TREATMENT OPTIONS
In this session you will learn:

- The methods of administering medication to pigs.
- Best practice injection techniques.
- How to use antibiotics prudently to minimise the risk of residues and resistance.
- Alternatives and adjuncts to antibiotics and how to use them:
  - Vaccines
  - Anthelmintics
  - Anti-inflammatory
  - Probiotics
Medication delivery systems

- **In-feed**
  - Good for prevention/not so good for treatment, growth promotion vs disease, easy, costly, delays

- **In-water**
  - Medium effectiveness, wastage, delivery

- **Injectable**
  - Most effective, cheap, high labour cost
Injectables

- Intramuscular
- Intravulvar (prostaglandins, oxytocin)
- Subcutaneous?
- Effective and accurate
- Labour-intensive
Why would you want to do this??

You can also pinch up a fold of skin to inject into but make sure that you miss your fingers!

CORRECT INJECTION
Correct Injection of Pigs

- Suitable drug (treatment list)
- Dose (treatment list)
- Technique
- Identification of treated animal
- Record animal ID and Withhold period
- Disposal of equipment
Quick Quizz-List 5 factors that will affect your choice of antibiotic
Quick Quizz-5 factors that will affect your choice of antibiotic

- Culture and sensitivity
- Past experience
- Type of bacteria
- Withhold period
- Cost
General guidelines for antibiotics

- Consider management first (hygiene, stocking rate, temperature, ventilation, vaccination)
- Use effective dose rates - consider reduced feed & water intakes for sick pigs
- Avoid “blanket” medication
- Keep it simple
Antibiotic Resistance
QUIZZ

What is the difference between an antibiotic residue & resistance?
Antibiotic residue: the concentration of the drug remaining in the carcase after treatment.

Antibiotic resistance: a property of bacteria that allows them to grow in the presence of antibiotic levels that would normally suppress growth or kill susceptible bacteria.
How antibiotic resistance develops
BACTERIAL SPREAD
(resistant pathogens)

Step 1: Emergence of antibiotic-resistant bacteria in animals

Transfer of antibiotic-resistance genes between animal bacteria

Step 2: Spread of resistant bacteria from animals to humans

Additional Step 2: Transfer of antibiotic resistance genes from animal to human bacteria

Step 3: Clinical disease in humans

Transfer of antibiotic resistance genes from human to other human bacteria

Emergence of antibiotic-resistant bacteria in humans

GENETIC SPREAD
(resistance genes)

Antibiotic use in animals amplifies resistant bacteria

ANIMAL BACTERIAL POPULATION

HUMAN BACTERIAL POPULATION

Antibiotic use in humans amplifies resistant bacteria
1 in $10^6$ Campylobacter bacteria with resistance gene for Tylosin

Tylosin for 14 weeks to prevent ileitis

Long-term use of antibiotics

1 in $10^6$ Campylobacter bacteria with resistance gene for Tylosin

Tylosin for 14 weeks to prevent ileitis

Selection for resistance

At slaughter

$10^5$ in $10^6$ Campylobacter bacteria with resistance genes for Tylosin

Pork under-cooked...Human ingests Campylobacter...food poisoning

Campylobacter spills onto the carcass

Patient dies

Erythromycin-resistant strains of bacteria in the intensive care ward

Human ends up in intensive care...treated with Erythromycin

Patient dies
Resistant

Plasmids

Bacterial chromosome

Sensitive

Plasmid replicates and copy transfers to sensitive cell

Resistant

Sensitive

Plasmid replicates and resistance gene expresses

Recipient

Donor
TRANSFER OF RESISTANCE PLASMIDS

Campylobacter with Tylosin-resistance plasmid + Erysipelas sensitive to Tylosin

Plasmids

Bacterial chromosomes

DONAR

RECIPIENT

Selected gilt (from Farm before)

Erysipelas resistant to Tylosin

Tylosin injection & in-water

erysipelas
How does this impact on us?

