfortable bedding material.

After the chicks hatch, they are counted, packed and transported by road or air to rearing farms.
Nutrition

Use the website [http://www.poultryhub.org/nutrition/nutrient-requirements/](http://www.poultryhub.org/nutrition/nutrient-requirements/) to research the nutritional requirements of chickens and complete the table

<table>
<thead>
<tr>
<th>Class of Nutrient</th>
<th>Why is the nutrient required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrates</td>
<td></td>
</tr>
<tr>
<td>Fats</td>
<td></td>
</tr>
<tr>
<td>Proteins</td>
<td></td>
</tr>
<tr>
<td>Vitamins</td>
<td></td>
</tr>
<tr>
<td>Minerals</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td></td>
</tr>
</tbody>
</table>

Explain why calcium, phosphorous and vitamin D are important in the diet of a laying hen?
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________

What factors affect the nutrient requirements of poultry?
___________________________________________________________________________
___________________________________________________________________________

What is the rule of thumb regarding water intake compared with feed intake?
___________________________________________________________________________

What are the main factors that affect water intake in chickens?
___________________________________________________________________________

What is the typical water intake of 1000 layer pullets when 4 weeks old? _____ g/day
What is the typical water intake of 1000 laying hens in full production? _____ g/day
What is the typical water intake of 1000 broilers at 8 weeks old _____ g/day

Complete the table below
### Term | Meaning
--- | ---
Metabolism | 
Digestion | 
Balanced daily ration | 
Feed formulation | 
Total digestible nutrients | 
Essential amino acid | 
Fatty acid | 
Hormone | 
Trace minerals | 

In chicken feed, what are the main sources of:

Energy ___________________________  Protein ___________________________

What are the main cereals used in chicken feed? ________________________________

What are the main vegetable protein sources and animal protein sources used in chicken feed? ____________________________________________________________
1. How often do you eat chicken?

2. In what forms do you eat it – eg, roasted; in soups and casseroles; stir-fries; take-away meals; in sandwiches?

3. Do you think chicken is a popular food type in this country? What makes you think this?

4. In what forms is chicken sold in supermarkets, butchers and delicatessens? Describe some of the ways you have seen chicken sold in these outlets for preparation and consumption at home.

5. Indicate whether you consider the following statements to be true or false:
   a) Chickens we buy for eating are the same type of chickens as those that produce eggs sold for human consumption. T / F
   b) Chicken meat has relatively low levels of fat contained in it. T / F
   c) All chicken meat sold in Australia for human consumption is grown in Australia. T / F
   d) Meat chickens tend to be large birds because of the way they are bred and fed. T / F

6. How much chicken meat do you think is sold in Australia each year?
The retail value is estimated to be closest to:
   a) $1 billion   b) $2 billion   c) $3 billion   d) $4 billion

7. What do you think chickens grown on a commercial scale for their meat are fed?

8. In what ways do you think farms that grow chickens for human consumption might protect the birds against disease?
In the Resource Kit you will find a DVD entitled From Hatchery to Home produced by the Australian Chicken Meat Federation Inc. **WHILE** viewing the DVD write your responses to the following.

**Introduction to the Chicken Meat Industry**

1. How many kilograms of chicken does the average Australian eat in one year? _____kg.

2. What was the equivalent figure back in 1965? _____kg.

3. Around 470 million meat chickens are processed in a year by the Australian chicken meat industry. What is the estimated weight of chicken meat produced from this many chickens? __________ tonnes.

4. Complete this table:

<table>
<thead>
<tr>
<th>Approximate gross value of chicken meat production per year.</th>
<th>Estimated retail value of chicken meat industry per year.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. Complete the sentence:
   a) Meat chickens are sometimes called ________________. They are very different from the chickens bred to produce ______________.
   b) Regarding this last statement, in what ways are they different? __________________________

   __________________________________________________________________________

   __________________________________________________________________________

6. What is meant by the statement that ‘the chicken meat industry is highly vertically integrated’? ________________________________________________________________

   __________________________________________________________________________

**Breeding and Breeder Farms**

7. How do the great-grandparents of the chickens that we eat in Australia arrive into the country? __________________________

8. State how many birds of each generation – great-grandparents, grandparents and parents of meat chickens grown for human consumption – might typically be out on the farms in Australia at any one time. ________________________________________________________________

9. How long are the parents of meat chickens kept? _________ weeks. Approximately how many fertile eggs are collected from them in this time? __________________________

10. The breeder flocks are kept in large sheds and are raised on the floor. What is the floor covered with? __________________________
11. Breeder flocks are kept in sheds with nest boxes when they reach maturity – at about 20 weeks of age. Why are they kept here, and why are males and females kept together?

__________________________________________________________________________

__________________________________________________________________________

12. Why is the feed for breeder chickens different from that given to those birds raised for meat consumption?

__________________________________________________________________________

__________________________________________________________________________

**Hatcheries**

13. Why might fertile eggs be fumigated before being incubated?

__________________________________________________________________________

__________________________________________________________________________

14. Complete the sentence:
   The two stages in the incubation process are called the __________________________ stage and the __________________________ stage.

