Examination of the pig

Introduction

Clinical examination skills and recognition of disorders

- Stockpersons recognition of clinical signs
- Clinical examination of the individual pig ï cooperative and uncooperative
- Recognition of the signs of ill-health
- Examination of a group of pigs
- The basics of a farm visit
- Disorders by clinical sign
- Disorders by age of the pig

Diagnostics

- Normal physiological parameters
- Tests for specific diseases
- Blood testing
- Tonsil sample
- Euthanasia of a pig
- Post-mortem examination
- Examination of a semen sample

Introduction

Making a diagnosis

A successful veterinarian is one whose clients have no sick or compromised animals ï an extremely difficult achievement. The clinician needs to remember that the clinical disease is only the terminal cause of death. It is imperative that the veterinarian concentrates on maintaining the animalôs health rather than treating its diseases.

Making an accurate diagnosis is the key to successful veterinary practice.
A diagnosis is to identify:

1. If there is a problem
2. The cause of the problem
3. Practical solutions to the problem
4. Means of preventing the problem occurring again

Is there a problem?

Making a diagnosis.
In Food Supply Medicine there are 7 key areas essential in assisting the clinician to make a diagnosis:

1. Taking a history
2. The examination of the individual pig
3. Post-mortem examination of the individual pig
4. Examination of the group of pigs
5. Examination of the environment of the pig
6. Examination of the farmôs performance
7. Suggesting practical solution to the identified problem

1. Taking a history of the problem

Clinicians have two ears and one mouth and should therefore listen twice as much as they talk.

Listening to the client and asking the correct questions is an essential component of making a diagnosis.

Consider the following line of enquiry:

What has the client seen?	Is the pig eating, defecating, urinating, coughing, sneezing, lame or dying?
Severity of the problem?	How many are sick or dead?
Location of the problem?	Which pens or age groups are affected?
When did the problem start?	Time, date, place?
How is the problem progressing?	Are more pig getting sick within the group?
More than one problem?	How many different problems in same group?
Epidemiological consideration?	Has the problem spread to other groups?
Are there any other factors?	Factors which the client thinks are relevant to the situation?
What has the client done?	Action to alleviate the problem? What was the result of the action?

2. The examination of the individual pig

In general practice a detailed individual examination of a pig is rarely performed, but it is essential that you know the basics.

Basic pig breeds
Basic pig terms
Handling and movement of pigs
Orientation around a pig
Surface anatomy of a pig
Weight and age of the pig ï expected growth curve
Taking a blood sample from a pig ï weaner and adult
Clinical examination of a cooperative and an uncooperative pig
Recognition and description of visible lesions
Auditing the welfare of the pig

3. Post-mortem technique

In Food Supply Medicine the postmortem examination is a cornerstone to health maintenance. The postmortem routine needs to be methodical, as generally the veterinarian is interested in the likely cause of death of the individual. The food supply veterinarian is also interested in reviewing the clinical presence or absence of other specific pathogens.

4. Examination of the group of pigs

Examination of the undisturbed group
Examination of the disturbed group
Examination of the farm

5. Examination of the environment of the pig

You will be expected to know how to measure and record:

Water	Type of drinker; height; flow and associated animal expectations
Food	Feeder space; feeder type; quantity of feed and basic make up of the feed
Floor	Space and stocking density, impact of worn equipment
Air	Ventilation patterns, temperature, humidity and gas concentration expectations

6. Examination of the farm performance

In any production system a systematic approach is required to analyse any farm records.

Stockperson's clinical signs of an unwell pig

Know what is normal about your pigs
– if you don't know what is normal how can you recognize abnormal?

Before entering the pen		
Look	**Pig not eating**	Pigs generally love food and a change in their eating patterns should always be a cause of further investigation
	Change in behaviour	Depending on the group size pigs individual behaviours may be known or the group has its own behaviour patterns
		Ideally the stockperson will know all the pigs personally, however, even in a large group; individual pigs tend to stand out, whereas the mass, sadly are unknown. The pigs that do standout are the extremes ï the top social order pigs, the lower social pigs and perhaps a few others who have unusual body markings ï wolf pig, leopard spotted etc.
	Group behaviours	
	Lying patterns	Try to observe the known pigs and note their lying patterns and position within the group. A sow standing at 2.00 in the afternoon, while all her companions are asleep may be in heat. She is exhibiting an unusual behaviour
	Individual being different	Look for pigs who are separate from the group
		Note groups of pigs gathered around a drinker or a feeder
Listen	**Note noises coughing or sneezing**	On entry to the room notice the sounds of greeting made by the pigs. Pigs with Swine Influenza are often very quiet and reluctant to get up as you enter. Well managed pigs should be pleased to see you.
		As the pigs move around, note any coughing or sneezing
Smell		Become familiar with the normal body odours of pigs. Swine Dysentery and Swine Fever may cause malodorous smells.
Enter the pen and walk the pigs		
Look		Look for the individuals, give them memorable names.
	Movement	Ensure all the pigs get up.
		Note pigs can be stiff or rising, but within 5 to 10 strides the stiffness should walk off
		Walk over to any pigs who fail to rise or walk off any stiffness
	Urination	When pigs rise, particularly in the morning they will urinate within 5 minutes. Note the colour of the urine and the posture of the pig urinating.
	Blood	Look for any blood on the floor or walls.
	Floor	Look at the floor for the consistency of the stools.
Listen		As the pigs move around note any coughing or sneezing
Smell		Smell the air ï if a pig has died the first indication may be a smell

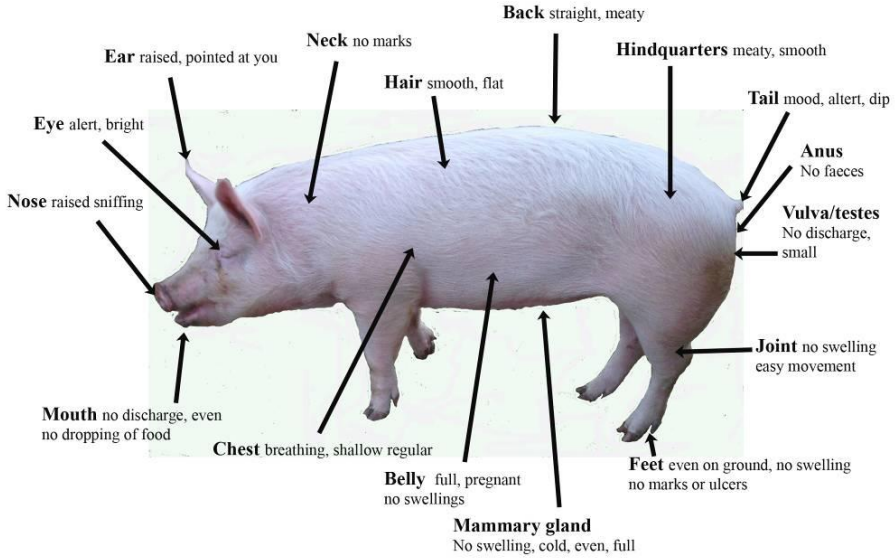
Individual pig behaviour		
This includes any pig placed in a compromised/hospital pen.		
Pigs housed in small numbers should all be given names. This should include artificial insemination centres and adults on farms of less than 50 sows.		
Know	Behaviour	Know the pigôs normal behaviour and note any sudden or progressive change in behaviour
	Feed	Know what food the pig likes and dislikes.
	Reproduction	Know what stage of reproduction the pig is at and note if the expected oestrus behaviour patterns fails to materialise
		Note changes in males (even when castrated) can occur in the presence of receptive females
Look		Loss of appetite ï pigs should beg for food
		Changes in behaviour ï aggressive/less aggressive
		Changes in head/ear posture
		Changes in eyeôs brightness
		Change in skin colour or hair position
		Locomotor changes ï reluctance to get up, do normal tricks
		Dirty anal/tail area ï diarrhoea. Changes in the stools. Signs of vomit
Listen		Coughing, sneezing, wheezing and breathing depth
Feel		Presence of a lump ï may be felt rather than seen

Once you have identified that there may be a problem, examine the pig in more detail

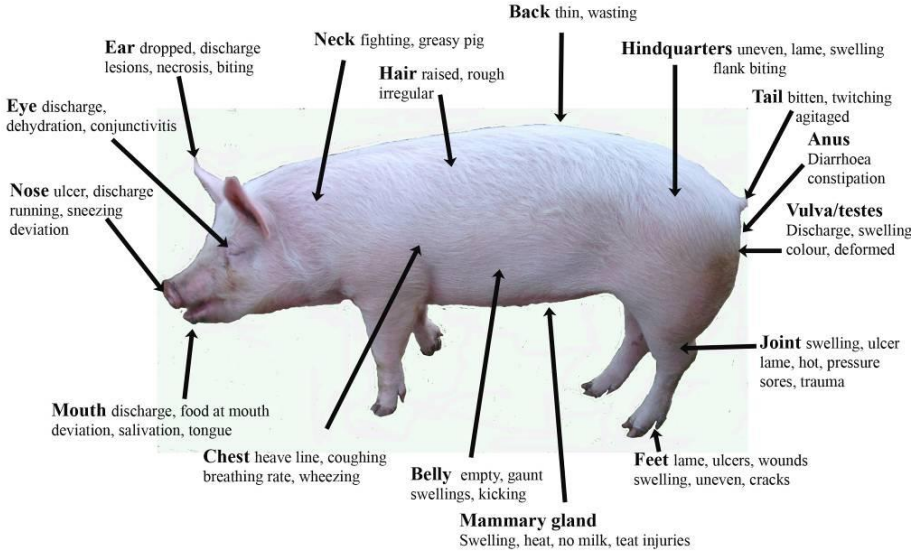
Stockpeople basics

Normal and Abnormal Clinical Signs

Normal expected signs



Signs which should raise concern



Veterinarian's Clinical Examination Skills

Clinical examination of an individual pig

Follow a set procedure to examine the animal

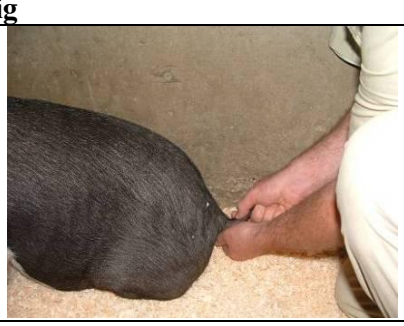
Assess the pigôs normal behaviour, its locomotion and its response to its owners. Enquire about eating, urination and defecating patterns.