Weaner Site

Amoxil from 2-10 weeks of age to prevent Strep/Glassers

1 in $10^6$ APP resistant to Amoxil

Grower Site

An APP outbreak occurs

10^5 in 10^6 APP resistant to Amoxil

R.I.P.
### APP Sensitivity Patterns

<table>
<thead>
<tr>
<th>Date</th>
<th>Amoxycillin</th>
</tr>
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<tbody>
<tr>
<td>19-Mar-98</td>
<td>Sens</td>
</tr>
<tr>
<td>07-Apr-98</td>
<td>Sens</td>
</tr>
<tr>
<td>22-Jul-99</td>
<td>Sens</td>
</tr>
<tr>
<td>28-Jul-99</td>
<td>Sens</td>
</tr>
<tr>
<td>28-Jul-99</td>
<td>Sens</td>
</tr>
<tr>
<td>29-Oct-99</td>
<td>Sens</td>
</tr>
<tr>
<td>15-Nov-99</td>
<td>Sens</td>
</tr>
<tr>
<td>15-Dec-99</td>
<td>Sens</td>
</tr>
<tr>
<td>15-Dec-99</td>
<td>Sens</td>
</tr>
<tr>
<td>04-Feb-00</td>
<td>Sens</td>
</tr>
<tr>
<td>07-Mar-00</td>
<td>Sens</td>
</tr>
<tr>
<td>29-Mar-00</td>
<td>int</td>
</tr>
<tr>
<td>17-Aug-00</td>
<td>Sens</td>
</tr>
<tr>
<td>15-Sep-00</td>
<td>Res</td>
</tr>
<tr>
<td>15-Sep-00</td>
<td>Int</td>
</tr>
<tr>
<td>15-Sep-00</td>
<td>Sens</td>
</tr>
<tr>
<td>29-Sep-00</td>
<td>Sen</td>
</tr>
<tr>
<td>03-Oct-00</td>
<td>Sens</td>
</tr>
<tr>
<td>05-Oct-00</td>
<td>Res</td>
</tr>
<tr>
<td>29-Mar-01</td>
<td>Sens</td>
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<tr>
<td>04-Apr-01</td>
<td>Sens</td>
</tr>
<tr>
<td>11-Apr-01</td>
<td>Res</td>
</tr>
<tr>
<td>11-Apr-01</td>
<td>Sens</td>
</tr>
<tr>
<td>24-Apr-01</td>
<td>Res</td>
</tr>
<tr>
<td>19-Jun-01</td>
<td>Res</td>
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<tr>
<td>02-Jul-01</td>
<td>Sens</td>
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<td>05-Jul-01</td>
<td>Res</td>
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<tr>
<td>05-Jul-01</td>
<td>Res</td>
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<td>16-Jul-01</td>
<td>Sens</td>
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<tr>
<td>12-Nov-01</td>
<td>Res</td>
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<tr>
<td>20-Dec-01</td>
<td>Int</td>
</tr>
<tr>
<td>20-Feb-02</td>
<td>Res</td>
</tr>
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</table>
Post-weaning Colibacillosis:
Resistance patterns

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Sensitivity</th>
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<tbody>
<tr>
<td>Amoxycillin</td>
<td>Res</td>
</tr>
<tr>
<td>Apramycin</td>
<td>Res</td>
</tr>
<tr>
<td>Tetracycline</td>
<td></td>
</tr>
<tr>
<td>Neomycin</td>
<td>Res</td>
</tr>
<tr>
<td>Sulphamethoxazole</td>
<td>Res</td>
</tr>
<tr>
<td>Trimethoprim</td>
<td>Res</td>
</tr>
<tr>
<td>Trivetin</td>
<td></td>
</tr>
<tr>
<td>Lincomycin</td>
<td></td>
</tr>
<tr>
<td>Penicillin</td>
<td></td>
</tr>
<tr>
<td>Ceftiofur</td>
<td>Sens</td>
</tr>
<tr>
<td>Tiamulin</td>
<td>Res</td>
</tr>
<tr>
<td>Spectinomycin</td>
<td>Res</td>
</tr>
</tbody>
</table>
Overseas experience

1999: APP outbreaks-isolates sensitive to Enrofloxacin (Baytril)

Jan-May 2000: Enrofloxacin sequentially added to the feed of all pigs continuously as they grew from weaner to grower in an attempt to eradicate APP

May 2000: APP strain 8 emerged in grower pigs which was highly resistant to Enrofloxacin

The result in 2002: Piles of Enrofloxacin in the feed mill and loss of Enrofloxacin as an option for treating APP in this herd
What about dose rate?

Amoxil @ 20mg/kg
Amoxil @ 30mg/kg
Amoxil @ 40mg/kg
Amoxil @ 50mg/kg

Resistant @ 20mg/kg
Resistant @ 30mg/kg
Resistant @ 40mg/kg
Sensitive @ 50mg/kg

APP
How do we minimise antibiotic resistance?