15. How many days are eggs incubated at each of these stages?

16. What is the purpose of grading the chicks after they hatch?

__________________________________________________________________________

__________________________________________________________________________

17. What does the term hatchability mean?

__________________________________________________________________________

__________________________________________________________________________

18. Identify four factors that can affect hatchability.

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

Feed Mills and Rearing Farms

19. What happens at a feed mill?

__________________________________________________________________________

__________________________________________________________________________

20. What role do poultry nutritionists play?

__________________________________________________________________________

__________________________________________________________________________
21. Identify the two grains that make up around 60 per cent of meat chickens’ feed.
__________________________________________
__________________________________________

22. Other than grains, what else is in the feed?
__________________________________________

23. Complete the sentence:
   In producing breeder chickens and meat chickens, no ____________________________
supplements are used in Australia – the practice was ____________________________
over 40 years ago.

24. Complete the sentences:
   Chickens that are raised for meat consumption are never kept in ________________.
   They live on the ____________ of large chicken sheds, which are covered with comfortable
   ________________ material.

25. What could the dimensions of a typical meat chicken rearing farm shed be?
__________________________________________

26. Up to how many day-old chicks could be housed in one of these sheds?
__________________________________________

27. What does brooding mean?
__________________________________________

28. Describe how the temperature inside the chicken sheds is controlled.
__________________________________________
__________________________________________

29. Why are all meat chicken farmers required to have biosecurity practices in place?
__________________________________________
__________________________________________

30. When might flocks be treated with an antibiotic?
__________________________________________
__________________________________________
__________________________________________

31. What measures do farmers use to prevent disease or infection?
__________________________________________
__________________________________________
__________________________________________
Processing Ready For Consumption

32. At what age are meat chickens ready for processing? __________________________

33. How do chickens get from the farm to the processing plant?

______________________________________________________________________________

34. Identify four steps taken after live birds arrive at a processing plant.

______________________________________________________________________________

35. Fill in the missing numbers:
   The largest chicken meat processing plant processes __________ birds per week, and
   employs __________ people.

36. What does HACCP stand for, and what is the purpose of HACCP?

______________________________________________________________________________

37. What should you look for to ensure chicken has been adequately cooked?

______________________________________________________________________________

38. Identify four factors that have led to the price of chicken not increasing as much as the
    prices of other meats over recent decades.

______________________________________________________________________________

39. Chicken meat is a good source of which dietary nutrients? ________________________
In the Resource Kit you will find a DVD entitled From Hatchery to Home produced by the Australian Chicken Meat Federation Inc.
AFTER viewing the DVD write your responses to the following.

Selective Breeding of Chicken Meat

In the Australian meat chicken industry, the great-grandparents of the birds that we eat are imported from overseas as fertile eggs. The birds that hatch from these eggs in quarantine have been selectively bred for desirable characteristics. They go out on to farms in Australia and produce eggs from which hatch the grandparent generation, which, in turn, produce the parent generation of the birds that end up on our tables.


1. List desirable characteristics for meat chickens.
   ____________________________________________________________________________
   ____________________________________________________________________________

2. What advantage does the Australian chicken meat industry gain by importing great-grandparent eggs from overseas?
   ____________________________________________________________________________
   ____________________________________________________________________________

3. Why are the imported eggs hatched inside a quarantine facility? Give some examples of precautions taken to maintain health and hygiene in a quarantine facility.
   ____________________________________________________________________________
   ____________________________________________________________________________

4. How old are the great-grandparent birds when they are released from quarantine?
   ____________________________________________

5. Explain the statement: “Each importation may have three or four separate genetic lines.”
   ____________________________________________________________________________
   ____________________________________________________________________________

6. Where are the eggs from great-grandparent birds hatched?
   ____________________________________________________________________________

7. Grandparent flocks that come from the eggs of great-grandparents then produce fertile eggs from which the parent birds hatch. There is some crossing of breeding lines in this generation – why?
   ____________________________________________________________________________
   ____________________________________________________________________________

Food Production 53 Selective breeding
What Does Selective Breeding Achieve?

Selective breeding plays a large part in the efficiency with which meat chickens convert feed to meat, and are able to attain their market weight quickly.


8. The genetics of the chicken is the major determining factor in chickens’ growth rate and size at the time they are harvested. Identify four other factors.

9. Over the past 50 years there have been considerable improvements in chicken growth rates. What proportion of this is attributed to improved breeds?

10. Outline some of the specific knowledge that has come from research into the nutritional requirements of meat chicken breeds.

11. Why has it been possible to make much larger genetic gains in meat chicken breeds over the past 50 years compared to other larger livestock such as cattle?

Further Research on Selective Breeding

Selective breeding is used in most livestock farming. One industry that is benefiting from selective breeding research and techniques is Tasmania’s $170 million Atlantic Salmon industry. The CSIRO in partnership with a company (Saltas) is undertaking selective breeding work to improve salmon bloodlines.

Use this CSIRO webpage [www.csiro.com.au/science/ps25f.html](http://www.csiro.com.au/science/ps25f.html), and any other information sources you can find to research this project, or another similar selective breeding program used in Australian livestock farming. Prepare a report, outlining the selective breeding program, how it is being implemented and monitored, and which characteristics are being targeted; who is funding it, and who benefits from the program.