Remember that the pig may live in a group (sounder) at home and other pigs may be presenting with the same clinical signs

Enquire about the recent history of the pig

Examination of an cooperative pig

Make contact both vocally and physically. Assess the body condition. Check breathing rate



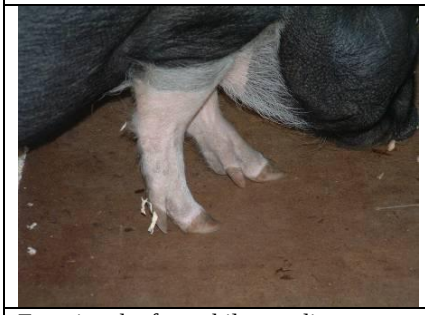
Take the rectal temperature. Normal 39°C. Examine the external genitalia.

Palpate the lumbar muscles, hind legs, abdomen and mammary area.

Some pigs may allow auscultation ï but this is generally unrewarding

Pigs like to be scratched particularly behind the ear and along the back. Check the head of the pig for any discharges from the nose, eyes, mouth

When handling the head watch that the pig does not try and bite



Examine the feet while standing

Grasp the pigôs front legs firmly. The pig is likely to vocally object.

Place the pig on its rear, holding its back with your knees

Palpation of the limbs should start at the top and work down the limb to the feet

Collect any samples are required. A blood sample can be obtained in this sitting position from the jugular vein

Uncooperative pig

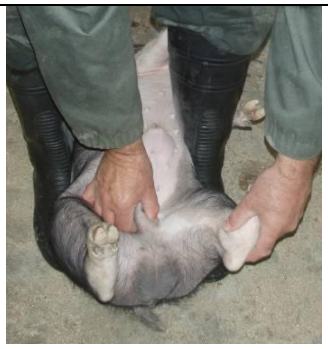
In an uncooperative pig, from the sitting position restrain the pig on its back where it will generally stop struggling. A full clinical examination can now be completed starting from the rear of the pig to the front of the pig

Walk backwards and lower the pig between your legs. Support its back with your feet and lower leg.

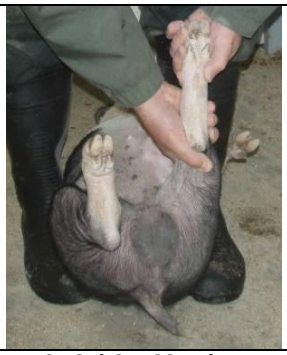
Keep a hold on the back legs and take the pigôs rectal temperature

Examine the anus for any discharge. Take samples if necessary

Examine the external genitalia

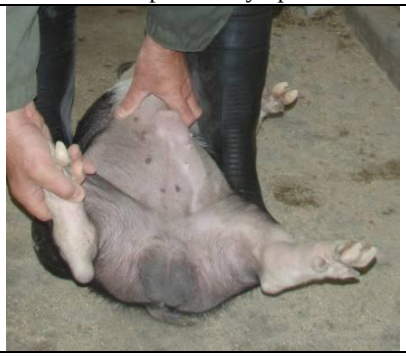


Examine the superficial lymph nodes



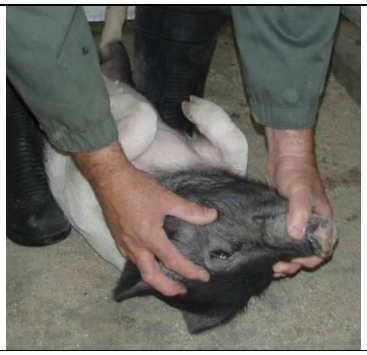
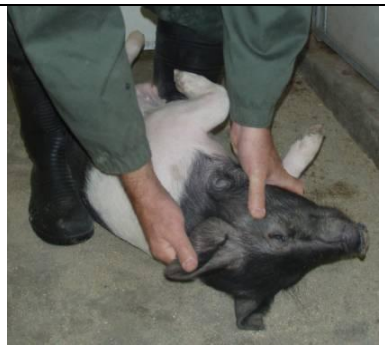
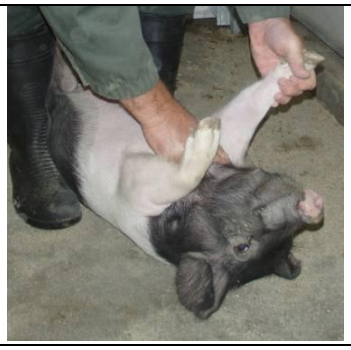
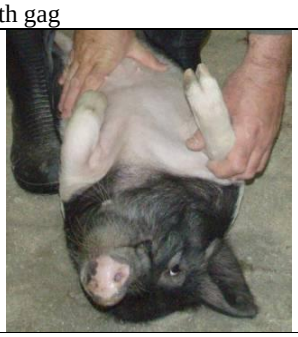
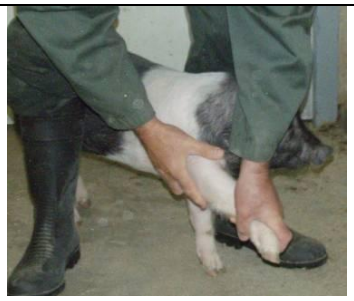
Examine the left hind leg from toe to hip

Examine the right hind leg from toe to hip

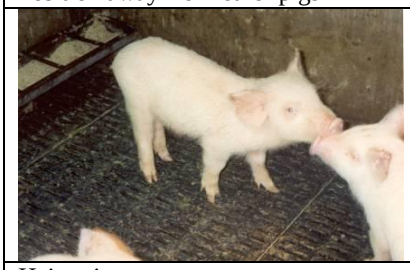
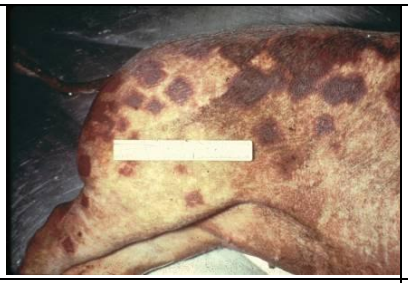
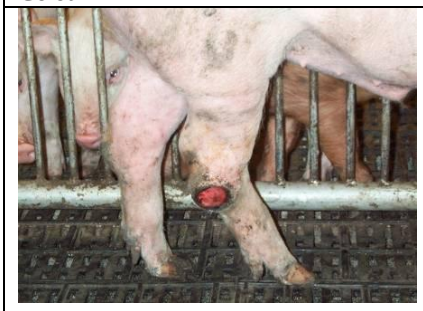


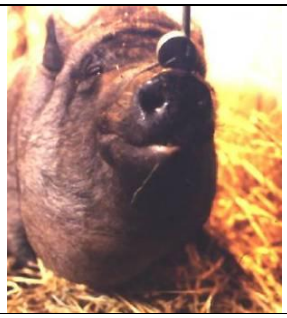
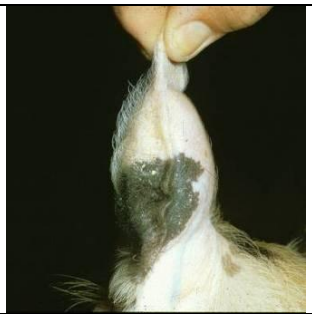
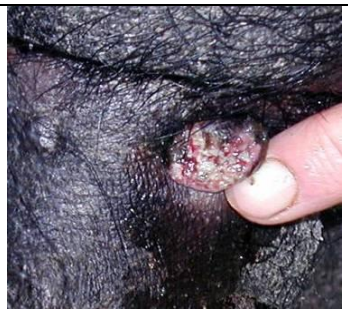
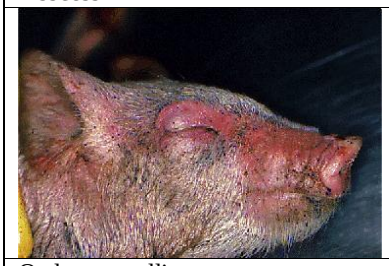
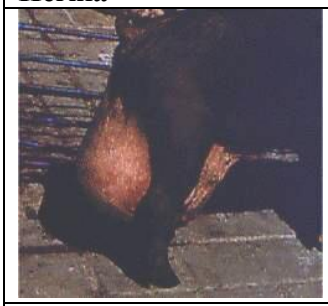
Examine the caudal ventral body wall and mammary glands