- Don’t use antibiotics as a prop for poor housing, environment, production design or management
- Minimise the duration of antibiotic use
- Minimise the number of pigs treated
- Don’t over-dose
- Minimise the number of pigs treated
- Don’t immediately choose a broad-spectrum.
QUIZZ

List 5 best-practice methods of minimising the risk of antibiotic residues in pigs at slaughter.
Minimising residues - General

- Write instructions - “Approved medication list”
- Observe withholding periods
- Ensure all off-label use is approved by a vet
- Identify treated pigs
- Use correct dose rates
- Accurate estimation of pig weights
- Staff training
- A system to ensure all pigs have gone through the withhold
Minimising residues from feed medication

- Systems for recording all feeds ordered & medications in the feeds
- ID all feed silos to ensure feed deliveries are correct
- Feed delivery check
- For home mixers-order of mixing feed & cleaning procedure for machinery that minimises cross contamination between medicated & non-medicated feeds
Vaccines

From...“He was winning until they started chanting his name”
Types of Vaccination used in pigs

- Bacterial eg *E.coli, Lepto, Erysipelas*
- Viral eg *Parvovirus*
- Autogenous - piggery specific
  - Live eg *Sowvac*
  - or killed eg *Glassers vaccine*
Breeder vaccinations

- **At selection**
  - Erysipelas, parvovirus, Leptospirosis, (E coli)

- **4 weeks later**
  - Erysipelas, parvovirus, Leptospirosis (E coli)

- **2 weeks before farrowing**
  - Erysipelas, Leptospirosis, E coli
“Progeny” vaccination

- Mycoplasma hyopneumoniae
- Actinobacillus pleuropneumoniae
  - Protection serovar-specific
- Haemophilus parasuis
  - Protection serovar-specific
- Colibacillosis-post-weaning
  - “Weanavac”
  - “Autovac”
- Erysipelas
Control of Mycoplasma pneumonia in a multi-site system
Mycoplasma pneumonia

• Costs:
  • Reduced growth rate
  • Reduced carcass weight
  • Medication
  • Decreased FE
  • Can lead to other diseases (APP)
Was MH pneumonia worsening?

- Pig performance—growth rate decline
- Clinical observations—more coughing
- Lung scores worsening
- Serology
How could we control MH pneumonia?

- Improve air quality
  - Reduce dust (oil spraying)
- Vaccination
  - 2-shot vaccines
  - 1-shot vaccines
- Medication
  - Strategic medication
  - Chlortetracycline, lincomycin, tiamulin
Oil spraying

Sprayed

Unsprayed
Oil spraying trial

Static monitoring

Personal monitoring
Oil spraying improved air quality

Results of static air quality monitoring at the Weaner Site in 2002

| Treatment | Time after Total dust Resp Dust Bacteria |
|-----------|--------------------------------------|--------------------------------------|--------------------------------------|
|           | (wks)                             | (mg/m3)                             | (mg/m3)                             | (cfu/m3)                             |
| Control   | < 2.4                             | < 0.23                              | < 100,000                           |
| Treatment | 1                                 | 13.9                                | 1.20                                | 835,500                              |
| Control   | 3                                 | 11.1                                | 0.81                                | 1,039,250                            |
| Treatment | 5.2                               | 5.2                                 | 0.44                                | 746,250                              |
Oil spraying improved pig performance

<table>
<thead>
<tr>
<th>Treat/Farm</th>
<th>Cole’s HCWt (kg)</th>
<th>P2</th>
<th>Meade’s HCWt (kg)</th>
<th>P2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unvaccinated</td>
<td>91.66</td>
<td>16.57</td>
<td>85.21</td>
<td>13.78</td>
</tr>
<tr>
<td>Vaccinated</td>
<td>93.76</td>
<td>17.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Vacc + Oil</strong></td>
<td><strong>92.33</strong></td>
<td><strong>14.85</strong></td>
<td><strong>92.33</strong></td>
<td><strong>14.85</strong></td>
</tr>
<tr>
<td>SED</td>
<td>1.53</td>
<td>0.54</td>
<td>1.55</td>
<td>0.43</td>
</tr>
</tbody>
</table>

* MH vaccine gave an extra 2.1kg HCWt

* MH vaccine + Oil spraying gave an extra 7.12kg HCWt.
Recommendation: Apply oil spraying

- 15% canola oil:water @ 6L/m² floor
- Applied with a hose once before weaners enter (is there a better method?)
- Material cost $500/shed (50c/pig)
- + Labour @ 3hr/shed
Vaccination

- 2-shot vaccine
  - Suvaxyn Mhyo $1.22-$1.28/pig

- 1-shot vaccine
  - New to Australia
  - Pfizer $1.43-$1.51/pig
  - Can it be given < 21 days of age?
  - Is it as good as a 2-shot?
2-shot vaccine trial

- **At the breeder site:**
  - Litters of pigs randomly allocated into vaccinated/unvaccinated groups
  - Vaccinated with Suvaxyn @ 4 days & weaning

- **At the weaner site:**
  - Vaccinates & non-vaccinates mixed together within each of 2 sheds of pigs (castrates/females)
At the grow-out site