Present your report as a written, verbal, audio, visual or multimedia presentation.
In the Resource Kit you will find a DVD entitled From Hatchery to Home produced by the Australian Chicken Meat Federation Inc.

AFTER viewing the DVD write your responses to the following.

Nutrition for Meat Chickens

Visit www.chicken.org.au/page.php?id=6 on the ACMF website to answer the following.

1. Identify 5 different nutrients (not feed ingredients) required by a growing meat chicken.

_________________________________________________________________________

2. The dietary formulation for chickens varies. How is the optimum and most economical combination of feed ingredients determined?

_________________________________________________________________________

3. Use the DVD or website to explain why feed prepared for meat chickens differs from that prepared for breeder chickens?

_________________________________________________________________________

4. Approximately what percentage of the cost of producing a live meat chicken is represented by feed? ________________

5. From which feed ingredients do meat chickens gain their energy? ________________

6. From which ingredients do they gain their protein? ________________

7. What are lysine and methionine, and why are they added to the diets of meat chickens?

_________________________________________________________________________

_________________________________________________________________________

8. Construct a pie chart showing the various percentages of the ingredients present in the feed of a typical meat chicken.

_________________________________________________________________________

9. In what form is feed given to:
   a) baby chicks? ________________

   b) chickens approaching their harvesting weight? ________________

10. How is the feed prepared and made into the form in which it is given to chickens?

_________________________________________________________________________

_________________________________________________________________________

11. What is the purpose of preparing it at such high temperatures?

_________________________________________________________________________
In the Resource Kit you will find a DVD entitled From Hatchery to Home produced by the Australian Chicken Meat Federation Inc. AFTER viewing the DVD use the table and graphs for Australian chicken meat production and consumption to write your responses to the following.

**Production and Consumption**

1. Describe the general pattern of chicken production in Australia over the 40 year period between 1965/66 and 2005/06.  
__________________________________________________________________________  
__________________________________________________________________________  

2. Was there any time during those 40 years that chicken production decreased from one year to the next? If so, when was it?  
__________________________________________________________________________  

3. Between the 1960s and the early part of the 21st century, why do you think the amount of chicken meat produced in tonnes has proportionally increased at a much higher rate than the number of birds produced?  
__________________________________________________________________________  
__________________________________________________________________________  

4. From what you learnt watching the ‘From Home to Hatchery’ DVD, suggest some reasons why the production of chicken meat has shown the trends that it has.  
__________________________________________________________________________  
__________________________________________________________________________  
__________________________________________________________________________  

5. Describe the general trend in per capita chicken meat consumption between 1945 and 1963.  
__________________________________________________________________________  

6. What has been the trend in Australian chicken meat consumption since 1964?  
__________________________________________________________________________  
__________________________________________________________________________  

7. Compare the general patterns of consumption of chicken meat with that of beef and veal, lamb and mutton and pig meat between 1945 and 2005/06.  
__________________________________________________________________________  
__________________________________________________________________________  
__________________________________________________________________________  

8. Which of the meat types shown has displayed:  
a) the greatest increase? __________________________  
b) the most consistent trend? ______________________  
c) the smallest increase (or largest decrease)? _______________
9. Taking the consumption figures for all the types of meat shown in the following years: 1960, 1970, 1980, 1990, 2000 and 2010, prepare pie charts showing the relative percentages of the per capita consumption of chicken meat, beef and veal, lamb and mutton, and pig meat in Australia.
In the Resource Kit you will find a DVD entitled *From Hatchery to Home* produced by the Australian Chicken Meat Federation Inc.

**AFTER** viewing the DVD use the table and graphs for Australian chicken meat production and consumption and any other research to complete the following task. Work in pairs or small groups.

**Food Promotion**

Prepare an advertisement promoting chicken meat as a popular and healthy food choice for one of the following media:

a) a full page in a newspaper or magazine
b) a 60 second spot on radio
c) a 60 second spot on television
d) a pop-up page on a relevant website

Your advertisement could include the following:

- reference (backed up with figures and/or graphs) to the increase in popularity of chicken meat among Australian consumers in recent decades
- reference to the fact that chicken is a convenient, nutritious and healthy food choice with many options for the way it is prepared and served
- reference to the fact that no hormones are fed to meat chickens; rather that their size and quality of meat results from selective breeding programs
- reference to the fact that meat chickens are not kept in cages at any stage, and that close attention is paid to their health and wellbeing

In undertaking this exercise, you need to do the following:

- carefully plan your advertisement and document all the planning stages
- prepare drafts for review by peers/teachers
- complete a finished version – ie, all artwork for a print media or website ad; sound recording for a radio ad; vision and sound for a TV ad
In the Resource Kit you will find a DVD entitled From Hatchery to Home produced by the Australian Chicken Meat Federation Inc. WHILE viewing the DVD write your responses to the following.