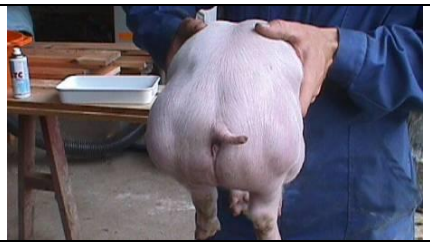
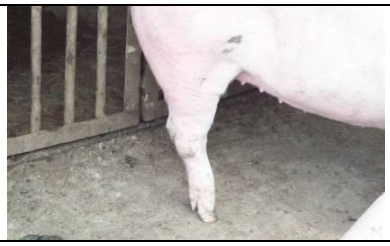
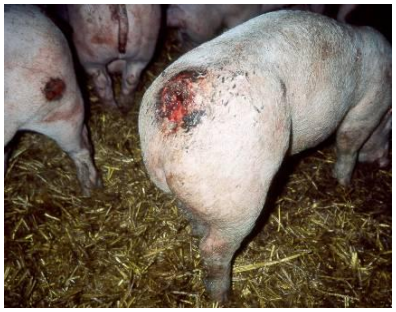
Carefully move or rotate your body to face the pigôs head

		
Support the pig with your feet under the shoulder blades (arrow)	Examine the pigôs eyes and jaw	Examine the pigôs ears
		
Examine the pigôs mouth using a mouth gag	Auscultate the heart and chest	Examine the left and right foreleg
		
Examine the cranial ventral body wall	Relax your left foot from the shoulder the pig will rotate onto its feet	Examine the dorsal body wall as the pig moves away

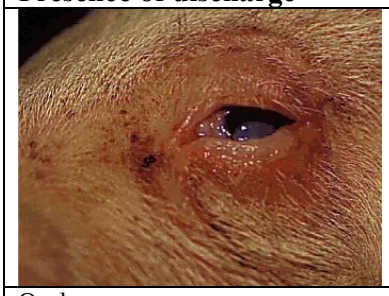
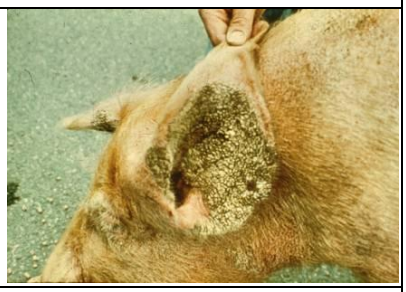
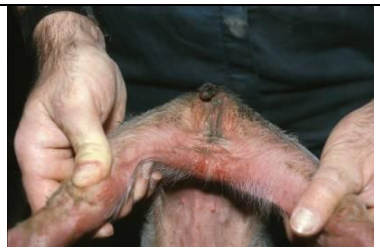
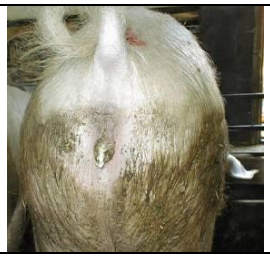
Clinical Examination Signs of Ill health

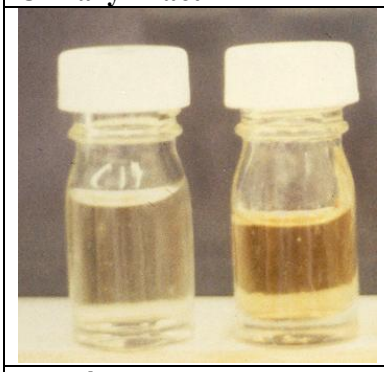
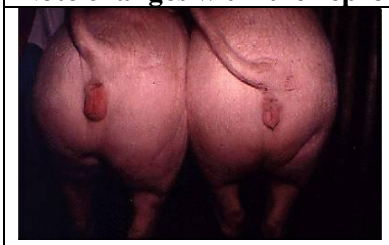
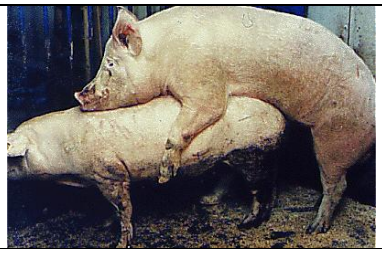
Position of pig in the pen		
		
Position away from other pigs	Lying when other standing	Stockmanship marks on back
		
Hairy pig	Chronically affected pig	Acutely affected pig
Skin changes		
		
Colour	Patches	Necrosis
		
Erosion	Scaly skin	Blueing of extremities
		
Too much skin	Greasy skin	Vesicles and blisters

Presence of lumps		
On the legs		
		
Bush Foot	Swollen joints	Granuloma
Elsewhere		
		
Abscess	Haematoma	Tumour
		
Oedema swellings	Overgrowth of the toes	Chronic mastitis
Hernia		
		
Scrotal	Umbilical	Acquired
Configuration		
		
Congenital defect	Kinky Back	Deviation

<table>
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>Swollen abdomen</td><td>Muscle changes</td><td>Limb shape</td></tr>
<tr><td colspan="3">Evidence of vice</td></tr>
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>Ear biting or suckling</td><td>Bitten vulva</td><td>Tail biting</td></tr>
<tr><td colspan="3">Prolapses</td></tr>
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>Uterine</td><td>Rectal or vaginal</td><td>Perineum</td></tr>
<tr><td colspan="3">Note the animal’s breathing</td></tr>
<tr><td>  </td><td>  </td><td rowspan="2">Note breaths per minute

Pig normally breathes 20 times per minute.
Over 45 and visible is abnormal.</td></tr>
<tr><td>Heave line</td><td>Deep breathing</td></tr>
<tr><td colspan="3">Behaviour and locomotor changes</td></tr>
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>Meningitis</td><td>Neurological deficit</td><td>Scratching</td></tr>
</table>

		
Paraplegia	Lame - high up the leg	Lame ï low down in the leg
		
Pigôs behaviour to yourself	Pigôs behaviour to each other	Pigs grouping
Presence of discharge		
		
Ocular	Nasal	Aural
		
Mouth	Anal	Vulva
Other observed changes associated directly with the pig		
		
Refusal of feed	Vomiting	Note any parasites

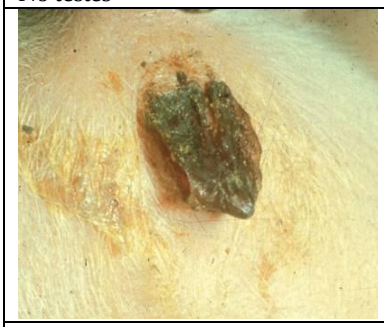
Look around the pen and observe the faeces consistency		
		
Normal	Loose	Diarrhoea
		
Constipated	Blood - Melaena	Blood - red
		
Mucus	Note color of faeces	Look also on the walls
Urinary Tract		
		
Normal	Smokey	Blood
Note changes with the reproductive cycle normal		
		
Vulval changes	Coming into oestrus	Allowing coitus

Abnormal reproductive

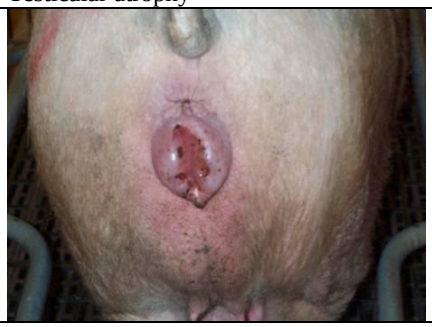
No testes

Testicular atrophy

Orchitis

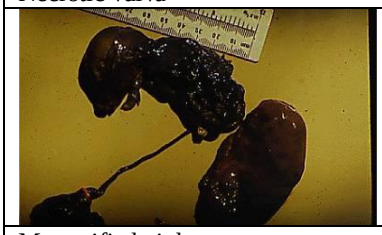


Necrotic vulva



Swollen vulva

Abortion



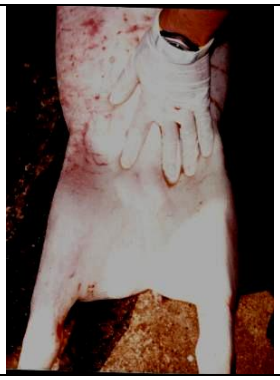
Mummified piglets

Late mummified

Stillborn piglet

Swollen lymph nodes

Unilateral



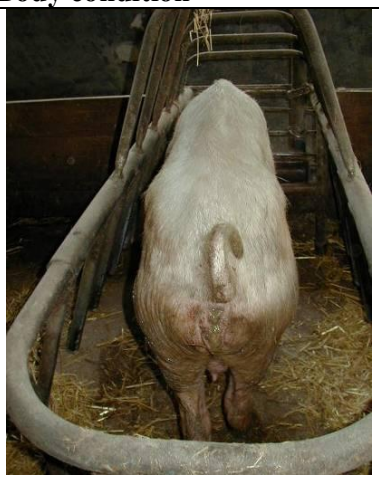
Bilateral

Clinical Examination in the Group of Pigs

Prior to entry into the room

Gain some indication of what the problem is by probing the farmer

Is the problem affecting a group or an individual only?