- **Traditional sheds**
  - Females: Unvac 225, Vac 225
  - Castrates: Unvac 225, Vac 225

- **Igloos**
  - Castrates: Unvac 188, Vac 189
  - Females: Unvac 188, Vacc 188
Predicted means of P2, Av. Lung score
& HSCW

<table>
<thead>
<tr>
<th>Vaccinated</th>
<th>P2 (mm)</th>
<th>Av. Lung score</th>
<th>HSCW (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>14.13</td>
<td>10.2</td>
<td>92.47</td>
</tr>
<tr>
<td>Yes</td>
<td>15.35</td>
<td>4.2</td>
<td>95.91</td>
</tr>
<tr>
<td>Difference</td>
<td>1.22</td>
<td>6 (p=0.06)</td>
<td>3.44 kg (p=0.03)</td>
</tr>
</tbody>
</table>

(*Vaccination did not affect grower mortality rates)
### Proportions of lungs positive for pleurisy, acute & chronic lesions & APP

<table>
<thead>
<tr>
<th>Vaccinated</th>
<th>Pleurisy1</th>
<th>Pleurisy2</th>
<th>Acute</th>
<th>Chronic</th>
<th>APP</th>
</tr>
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<tbody>
<tr>
<td>No</td>
<td>0.011</td>
<td>0.081</td>
<td>0.022</td>
<td>0.721</td>
<td>0.006</td>
</tr>
<tr>
<td>Yes</td>
<td>0.014</td>
<td>0.071</td>
<td>0.010</td>
<td>0.471</td>
<td>0.009</td>
</tr>
<tr>
<td>P value</td>
<td>0.75</td>
<td>0.55</td>
<td>0.21</td>
<td>0.06</td>
<td>0.70</td>
</tr>
</tbody>
</table>
The vaccinated group had proportionately fewer pigs in the higher lung score categories (P<0.001)

<table>
<thead>
<tr>
<th>Vaccinated</th>
<th>0 - &lt;10</th>
<th>10 - 20</th>
<th>&gt;20</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>213</td>
<td>78</td>
<td>57</td>
</tr>
<tr>
<td>Yes</td>
<td>305</td>
<td>27</td>
<td>18</td>
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Recommendation:
Start vaccinating suckers with Suvaxyn at 4 days & at weaning.
Strategic medication

* Not trialled in the 3-site system.
* Other results did not look promising.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>ADG (10-16wks)</th>
<th>HCWt(kg)</th>
<th>P2</th>
<th>Lung score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lincomycin + MH Vacc</td>
<td>0.657</td>
<td>65.58</td>
<td>9.18</td>
<td>2.09</td>
</tr>
<tr>
<td>Vacc only</td>
<td>0.668</td>
<td>65.69</td>
<td>9.10</td>
<td>3.13</td>
</tr>
<tr>
<td>LSD$_{5%}$</td>
<td>0.036</td>
<td>2.81</td>
<td>0.52</td>
<td>1.85</td>
</tr>
</tbody>
</table>

Treatment had no significant effect on mortalities or extra treatments given
Summary

- Mycoplasma pneumonia in the 3-site system had increased in incidence & severity.
- The severity varied among batches of pigs (but this is not predictable).
- Oil spraying improved carcass weight through improved air quality at the Gre Weaner Site.
- Mycoplasma vaccination improved carcass weight through a reduction in pneumonia severity & a lower incidence of chronic pneumonia.
Recommendations:

1. Routinely oil spray at the weaner sites.
2. Vaccinate suckers with Suvaxyn at 4 days & at weaning.
Anthelmintics

- Roundworm mainly
- Pulse (to inhibit lifecycle) or continuous (to minimise damage through larval migration etc)
- In-feed and injectables easiest
- Oral drench:
  - Tolturazol
- In-feed:
  - Ivermectin, Fenbendazole, Morantel, Hygromycin
- Injectable:
  - Ivermectin, Doramectin
Anti-inflammatories

- Minimise pain and reduce clinical signs
- Dexamethasone, Flunixin

Application:
- Mastitis
- Meningitis
- Acute febrile illness (APP, Erysipelas)
- Lameness
Non-antibiotics

- Organic acids
- Inorganic chemicals (ZnOxide)
- Controlled fermented liquid feeds
- Probiotics
In this session you will have learnt:

- The methods of administering medication to pigs.
- Best practice injection techniques.
- How to use antibiotics prudently to minimise the risk of residues and resistance.
- Alternatives and adjuncts to antibiotics and how to use them:
  - Vaccines
  - Anthelmintics
  - Anti-inflammatories
  - “Other”