Technology in the Chicken Meat Industry

Note down every point at which you notice evidence of technology being applied to farming and processing, and a brief description of what it involves (ie, a few words or a sentence). You may find it useful to make your notes under these headings:

- Breeding and Breeder Farms
- Hatcheries
- Feed Mills
- Rearing Farms
- Processing

Compare your lists with other students in the class. Design a poster or montage for display in the classroom that leads off with the words – Technology in the chicken meat industry is found in:….

Selective breeding over a number of decades has resulted in chickens that are very efficient at converting feed into meat, and which grow quickly to market size. Selective breeding is different from genetic modification. There are no genetically modified chickens in Australia.

1. Explain how selective breeding and genetic modification are different. A visit to the webpage www.nerc.ac.uk/research/issues/geneticmodification/selective.asp from the National Environment Research Council in the UK will be of assistance:

2. Visit this webpage www.chicken.org.au/page.php?id=8 on the Australian Chicken Meat Federation website. Look at the graphs that show a) the relative price of meats in Australia since 1970, and b) the consumption of various meats in Australia since 1945.

a) Describe the trend in the price of chicken in Australia compared with the other meats shown.
b) Describe the trend in the consumption of chicken in Australia compared with the other meats shown.

__________________________________________________________

c) Read through the information under the headings ‘Growth Rates’ and ‘Feed’ on this ACMF webpage www.chicken.org.au/page.php?id=6. Write an extended response (150 – 200 words) on how research and technology have enabled the trends in chicken meat pricing and consumption to follow the patterns they have.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Ongoing Research and Development

   a) What does CRC stand for? ________________________________

   b) Describe the make-up of the Poultry CRC. ________________________

   c) What are the objectives of the Poultry CRC? _________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

   a) Outline two research programs currently being undertaken by the Poultry CRC, and provide a one-sentence description of each. ________________________________

   b) Describe the make-up of the Poultry CRC. ________________________
b) The need for sustainability in the industry is often mentioned. What does sustainability mean? How might it directly relate to the chicken meat industry?

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

c) Take two examples of Poultry CRC programs (accessed via the above weblink), and briefly outline how each one focuses on sustainability in one or more aspects of the chicken meat industry.

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

d) Use the www.poultrycrc.com.au website to research what, in the view of the Poultry CRC, is identified as a major challenge facing the chicken meat industry. Outline the challenge.

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________
Food Preparation
Time to Cook with CHICKEN!

Hawaiian Chicken

**Ingredients**

- 1 chicken
- ½ cup celery
- 1 cup pineapple
- 1 can cream of chicken soup
- ¼ cup cream
- 1 onion, sliced
- ½ cup carrot
- 1 capsicum
- Almonds or cashews
- Salt & Pepper

**Method**


Apricot Chicken

**Ingredients**

- 6-8 pieces chicken
- 2 bacon rashers
- 2 sticks celery
- 2 carrots
- 1 tin 440g apricot nectar
- 1 creamy onion soup
- 1 tablespoon cornflour

**Method**

Place chicken, bacon rashers, celery stick and carrots in an ovenproof dish. Put apricot nectar, onion soup and cornflour together and pour over top of other ingredients. Cook 2 hours in a moderate oven.


There are many more chicken recipes to be found at

Time to Cook with CHICKEN!

Lemon Chicken

*Ingredients*
- 1 ½ teaspoons paprika
- ½ teaspoon black pepper
- 6-8 Chicken pieces
- 2 tablespoons grated rind
- 2 teaspoons soy sauce
- 1 ½ teaspoons salt
- 2 tablespoons oil
- ½ cup lemon juice
- 1 clove garlic
- 2 teaspoons brown sugar

*Method*
Mix paprika, salt and pepper. Rub over chicken pieces. Heat oil in pan and fry chicken until golden brown. Mix remaining ingredients and pour over chicken.

*Source:* Hart, J. *Party Time at Riverview, Recipe Book*, Toowoomba Education Centre, Toowoomba. Sweet and Sour Chicken (Serves 4)

Sweet and Sour Chicken

*Ingredients*
- 500g skinless, boneless chicken breast fillets, diced
- 2 tablespoons vegetable oil
- 1/2 green capsicum, sliced
- 1/2 red capsicum, sliced
- 2 carrots, cut into long, thin slices
- 1 clove garlic, finely chopped
- 1 tablespoon cornflour
- 4 tablespoons soy sauce
- 225g can pineapple pieces, juice reserved
- 1 tablespoon rice vinegar
- 1 tablespoon soft brown sugar
- 1/2 teaspoon ground ginger

*Preparation Method* 10 mins | Cook: 10 mins
1. Heat oil in a large wok over medium high heat and brown chicken. Add green and red capsicum, carrot and garlic and stir-fry for 1 to 2 minutes.
2. In a small bowl, mix together the cornflour and soy sauce. Add to wok along with the pineapple and juice, vinegar, sugar and ginger. Stir together and bring to a boil. Serve over rice.
Research and Experiments
Research Topics

Welfare issues relating to production can often be a ‘hot topic’ amongst consumers and the media. As a consumer we should all make INFORMED decisions.

The following topics often provoke thought and discussion. The students could complete the research using the following ideas:

1. Groups could present the advantages and disadvantages of their topic in a written format, poster and/or presentation.

2. Debate the topics with the aim of convincing the audience that their topic is the most suitable production method: they could relate this to any aspect eg, animal welfare, financial return, etc.