		
Observe pigs through window	Examine their sleeping patterns	Observe pigs away from group
Quietly enter the room		
Listen		
Coughing	Sneezing	Change in normal pig noises
Observe the animals		
Type of animals	Dead in the pen?	Weight and age	Male, Female, Castrate
Body condition		
		
Condition 1	Condition 3	Condition 5
		
Hairy	Chronic	Acute

Basic clinical examination of the farm

These notes are provided as an overall guide to the clinical examination of the whole farm. The notes take you through a typical farrowing to finish farm visit

Getting to the farm

Examine the farm records and arrange the visit. This may even be done at the last visit, but needs at least 2 weeksô notice

Ensure your own biosecurity is adequate ï truck clean. It is imperative that you are not a risk ï real or perceived to the farm

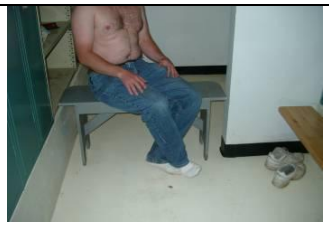
Examine the surrounding area for local farms. As you approach the farm ï especially on the 1st visit. Drive around the farmôs locality.

The locality of the farm will have a significant impact on the presence of diseases on the farm

Entering the farm

Walk the farmôs outer perimeter, ensuring that the perimeter is secure. Note areas which can be improved ï can feed trucks be kept off?

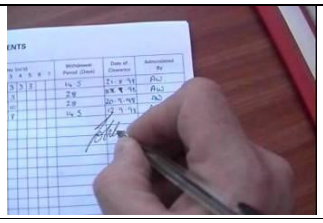
Examine the entry facilities, does the klaxon or horn work and attract attention. Are restriction notices clear?



Abide by farm biosecurity rules. Ensure that the biosecurity notices are well posted.

Use farmôs outer clothing. As an absolute minimum do not wear your own outer-clothing, always wear farm clothing or disposable overalls.

In addition to farm outer clothing, boots or protective foot wear should be provided by the farm



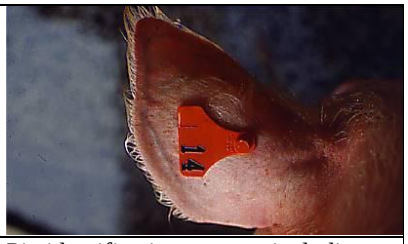
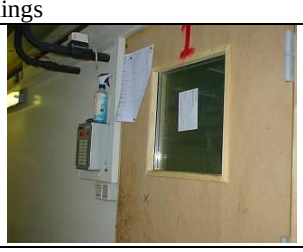
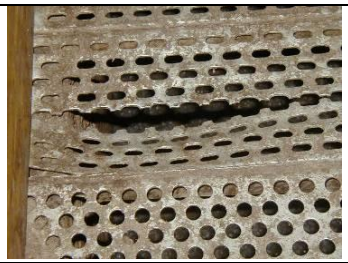
Discuss farm targets and expectations in the farm office. In particular review pig flow and all-in/all-out. Sign the visitors book

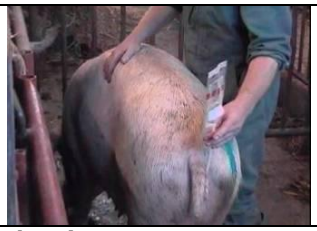
Medicine check

Check cold medicine storage including max/min thermometer. The fridge must run at 2-8°C. Freezing of vaccines will cause inactivation.

Check warm medicine storage Hygiene and medicine use. Many antibiotics have a max. storage temperature of 25°C. This may be difficult in the summer

Check needle, syringe and disposal systems. Medicine products must be kept away from children at all times. Disposal through the routine trash is not acceptable

		
Teeth clippers and other instruments used in processing. Ensure all protocols are followed.	Injection techniques - the picture shows a neck abscess	Pig identification systems including pre-slaughter. Look for evidence of poor pig identification which can falsify records
Farm building examination – for each building an overall check is required		
Check outside the of the buildings		
		
Outside security. Rodent control is a vital part of disease control. Ensure there are no rodent access points. Are rodent boxes full of bait?	Outside Ventilation system. The inlets and outlets need to be visually inspected from the outside. Bird nests and obstructions are common findings	Feed may be stored in a variety of places. Commonly bulk feed is stored in a bin. Climb up to the top of the bin and examine the binôs hygiene and cleaning protocols?
		
Vermin control ï rodents, birds, flies and pets	Examine pigs without entering building	Room biosecurity. Foot baths need to be clean
Note the sleeping pattern of the undisturbed pigs. Quietly enter the room and observe any biosecurity arrangements		
Enter building		
Review the basic environmental necessities. This needs the clinician to understand the basic husbandry requirements of water, food, floor and air for each age group of pig. The clinical examination of stock is covered in detail next. The clinician must realize that the level of investigation expected of the stock is the same required to investigate the environment.		
		
Water	Feed	Floor

		
Air	Stock ï healthy and sick pigs	Stockpeople/pig behavior
Progressively examine the farm using the above scheme for each building The farm walk needs a protocol. The following is a suggested walk to minimise the spread of potential disease pathogens by following the pig flow from birth to finish.		
		
Farrowing area	Sow breeding area	Gilt breeding area
		
AI storage area	Gestation area	Hot Nursery
		
Cold Nursery	Grower	Finisher
		
Hospital pens/areas	Examine animal loading and entry points	During visit explain your observations to the staff
		
Dead animal disposal ï picture shows composting	Isolation area may need change of clothing etc	**Prepare and send the report – within a working week**

Recognition of disorders by clinical signs

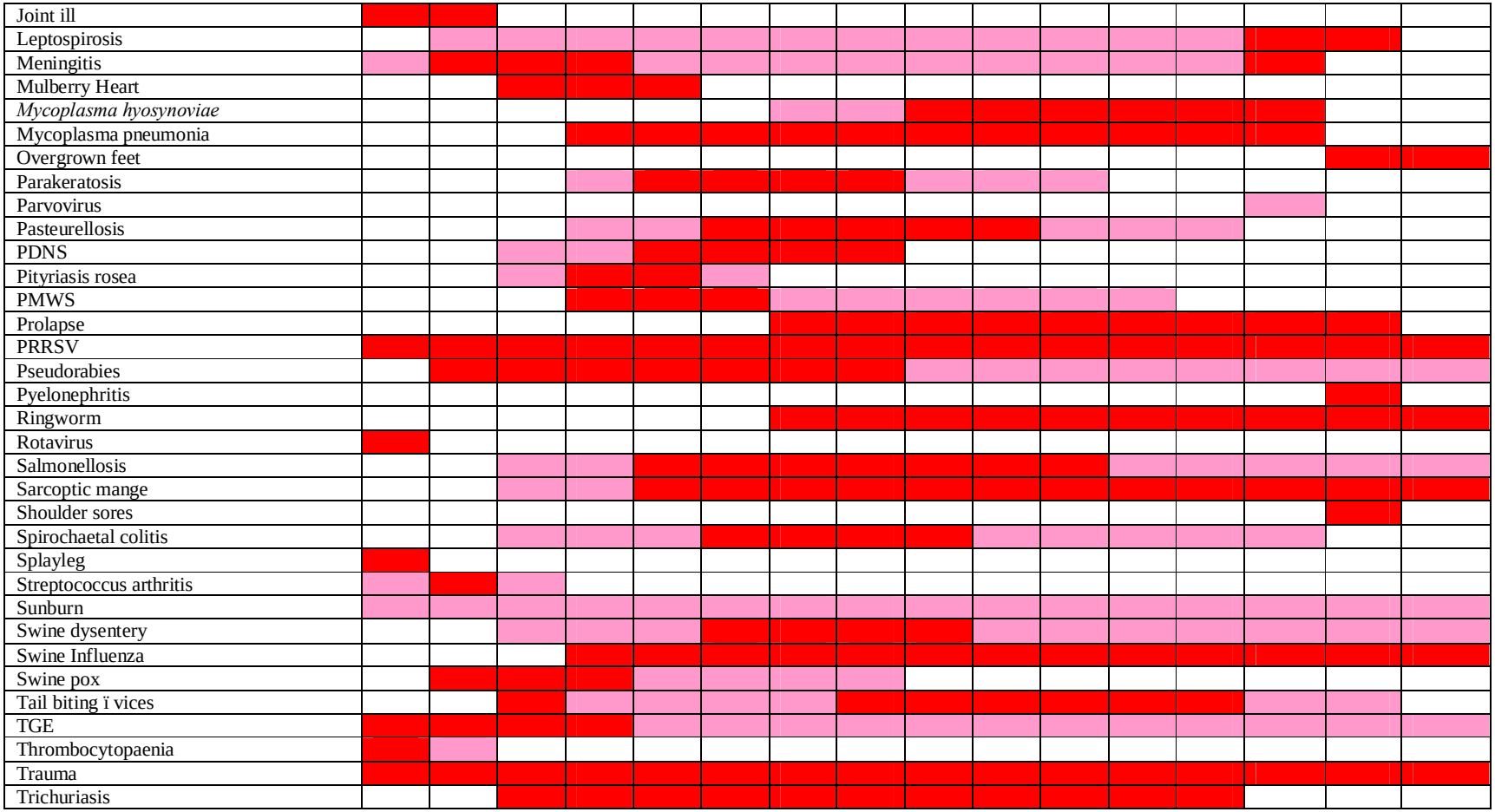
Abortions	Abortion in the sow Leptospirosis Pseudorabies - Aujeszkyôs Disease Swine Fever
Abscess	*Arcanobacterium pyogenes* *Actinobacillus pleuropneumoniae* 3 Streptococci infections
Anaemia	Iron Deficiency Gastric ulceration Ileitis, PIA, PED Swine Dysentery *Mycoplasma haemasuis*
Breathing - heave line	Glasserôs Mycoplasma ï Enzootic pneumonia - PRDC Pasteurella/Streptococcus pneumonia PMWS Salmonella
Breathing deep	APP ï Actinobacillus pleuropneumonia Lice Pasteurella/Streptococcus pneumonia Salmonella SIV ï Swine Influenza Swine Fever
Breathing more per minute	APP ï Actinobacillus Pleuropneumonia Heat Stress PMWS
Bush foot	Bush foot
Coughing	*Actinobacillus suis* APP - Actinobacillus Pleuropneumonia Gastric Ulcer Mycoplasma ï enzootic pneumonia - PRDC Porcine Respiratory Coronavirus Pseudorabies - Aujeszkyôs Disease Swine Influenza -SIV
Deviation	Acquired deviation Progressive atrophic rhinitis
Diarrhoea	Coccidiosis Colitis Dysentery *Escherichia coli* Ileitis - PIA PED Rotavirus Salmonella TEG
Diarrhoea - Yellow	Coccidiosis *Escherichia coli* Salmonella
Diarrhoea - red blood	Clostridia enteritis Swine dysentery
Diarrhoea – black	Ileitis - PIA Ulcer
Diarrhoea - clear	Rotavirus TEG
Diarrhoea – gray	Colitis *Escherichia coli* Ileitis
Discharge - nasal	Actinobacillus Pleuropneumonia ï blood Foot and Mouth Progressive Atrophic rhinitis - blood SIV ï Swine Influenza
Discharge - anal	See causes of diarrhea

Discharge - aural	Mange
Discharge - mouth	Actinobacillus pleuropneumonia ï blood Foot and mouth
Discharge - ocular	Bowel edema Progressive Atrophic rhinitis SIV ï Swine Influenza
Discharge - vulva	Brucellosis Cystitis Vulval discharges
Granuloma	Granuloma
Greasy skin	Greasy pig disease
Haematoma	Aural haematoma
Lame high up	Glasserôs Lame sows Mycoplasma arthritis
Lame low down	Erysipelas Foot and mouth Glasserôs Lame sows
Limb shape	Conformation
Loose faeces	Colitis Ileitis - PIA Salmonella
Lymph nodes swollen	Lymphosarcoma PMWS PRRSV
Mastitis	*Actinobacillus suis* *Escherichia coli* Streptococci species
Meningitis	Glasserôs Streptococcus meningitis
Mucus	Colitis Dysentery Ileitis- PIA
Mummified	Parvovirus PRRSV
Neurological problems	Congenital tremor Middle ear disease Pseudorabies - Aujeszkyôs Disease Stroke
Noise change	Bowel Edema Streptococcus meningitis
Oedema swellings	Bowel Oedema Glasserôs
Orchitis	Brucellosis
Paraplegia	Sow paraplegia Splay legs
Parasites seen	*Ascaris suum* Lice
Pig grouping	Salt poisoning - water deficiency
Refusal of feed	Almost all conditions
Scratching	Allergy Lice Mange
Skin bluing	*Actinobacillus suis* APP ï Actinobacillus Pleuropneumonia Erysipelas Glasserôs Salmonella Streptococcus infections
Skin color change	Gastric ulcer Ileitis Leptospirosis
Skin erosions	Leg injuries

Skin necrosis	Glasserôs Streptococci
Skin patches	Erysipelas PDNS Pityriasis rosea Ringworm Swine Fever
Skin scaly	Essential oil deficient Lice Mange
Sneezing	Pasteurella Progressive Atrophic Rhinitis Swine Influenza
Stillborn	Parvovirus PRRSV
Sudden death	APP- Actinobacillus Pleuropneumonia Clostridial enteritis Dysentery Erysipelas Glasserôs Mulberry Heart Pasteurella/Streptococci pneumonia Pseudorabies - Aujeszkyôs Disease Swine Fever
Swollen abdomen	Glasserôs Rectal stricture Salmonella Twist
Swollen joints	Erysipelas Glasserôs Mycoplasma arthritis Streptococci infections
Tumor	Tumors
Urine - blood	Pyelonephritis
Urine – Smokey	Cystitis
Vesicles and blisters	Foot and mouth
Vomiting	Gastric ulcer Salmonella TGE
Vulva -Necrotic	Mycotoxins
Vulva -Swollen	Mycotoxins

Recognition of disorders by age Rare possible common

Condition	Age in weeks													Adults		
	2	4	6	8	10	12	14	16	18	20	22	24	26	Gilt	Sow	Boar
A. pleuropneumonia																
Abrasions																
Abscesses																
Actinobacillus suis																
Ascariasis																
Atrophic rhinitis ï sneezing																
Atrophic rhinitis ï twisted																
Bacterial arthritis																
Bordetella bronchiseptica																
Borrelia granuolma																
Bursitis																
Carpal abrasion																
Swine feverõs																
Clostridium difficile																
Clostridium perfringens																
Coccidiosis																
Colitis																
Congenital tremor																
Cystitis																
Dermatosis vegetans																
E. coli																
Epidemic diarrhoea																
Epiphysiolysis																
Epitheliogenesis imperfecta																
Erysipelas skin																
Erysipelas arthritis																
Facial necrosis																
Flakey skin																
Foot and Mouth																
Gastric ulceration																
Glassers																
Greasy pig disease																
Haemorrhagic bowel																
Hernia																
Ileitis																
Insect bites																


Joint ill
Leptospirosis
Meningitis
Mulberry Heart
Mycoplasma hyosynoviae
Mycoplasma pneumonia
Overgrown feet
Parakeratosis
Parvovirus
Pasteurellosis
PDNS
Pityriasis rosea
PMWS
Prolapse
PRRSV
Pseudorabies
Pyelonephritis
Ringworm
Rotavirus
Salmonellosis
Sarcoptic mange
Shoulder sores
Spirochaetal colitis
Splayleg
Streptococcus arthritis
Sunburn
Swine dysentery
Swine Influenza
Swine pox
Tail biting ï vices
TGE
Thrombocytopaenia
Trauma
Trichuriasis

Basic Haematology and Biochemistry

Chromosome number is 38, Blood volume 61-68 ml/kg
Ventilation pressure is 18-22 cm H_20, Respiration rate of 12-15 / min, Tidal Volume is 5ï 10 ml/kg

Haematology

	Unit	Weaner 10-30 kg	Finisher 30-110 kg	Adult Pet Pig
Haemoglobin	g/l	90-140	100-150	100-170
Haematocrit	l/l	0.26-0.41	0.29-0.42	0.29-0.46
Erythrocytes	$x10^{12}$/l	5.3-8.0	5.7-8.3	5.1-8.0
MCV	fL	42-62	44-56	52-63
MCH	pg	14-21	15-20	18-22
MCHC	g/l	320-360	320-380	340-380
WBC	$x10^9$/l			
Leucocytes	$x10^9$/l	8.7-37.9	11.6-32.9	10.6-24.0
Lymphocytes	$x10^9$/l	2.2-16.0	3.6-18.5	3.7-14.7
Eosinophils	$x10^9$/l	0-1.8	0-2.5	0-2.4
Basophils	$x10^9$/l	0-0.5	0-0.7	0-0.5
Monocytes	$x10^9$/l	0-6	0-4.9	0-2.4
Platelets	$x10^9$/l			100-900