Topics

1. Choose one of the following methods of housing laying chickens. Investigate the advantages and disadvantages. Present your findings as a written report.
   - Barn
   - Free-range
   - Cage

2. Prepare a PowerPoint or Keynote presentation on the advantages and disadvantages of intensive production such as caged housing verses extensive production such as free-range housing.

3. Debate the topic “That organic feeding of chickens has no real benefits over conventional feeding.”

4. Prepare a two page report on the development and changes that have taken place in the chicken meat industry or the egg industry over the last fifty years. Special emphasis should be given to the welfare of chickens.

5. Prepare a PowerPoint or Keynote presentation on the people that work in the chicken industry. Be sure to include the ways these workers are involved in the welfare of chickens.

6. Prepare a discussion of the issues involved in the location of egg farms close to urban areas.

7. Debate the topic “That egg production is harmful to the environment.”

8. Prepare a PowerPoint or Keynote presentation on avian influenza (bird flu). Include the causes, the human risks and the research and management practices used to combat this disease.

9. Prepare a report on the biosecurity measures undertaken by egg producers to limit the spread of infectious diseases and pests.
Examples of Experiments for Schools

1. Different levels of the amino acid lysine in the feed of broiler birds. One diet optimal, one sub-optimal and compare the growth rates of the two groups of birds.

2. Different levels of a mineral such as zinc in feed. One diet would contain 20-30 ppm which is the normal requirement, the other diet would have a level of 10 ppm and birds will not grow properly on this level of Zn.

3. For laying hens, different levels of yolk pigment can be added to feed and the yolk colour of the eggs compared.

4. Broiler chicks can be fed feeds based on barley, one without an enzyme and the other with enzyme added, and the growth rates of the birds compared.

5. Diets for broiler birds could be formulated based on different feed ingredients and/or different levels of protein.

6. For layer birds, production and egg quality could be compared for different types of housing e.g. cages versus barn or free range.

7. Comparison between broiler and layer birds fed the same diet (ACMF Project)

8. Behavioural studies such as raising birds in cages and then keeping one group in cages and placing the other group into floor pens. Then score the range and frequency of bird behaviours.

9. Compare the behaviour of birds that have been handled regularly and are used to humans and a group that has not been handled regularly, when they are exposed to new situations involving people.

10. Obtain eggs from a supermarket. Keep half of the eggs in the refrigerator and leave the other half out at room temperature. Then test the eggs from the two groups for albumen quality (albumen height and calculate Haugh Units).


12. For laying birds, use different lighting programs e.g. different hours of daylight and see what effects this has on production.

13. Incubate fertile eggs and candle the embryonated eggs at different ages to observe the rate of development.

14. Make up a diet and feed some of it in mash form and some in pelleted form to birds and see what effect it has on feed intake and growth rate.

15. Investigate the relationship between the body weight of newly hatched broiler birds and the rate of growth and weight at different ages.
Experiment: Body Weight

Investigate the relationship between the body weight of newly hatched broiler birds and the rate of growth and weight at different ages.

Material:

- Heat lamps (infra-red heat lamp, 150 watt external spot-light or an incandescent globe is suitable)
- Draught excluder and insulation material (if required)
- Litter
- Feeders
- Waterers
- Ration
- Day-old broiler birds
- Scales
- Measuring tape
- Identification tags

Method:

1. Prepare area for rearing chickens
   a. Ensure area is clean and disinfected
   b. Set up area with plastic sheeting on the ground and draught excluder around the edges of the plastic sheeting (can use hay bales, cardboard, etc.)
   c. Lay litter
   d. Place in feeders and waterers
   e. Connect heat lamps to power – chicks should be kept at 33°C for the first week, then reduce by 0.5°C per day to about 24°C in the fifth week.
2. Place day old chicks in rearing area
3. Ensure the chicks food and water is fresh and checked daily

Recordings: These are only ideas...

Weight and growth records

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<th>Chick ID</th>
<th>Weight (g)</th>
<th>Height (cm)</th>
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Feed and water records

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<th>Date</th>
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<th>Water (l)</th>
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Writing Laboratory Reports

All laboratory reports follow a standard format. The basic purpose of laboratory reports is to record your findings accurately and describe their significance. A laboratory report is more than simply a copy of the results from your experimental work. You need to demonstrate how well you understand the concepts that underpin both the experiment and the data you generate. In order to convey your understanding convincingly, you will need to write clearly and order your thoughts in a logical way throughout the report.

**Step 1: WHAT do you need to know in order to understand this experiment?**

Research your topic! Most laboratory reports require an explanation of the background concepts involved in the experiment. Asking yourself questions about the purpose of the experiment before it starts will help you establish what it is you need to know from the experiment.

- What is the aim?
- Why is it important to explore this topic?
- How is this topic related to the other concepts you are examining in the unit?

**Step 2: WHY you are doing this experiment?**

Research the scientific principle you are trying to demonstrate through the experiment. Read the relevant material beforehand to establish what you will be doing and what results to expect (in a general sense) and why. Write a paragraph or two answering the following question:

- What scientific principles will this experiment help you explore?