Pet pigs may have a lower total white blood cell count ï 5-18 x 10^9/l

Serum Biochemistry

	Unit mmol - mg/dl		Weaner 10-30 kg	Finisher 30-110 kg	Adult
γGT	IU/l				41-86
A/G	g/g		0.5-2.2	0.4-1.5	0.6-1.3
Albumin	g/l		19-39	19-42	31-43
Alk Phos	IU/l		142-891	180-813	36-272
ALT	IU/l		8-46	15-46	19-76
Amylase	IU/l		528-2616	913-4626	432-2170
Anion Gap	mmol/l				7.5-36
AST	IU/l		21-94	16-67	36-272
Bicarbonate	mmol/l				8-31
Bilirubin	µmol/l	x60	0.9-3.4	0-3.4	0-3.4
Calcium	mmol/l	x4	2.02-3.21	2.16-2.92	1.98-2.87
Chloride	mmol/l				96 – 111
Cholesterol	mmol/l	x39	1.06-3.32	1.37-3.18	1.24-2.74
CK	IU/l		81-1586	61-1251	120-10990
Conj. Bilirub	µmol/l	x60	0.9-3.4	0-1.7	0-1.7
Creatinine	µmol/l	/88	67-172	77-165	110-260
Fibrinogen	g/l				1.60-3.80
Free Bilirub	µmol/l	x60	0-3.4	0-3.4	0-3.4
Glucose	mmol/l	x18	3.5-7.4	4.0-8.1	2.9-5.9
GSHPx	IU/gHb		30-137	40-141	48-135
IgG piglet blood at 7 days	mg/ml		➢ 10 25-35 normal		
Iron	µmol/l	x5.59	3-38	39-43	9-34
LDH	mmol/l	x9			0-11
Magnesium	mmol/l				0.5-1.2
Osmolarity	mOsmol/kg				282-300
Pepsinogen	ng/ml		149-313	230-570	
Phosphorus	mmol/l	x3.1	1.46-3.45	2.25-3.44	1.49-2.76
Potassium	mmol/l	x3.9			3.5 – 4.8
Sodium	mmol/l	x2.3			132-170
Total Protein	g/l		44-74	52-83	65-90
Triglyceride	mmol/l	x89			0.2-0.5
UIBC	mmol/l	X2.8	43-96	48-101	54-99
Urea Nitrogen	mmol/l		2.90-8.89	2.57-8.57	2.10-8.50

Iron saturation % 12-27 µmol/l. Total Iron Binding capacity 71-111 µmol/l

Temperature, respiration and pulse rates

Age/Weight	Rectal Temperature		Respiratory Rate	Pulse Rate
	°C	°F		(per minute)
At birth	39.0	102.0	40 ï 50	200 ï 250
During suckling	39.2	102.5	30 ï 40	80 - 110
At weaning	39.3	102.7	25 ï 40	80 - 100
25 ï 45 kg	39.0	102.5	30 ï 40	80 - 90
45 ï 90 kg	38.8	101.8	30 ï 40	75 - 85
Pregnant sow	38.6	101.6	15 ï 20	70 - 80
During farrowing	39.0 ï 40.0	102.0 ï 104.0	40 ï 50	80 - 100
During lactation	39.1	102.5	20-30	70 - 80
Boar	38.6	101.5	15 ï 20	70 - 80

Urine analysis

Volume l/day ï depends on age	2 ï 6
Specific gravity	1.000 ï 1.040
pH	6 ï 8
Bilirubin	None
Blood	None
Glucose	None
Protein	None

Semen typical values

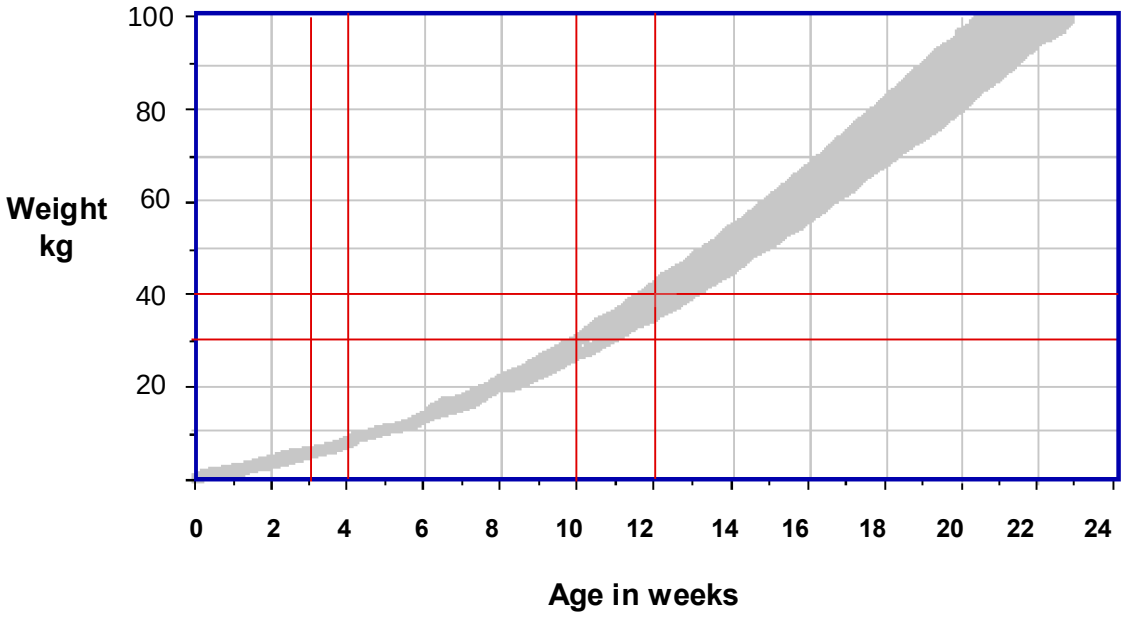
Volume	50 ï 400 ml ï mean 250 ml
Colour	White cloudy
Consistency	Clear/Cloudy/gel
Motility	Active some wave motion
Sperm density (undiluted)	10^{10} /100ml
pH	7. 3 ï 7.8
Osmolarity	290-300 mOsmols
Temperature at ejaculation	36° C

TRADITIONAL PIG FARM TARGETS PER 100 SOWS

	Target	Interference
Reproduction		
No of gilts available for service	6	<5
Age at first service	210 days	>240 : <200 days
No of sows productive	100	<95
Weaning to service interval	5 days	> 7 days
Repeat matings Regular returns (18-24 days)	8	>9
Irregular returns (other times)	3	> 4
Empty days per sow	12	> 14
Abortions %	< 1	> 1.5
Sows NIP %	1	>2
Culled pregnant %	1	>2
Deaths pregnant %	1	>2
Farrowing rate	87	< 82
Vaginal discharge - more than 7 days post-service %	1	>1.5
Sows culled per year %	38	>42
Sow parity at culling	6-7	>8
Sow deaths per year	<5	>5
Number of boars no AI	5	<5 > 6
Number of boars AI + Natural	3	<3 >4
Matings per week per boar	4	<2 or >6
Farrowing house performance		
Total born/sow	11.2	<11
Pigs born alive/sow	10.9	<10.4
Stillborn rate %	< 7	>10
Piglets mummified %	<1.5	>2.5
Litter scatter (sows with < 7 piglets)	<15%	>15%
Preweaning losses (28 days)	10	<14
Piglets weaned per litter	10	<9.6
Litters per sow per year	2.35	<2.3
Piglets weaned per sow per year	23.5	<22
Feeding herd performance		
Postweaning losses (7 to 95 kg)	3	>5
Pigs sold per sow per year	23	<21.5
Feed parameters		
Sow feed in tonnes per year	1.1	> 1.2
Total tonnes farm feed per sow	6.5	<6 >7
Food conversion 4 to 100 kg	2.2	>2.4
Daily gain 10 - 90 kg	570g/day	<520
Days to market 90 kg	150	160+
Killing Out %	75%	<72%

A 100 sow unit producing 22 pigs per sow per year sold at 70 kg dead weight produces enough pig meat to feed 6,500 people per year if the consumption is 24.5 kg person/year

Growth rate of normal pigs



Age of the pig		Daily Liveweight Gain	Weight
Weeks	Days	g/day	(kg)
4	28	215	7.0
6	42	395	12.5
8	56	630	21.3
10	70	660	30.5
12	84	715	40.5
14	98	800	51.5
16	112	965	65.0
18	126	1000	80.0
20	140	1100	95.0
22	154	1100	110.0

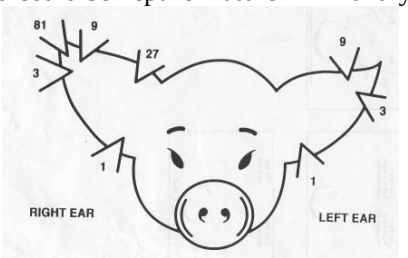
Identification of Pigs

Formal identification of pigs or pens is essential for record analysis

Ear notching

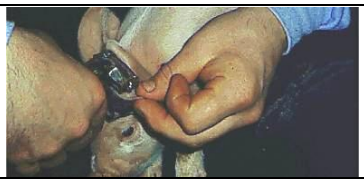
The pigôs ears are notched in the farrowing house
The right ear signifies the motherôs number the left ear the pigletôs number within the litter
One of the small notches removed could be kept for future DNA analysis

Notching equipment



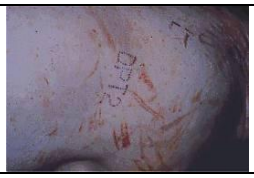
Ear tattoo

Again applied in the farrowing house. Tattoos can be very difficult to read in older life



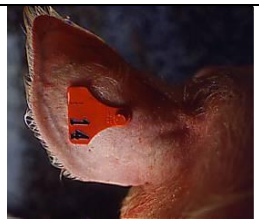
Slap maker ï prior to slaughter

This is to be read after the animals are dead and de-haired



Ear tag

These can be applied at any age. Two tags are more likely to allow identification to be retained. The tags may be electronic to allow computer identification. The ear tag can be notched to help identification outdoors. Pigs over 60 kg which are treated with injectable antibiotics should be individually tagged



Spray marking

Useful for temporary identification of medicated or selected pigs. However, note that many sprays do not last for the entire length of medicine withdrawal times. Pigs in some parts of the world are spray marked before loading when intended for slaughter. Computerized sorting can mark pigs

Hair Clipping

Can be useful as a temporary marking method. Using a pair of curved scissors trim a line of hair. The hair will re-grow in 6 weeks

Diagnostic Specimens and Tests
For The Major Porcine Diseases

Disease Suspected	Specimen	Sample Preparation	Laboratory Procedure
Abortion	Foetus: liver, kidney, stomach content, thoracic fluid. Placenta. Swabs Sow: paired sera	Refrigerate	Culture-Sensitivity Leptospira-FAT Parvovirus EM Serology
Actinobacillus pleuropneumoniae	Lung Swabs Serum	Refrigerate	Culture-Sensitivity Serotyping Serology **CF 1:4 suspect** **CF 1:8 positive**
Anthrax	Impression smear from retropharyneal fluid in swollen neck		Stain for Bacillus ï capsule does not form readily in pigs
Arthritis	Exudate, joint fluid, synovia swab and tissue Joint fluid Whole joint ï piglet and weaner	Refrigerate Formalin Refrigerate	Culture-Sensitivity Histopathology Serology
Atrophic Rhinitis	Snout, turbinates, nasal swab and tissue Nasal Section Nasal swab	Refrigerate Formalin	Culture-Sensitivity Pm toxin test Histopathology View and Score ELISA toxin presence
Circovirus 2	Swollen lymph nodes, selected tissues. Note always present	Formalin	Histopathology IFA and IHC
Coccidiosis	Faeces Small intestine smear (wash away faeces first)	Refrigerate Air dried smear Formalin	Smear, flotation Histopathology
Colibacillosis	Several acutely affected pigs Duodenum, mesenteric lymph nodes, liver smears and tissue. Note alkaline pH of contents.	Live Refrigerate Formalin	Culture-Sensitivity Serotyping Histopathology Toxin gene typing PCR
Colostrum	Heart Blood	Refrigerate	IgG **> 10 mg/ml normal**
Cryptosporidium	Small intestine smear and tissue	Refrigerate Formalin	Smear Histopathology
Cystitis/ pyelonephritis	Renal pelvis	Refrigerate	Culture-sensitivity anaerobic
Cytomegalovirus	Turbinates, lung, kidney	Formalin	Histopathology
Enteritis (non-specific)	Acutely affected pigs pH of contents Small & large intestine, liver, mesenteric lymph node swab, smear, tissue Intestine content	Live Refrigerate Formalin Contents	View villi Acid viral Alkaline *E. coli* Culture-Sensitivity Smear Clostridium Rotavirus Histopathology Clostridial toxin
Enzootic/ Mycoplasma pneumonia	Lung, respiratory lymph nodes, swab and tissue Serum	Refrigerate Formalin	View and score Culture-sensitivity IHC PCR Serology **S/P <0.3 negative** **0.3-0.4 suspect** **> 0.4 positive**

Erysipelas	Heart, lymph node, liver, spleen, swollen joints swabs. Serum	Refrigerate Formalin	Culture-Sensitivity Serology Histopathology
Genetic examination	Blood sample unclotted Tissue Note use separate needle for each pig	Separate needle Refrigerate/ freeze	PCR
***Haemophilus parasuis* (Glasser's disease polyserositis)**	Sick pig Cavity of joint fluids Serous membranes, meninges, lung Serum Note organism dies rapidly	Live Refrigerate Formalin	Culture-Sensitivity Serotyping Serology Histopathology
Greasy Pig	Affected animal swabs from skin	Live Refrigerate	Culture-Sensitivity
Ileitis (*Lawsonia intracellularis)*	Ileum Tissue	Formalin Fresh refrigerate	Histopathology PCR IHC
Influenza	Trachea, lung, nasal swabs (in transport media) Serum	Refrigerate Formalin	Virus Isolation Immunoperoxidase PRC Serology **HI > 1:40 positive**
Leptospira	Foetus: kidney, thoracic fluid swab and smear Oviduct smear Sow: sera (paired)	Refrigerate	FAT Serology **1:100 suspect** **1:200 diagnostic**
Mastitis	Difficult to get a diagnostic sample	Refrigerate	Culture and identification
Meningitis	CSF (Cerebral spinal fluid) before cutting the skin of the head Brain and meninges	Refrigerate Formalin	Culture and identification Histopathology
Mulberry Heart	Heart and Liver	Formalin	Histopathology
Mycoplasma arthritis	Joint serosa Joint fluid	Formalin Refrigerate	Histopathology Serology
Mycoplasma haemosuis	Blood smear	Air dry	
Mycotoxins	Tissues ï submit at least 100g Food materials ï submit at least 1 kg (avoid condensation and fugal growth during transport)	Freeze Place feed in paper bag	
Oedema Disease	Stomach, intestine, kidney, brain, liver Sick live pig	Refrigerate Formalin	Culture-Sensitivity Serotyping Histopathology
Parvovirus (PPV)	Foetus: liver, thoracic fluid Sow: paired sera	Refrigerate	EM Serology
PMWS	Lymph nodes ï 5 from around the bodies	Formalin	Histopathology
PRCV	Serum Lung tissue	Formalin	Serology (note differential test re-TGE) IHC
PRRSv	Lung tissue Thymus Tonsilar scrape and biopsy ï use Dacron swab Blood serum via Dacron swab Serum	Refrigerate Formalin	Virus Isolation Histopathology IHC PCR Sequencing Serology
Rotavirus	Middle and lower jejunum, upper ileum, faeces	Refrigerate Formalin	Latex agglutination. Histopathology IHC
Salmonellosis	Colon, liver, lung, spleen, faeces, mesenteric lymph node swabs Live sick pig	Refrigerate	Culture-Sensitivity Serotyping

Streptococcus	Brain, Cerebral spinal fluid, lung, joint Serum	Refrigerate	Culture-Sensitivity Serotyping IHC Serology
Swine Dysentery	Affected pigs faeces, colon	Live Refrigerate Formalin	Culture-Sensitivity Darkfield Histopathology IHC PCR
Transmissible Gastroenteritis (TGE)	Affected pigs faeces, small intestine contents and tissue Serum Jejunal contents acidic	Live Formalin	Histopathology IHC Serology **NA 1:4 positive**
Water depravation	Brain	Formalin	Histopathology

Abbreviations

CF = Compliment Fixation ELISA = Enzyme-linked Immunosorbant assay
EM = Electron Microscopy FAT = Fluorescent antibody test
IFA = Indirect Fluorescent Antibody IHC = Immunohistochemistry
PCR = Polymerase chain reaction

Selection of Specimens

Animals selected for laboratory analysis, ideally should be free from antimicrobial therapy and in an early or acute disease stage. Selected tissues should be collected as aseptically as possible. In addition, a meaningful history of the disease outbreak and a tentative diagnosis, based upon clinical evaluation, should be included. Laboratory tests results are directly affected by the selection, preparation, handling, and shipment of selected specimens.

Identify tissue and samples:
- Building or site
- Animal identification number
- Fluids, Exudate/Aspirates, Tracheal Washes, Urine

Preparation & Collection of Samples

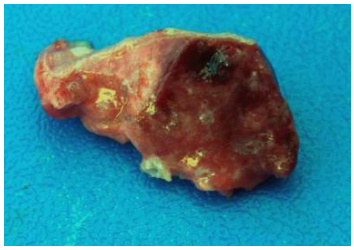
Tissues - Fresh
Collect aseptically approximately 6 to 12 cm samples and place each in a plastic bag (e.g. whirl-paks). Sample visible lesions with adjacent normal tissue. Double bag in whirl-pak bags. Do not mix tissues in one single bag. Transport with cold packs.

Eighteen to 24 cm of intestine should be carefully removed from the mesentery and tied to prevent leakage of intestinal contents. Collect sections of small and large intestine. The selected, clearly identified samples are double bagged and sealed in whirl-pak bags to prevent spillage. The sample should be refrigerated and cooled thoroughly prior to shipping.

Swabs
Aerobic culture: Commercial swabs with Stuart or Amies transport media is recommended to prevent desiccation.
Anaerobic culture: Note exposure to air for 20 minutes may destroy the sample. Transport in anaerobic transport media: for example a Clare Blair tube.
Virus culture: Collect blood in citrate tubes as EDTA may be detrimental to viral isolation. Dacron swabs are preferable over standard cotton swabs which may contain bleach which can reduce the viability of the viruses. The swabs must be prevented from dying out.

Histopathology
Preparation of Tissue for Fixation

Multiple sites or types of lesions should be taken. The sections should **only be 2 cm thick.** The small size of the tissue results in rapid and complete penetration of the fixative. Present normal looking tissue with the pathological specimen.



Normal lung left portion with pathological area on the right

Selected tissues should be cut with a sharp scalpel since the squeezing action of a scissors crushes and tears tissue. The tissue should be rinsed briefly with 0.85% NaCI to remove adhering blood, since blood will retard fixation. Autolysis or freezing will make samples unsuitable for proper evaluation. Place tissues in double whirl-paks. Identify bags if multiple animals are submitted. Do not use narrow mouth bottles to submit fixed tissue. Note: All hollow organs (intestine or uterus) are gently flushed with 10% formalin without disturbing the mucosal lining before placing them in formalin.