**Step 3: HOW are you going to do this experiment?**

Determine the sequence of tasks you will perform and what instruments and materials you will be using. Make sure you are clear about:

- The order in which each task should be done
- Whether you need to start some tasks while other tasks are continuing
- Whether you are working alone, in pairs or in groups
- What the instruments are and what they do

Knowing how you will complete the experiment will make it easier to write about the process in the report. Also, these factors can have an impact on your results, so it is worthwhile keeping track of them.

**Step 4: Create the format for your report**

The following format is a guide or template.

**Basic Format of a Lab Report**

*Title Page:* Must have title of experiment & names of people in your group. Title should be short while reflecting the exact nature of the experimental study.

*Abstract:* Summarise in one short paragraph the reason for the study, the methodology, the results that were obtained and the conclusions that you reached.
**Introduction:** Explain why this study was carried out (i.e. what were you trying to explore or prove?). Summarise the relevant background information that explains existing theories or knowledge about this experiment. Finally, state your scientific objective, i.e. the hypothesis you are addressing.

**Materials and Methods:** List the materials used and describe *exactly* how the experiment was conducted. Be sure to use correct referencing! (both in-text and end of text referencing). Always write your methodology in the past tense.

**Results:** Summarise your observations and the data of the experiment *without* interpreting them, i.e. no comments about why you got the results you did. It is extremely useful to present your data using tables and figures (graphs, photos, illustrations are all figures); however, you must also include a description of your findings. This can be as simple as a few sentences and must appear before the table or figure it refers to. Concentrate on the overall trends in your data, not every single detail. Always write your results in the past tense.

**Reminder!**
All tables and figures must have a title and number. You must use this number when describing your findings. For example, “There was a 30% increase in the rate of heating (Fig.1).” Make sure the axes on any graphs are labeled correctly and include the appropriate units of measurement.

**Discussion:** Discuss the experiment by interpreting your data, explaining what your outcome means and how your results relate to the background theory already mentioned in your Introduction. A very good way to begin your discussion is with a sentence that describes your most significant results. This is also the section to discuss factors which may have influenced your results (did everything go according to plan? If not, how did it affect your results?). It may be necessary to offer possible reasons why your results did not match those of similar experiments. Where appropriate, reference information. Your discussion needs to let your reader know what can be concluded from your results. Write in the present tense.

**Conclusion:** Provide a statement or two about what you can accurately conclude from the results you obtained.

**References:** Include all material you have used to help you write this laboratory report. Ensure that you use the recommended referencing style

**Appendix:** Include raw data here if appropriate; this might include sample calculations.

**Tip!**
Write the abstract last – when you know exactly what you did and what you achieved. A template is provided on the next page.
Experiment Proforma

Student Name: ____________________  Class: ____________________

Teacher Name: ____________________  Date: ____________________

Experiment Title: ____________________

___________________________________________________________________________

Group Members: ____________________

Aim: ____________________

___________________________________________________________________________

Hypothesis: ____________________

___________________________________________________________________________

Materials: ____________________

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Conclusion:

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References:

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Appendix:

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Teacher Help
Scientific Method

Scientific enquiry consists of observation and experimentation. An informed observer i.e. a person who has some background knowledge in a field of study, makes an observation and then, using prior knowledge, generates an hypothesis or educated guess.

The hypothesis is tested by designing an experiment. An experiment will include two variables:

- independent variable (also called experimental variable)
- dependent variable (the variable which is being measured)

The example given in Silverthorn’s book is the observation made by a biologist that birds at a garden feeder appear to eat more feed in winter than in summer. Her hypothesis is that cold temperatures lead to increased feed intake in birds. She designs an experiment where she houses birds at different temperatures (the independent variable) and measures their feed intake (the dependent variable).

Every experiment must have a control which is a group which is exactly the same as the experimental group in every way except that the independent variable is not changed from its initial value. In the example from Silverthorn’s book, the control group would be birds which are maintained at a warm summer temperature.

The information collected during the experiment is called data (plural, the singular of data is datum). In biological systems, there is variation among individuals so it is important to have replication in an experiment.

When an hypothesis is supported by many experiments, it may become an model. If a model has substantial scientific evidence supporting it, it may become a scientific theory.

Another way of addressing the extent of variability in a biological population is to use a crossover study where each individual acts as its own control. Each individual has the dependent variable measured under both control and experimental conditions.

When experiments are conducted with humans, there can be particular difficulties because of psychological factors such as the placebo effect where a person feels better because they are taking a treatment, even if they are just receiving the control treatment such as a sugar pill. Another condition is the nocebo effect where people who have been warned that a drug may have specific adverse side effects report a higher incidence of such side effects than people who were not warned. Because of these effects, experiments with humans may be conducted as blind studies where the participant does not know what treatment they are receiving. Another problem with human experimentation is potential bias on the part of the experimenter where the experimenter expects a particular outcome. In order to avoid this problem, a double blind study can be conducted where neither the participants nor the experimenter know what the treatments are.

Ethical issues arise with the use of animals or humans as experimental subjects or participants. You need to be familiar with the ethical requirements for your school prior to conducting any experiments. Your teacher will be able to help you with this.

Sources of Information

### Equipment Suppliers, Small Scale – suitable for schools

N.B. This information is provided for assistance only. The Poultry CRC does not endorse any of these suppliers.

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Contact Information</th>
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<tr>
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<td>A.C.N. 052 290 249 - ABN 30 052 290 249</td>
<td>Stock plastic eggs, therapeutics, needles, syringes, wing bands, disinfectants</td>
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<td>Roland &amp; Janelle Lenhardt</td>
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<td>Email: <a href="mailto:lentradirect@ecemail.com.au">lentradirect@ecemail.com.au</a></td>
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<td>Fax: (03) 9352 8882</td>
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<td>Marg Goodwin</td>
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<td></td>
<td>Phone: (03) 5763 2446</td>
<td>Fertile eggs of different breeds of poultry</td>
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<td><strong>Peter Gibbs Stockfeeds</strong></td>
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<td>Email: <a href="mailto:sales@kewpie.com.au">sales@kewpie.com.au</a></td>
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<tr>
<td><strong>Brookfield Poultry Equipment</strong></td>
<td>Phone/Fax: (07) 3374 3031</td>
<td>Posters, prints, books, feeders, drinkers, incubators, brooders, crates, leg rings</td>
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<td>Mobile: 0420 775 313</td>
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<td><a href="http://www.brookfieldpoultryequipment.com">www.brookfieldpoultryequipment.com</a></td>
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<td><strong>Planet Poultry</strong></td>
<td>Norm Black</td>
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<td>Phone: (02) 6689 5126</td>
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<td>Mobile: 0407 786 924</td>
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<tr>
<td><strong>Allied Animal Health (also Allied Diagnostics Pty Ltd veterinary diagnostic company)</strong></td>
<td>15/11 Bowmans Road</td>
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<td>Phone: (02) 6689 5126</td>
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<td></td>
<td>Mobile: 0407 786 924</td>
<td>Speciality coops, incubators, poultry accessories</td>
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<tr>
<td><strong>Agricultural Automation</strong></td>
<td>Phone: (03) 5987 2870</td>
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<tr>
<td><strong>Poultry Industry Teaching Resource</strong></td>
<td><strong>Equipment Suppliers</strong></td>
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<td><strong>Priam Psittaculture Centre</strong></td>
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<tr>
<td>2 Australis Place</td>
<td>341 Barwon Heads Rd</td>
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<tr>
<td>Phone: (02) 6128 0800</td>
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<tr>
<td>Fax: (02) 6128 0810</td>
<td>Email: <a href="mailto:grandpa@iprimus.com.au">grandpa@iprimus.com.au</a></td>
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<tr>
<td>Email: <a href="mailto:ppc@priam.com.au">ppc@priam.com.au</a></td>
<td>Web Site: <a href="http://www.poultry-feeders.com">www.poultry-feeders.com</a></td>
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<td>Web Site: <a href="http://www.priam.com.au">www.priam.com.au</a></td>
<td>Grandpa's chook feeders</td>
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<td>Aviculture supplies (not just poultry)</td>
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<td><strong>Waterworks Road Poultry Vet Surgery</strong></td>
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<td>333 Waterworks Road</td>
<td>9 Hercules Street</td>
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<td>Ashgrove</td>
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<td>Poultry transport containers</td>
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<td><strong>Innisfail Stockfeeds</strong></td>
<td><strong>Intensive Farming Supplies Australia</strong></td>
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<tr>
<td>Phone: (07) 4061 2022</td>
<td>Phone: (08) 8349 8077</td>
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<td>Mainino Incubators</td>
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<td><strong>MKB Poultry Care</strong></td>
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<td>15 Hodgins Crs</td>
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<td>Frankston North</td>
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<td>VIC 3200</td>
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<tr>
<td>Phone: (3) 9786 3791</td>
<td>Web Site: <a href="http://www.mkbpoultry.com">www.mkbpoultry.com</a></td>
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<tr>
<td>Wire cage fronts poultry and pigeons</td>
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<tr>
<td><strong>Peters Free Range Poultry Mix</strong></td>
<td><strong>McCallum Made Chicken Tractors</strong></td>
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<tr>
<td>49-53 Capital Link Drive</td>
<td>Phone: 1800 337 874</td>
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<td>VIC 3061</td>
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<tr>
<td>Phone: 1800 351 339</td>
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<tr>
<td><strong>Incubators and More Pty Ltd</strong></td>
<td><strong>HJN International Pty Ltd</strong></td>
<td></td>
</tr>
<tr>
<td>212A Gouger Street</td>
<td>Unit 7, 21 Groves Avenue</td>
<td></td>
</tr>
<tr>
<td>Adelaide</td>
<td>McGraths Hill</td>
<td></td>
</tr>
<tr>
<td>SA 5000</td>
<td>NSW 2756</td>
<td></td>
</tr>
<tr>
<td>Phone: (08) 8231 8778</td>
<td>PO Box 211</td>
<td></td>
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<tr>
<td>Fax: (08) 8231 8680</td>
<td>Kenthurst</td>
<td></td>
</tr>
<tr>
<td>Email: <a href="mailto:incmore@senet.com.au">incmore@senet.com.au</a></td>
<td>NSW 2156</td>
<td></td>
</tr>
<tr>
<td>Web Site: <a href="http://www.incubatorsandmore.com.au">www.incubatorsandmore.com.au</a></td>
<td>Phone: (02) 4587 9516</td>
<td></td>
</tr>
<tr>
<td>Incubators, feeders, drinkers, medicines, plucking machines, egg graders, leg rings, incubator parts, capsules, microswitches, books, nests, aviarries, thermometers, wet bulbs</td>
<td>Fax: (02) 4587 9506</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Email: <a href="mailto:jenece@hjininternational.com.au">jenece@hjininternational.com.au</a></td>
<td></td>
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<tr>
<td></td>
<td>Web Site: <a href="http://www.hjininternational.com.au">www.hjininternational.com.au</a></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Drinkers, incubators, beak trimming equipment</td>
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<tr>
<td><strong>Poultry Suppliers</strong></td>
<td><strong>Website</strong></td>
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<tr>
<td><strong>Brian Larkins</strong></td>
<td>Allfarm Animal Health</td>
<td></td>
</tr>
<tr>
<td>Lot 3, Nattai St</td>
<td>2 Glendale Ave</td>
<td></td>
</tr>
<tr>
<td>Tahmoor</td>
<td>PO Box 450</td>
<td></td>
</tr>
<tr>
<td>NSW 2573</td>
<td>Hastings</td>
<td></td>
</tr>
<tr>
<td>Phone: (02) 4681 9722</td>
<td>VIC 3915</td>
<td></td>
</tr>
<tr>
<td>Layer Pullets</td>
<td>Phone: (03) 5979 4488</td>
<td></td>
</tr>
<tr>
<td>Tinted and brown egg layers, not beak trimmed,</td>
<td>Email: <a href="mailto:allfarm@allfarm.com.au">allfarm@allfarm.com.au</a></td>
<td></td>
</tr>
<tr>
<td>regular delivery to most areas NSW &amp; VIC</td>
<td>Web Site: <a href="http://www.allfarm.com.au">www.allfarm.com.au</a></td>
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<thead>
<tr>
<th><strong>Quality Wire Cage Fronts</strong></th>
<th><strong>Smart Incubators</strong></th>
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<tbody>
<tr>
<td>Ian Trass</td>
<td>Laurie Smart</td>
</tr>
<tr>
<td>109 Sierra Drive</td>
<td>129 Main St</td>
</tr>
<tr>
<td>North Tamborine</td>
<td>Elliminyt</td>
</tr>
<tr>
<td>QWLD 4272</td>
<td>VIC 3250</td>
</tr>
<tr>
<td>Phone: (07) 5545 0365</td>
<td>Phone: (03) 5231 3156</td>
</tr>
<tr>
<td>Mobile: 0408 193 759</td>
<td>Web Site: <a href="http://www.smartincubators.com">www.smartincubators.com</a></td>
</tr>
<tr>
<td>Cage fronts for poultry, pigeons, caged birds</td>
<td>Incubators</td>
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<thead>
<tr>
<th><strong>WA Poultry Equipment</strong></th>
<th><strong>Abundant Layers</strong></th>
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<tbody>
<tr>
<td>1170 Baldivis Rd</td>
<td>3 Mulhalls Rd</td>
</tr>
<tr>
<td>Baldivis</td>
<td>Macclesfield</td>
</tr>
<tr>
<td>WA 6171</td>
<td>Emerald 3782</td>
</tr>
<tr>
<td>Phone: 1300 881 170</td>
<td>Phone: (03) 5968 6765</td>
</tr>
<tr>
<td>Fax: (08) 9524 1716</td>
<td>Web Site: <a href="http://www.abundantlayers.com">www.abundantlayers.com</a></td>
</tr>
<tr>
<td>Email: <a href="mailto:chris@wape.com.au">chris@wape.com.au</a></td>
<td>Egg laying hens, pure breeds, fertile eggs, day</td>
</tr>
<tr>
<td>Web site: <a href="http://www.wapoultryequipment.com">www.wapoultryequipment.com</a></td>
<td>olds</td>
</tr>
<tr>
<td>Shop Cart: <a href="http://www.wapoultryequipment.net.au">www.wapoultryequipment.net.au</a></td>
<td></td>
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</tbody>
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<tr>
<th><strong>FowlBiz</strong> (formerly Livestock &amp; Poultry Services)</th>
<th><strong>Another website that maybe useful</strong></th>
</tr>
</thead>
</table>
| Phone/Fax: (07) 5428 3033 | http://www.poultryhub.org/poultry-hub-
| Mobile: 0448 283 022 | address-book-organisations/ |
| Email: fowlbiz@bigpond.com | |
| Incubators, feeders, drinkers, leg bands | |
Animals in Schools:
Information about Animal Welfare Requirements

NSW

For specific information about poultry go to:
and click on the poultry options

ACT

VIC

SA

TAS

QLD

WA
http://policies.det.wa.edu.au/our_policies/ti_view?uid=e023bc342e2c59482edd1c2e27d57d92&iview=summary_view