Volume of fixation

The selected tissues are fixed in 10% Neutral Buffered formalin. Use 10 times the volume of the tissues being fixed.

Wrong bottle for tissue

Insufficient formalin

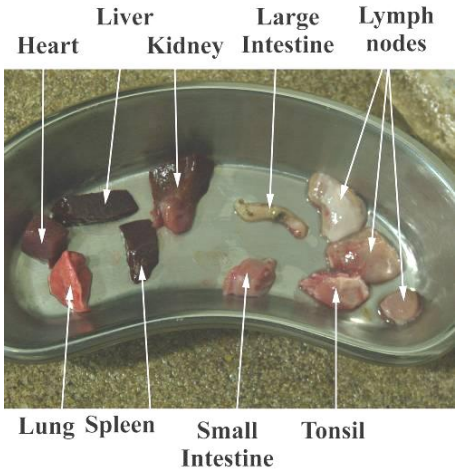
Correct formalin to tissue ratio

Tissue which floats formalin penetration assisted by placing a small piece of card over tissue (picture right)

Collection of samples

Ideally collect samples from all abnormalities visually recognised and from the draining lymph node. In addition, collect from the following organs: lung, heart, liver, spleen, kidney, small intestine, large intestine, tonsils and two lymph nodes.

In pigs less than 30 kg a piece of brain and meninges can be extremely helpful in reaching a final diagnosis.



Blood Samples

Blood smear: Prepare the blood smear on the slide at the farm. Allow to air dry and stain back at the laboratory.

Unclotted blood sample: Collect in either EDTA, Heparin or Citrate tubes. Pig blood clots extremely quickly.

Clotted blood samples: serum or plasma ï useful for biochemistry or antibody examination.

When sending paired serum, identify the acute samples from the convalescent samples on the tube and on the request form.

Packing Specimens

To avoid leaking in transit, double bag the samples. Whirl-pak bags work well for this purpose. Wrap sample bags and 2-4 ice packs on absorbent paper (e.g. newspaper) to absorb in the event of leaking. Place the package into a Styrofoam container. Completed submission forms should be inserted into the envelope on the inside cover of the cardboard box.

Mailing

Samples should be submitted by the fastest means possible to avoid deterioration of specimens. Next day or overnight delivery is preferred over others. Discuss with the mailing system selected any specific requirements. Ideally take the samples to the diagnostic laboratory personally or by carrier. Note try to avoid Friday or Holiday samples.

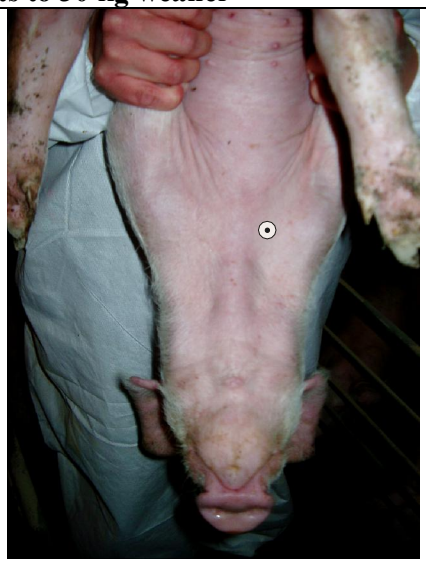
Ensure that all samples are adequately identified and a suitable history is provided with the samples.

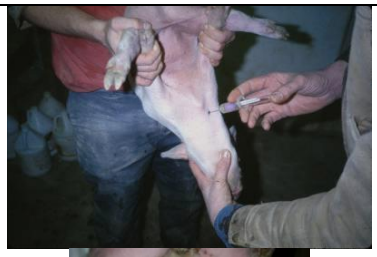
Specific testing procedures

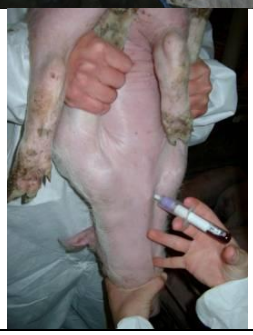
Blood testing
Tonsilar scrape
Post-mortem examination
Slaughterhouse examination
Semen analysis
Basic parasitology
Faecal worm egg count
Basic bacteriology
Basic virology

Blood Collection in Pigs

Piglets to 30 kg weaner

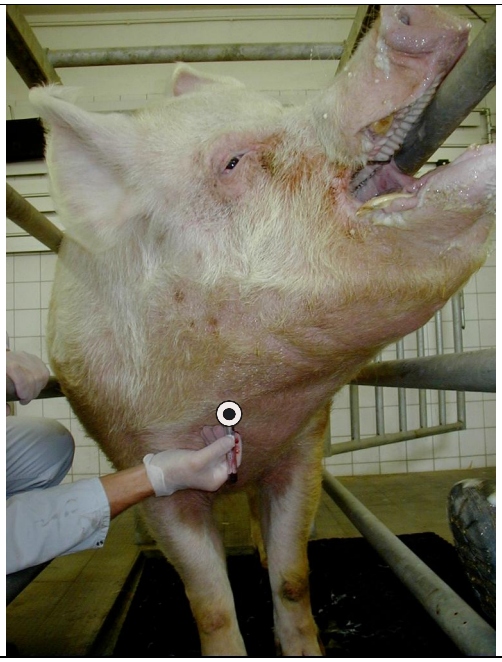






Avoid the left hand side as it is possible to damage the left recurrent laryngeal nerve

Adult



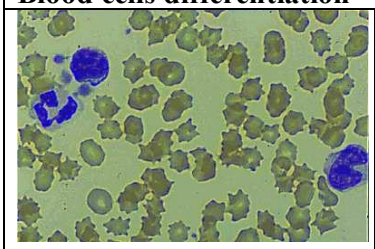
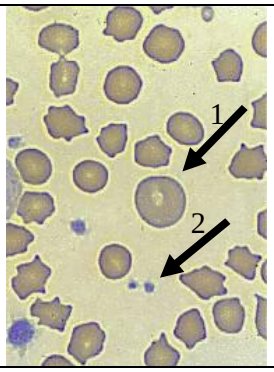
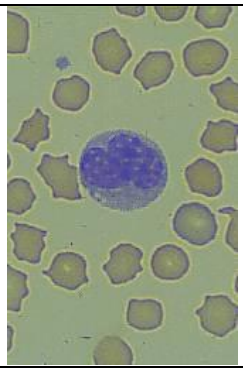
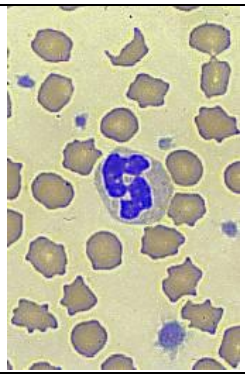
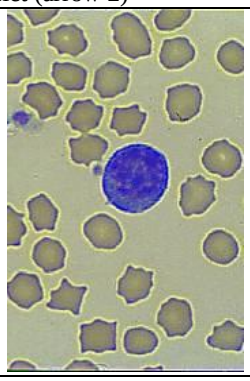
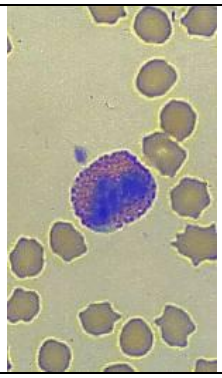
Grower and finisher pigs may be bled out of the jugular with a vaccutainer and a 30 mm (1 inch) needle. Most adults can be bled with a 40 mm 18 gauge (1.5 inch) needle. Keep the needle perpendicular to the skin and vertical. Do not try too hard by moving the needle lateral and medial searching for the jugular. Most problems occur because needle is not in deep enough and the needle tip is bouncing off the jugular.

Blood cells

Stained with diff-quick

Technique	
	Make a smear of a drop of blood and air dry
	Fix in Diff-Quick solution A for 10 minutes
	Dip slides 25 times in Solution B ï allow slide to remain in solution B for total of 10 minutes. Do not rinse slide
	Dip slide 25 times in solution C for a total of 25 minutes
	Wash with Phosphate buffered saline or distilled, deionized water
	Permanent fixation:
	Air dry slides. Clear in Xylene and mount using synthetic mounting medium

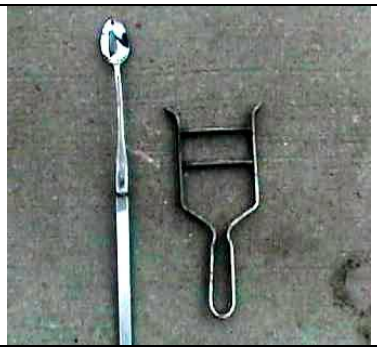
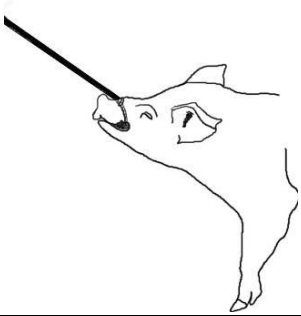
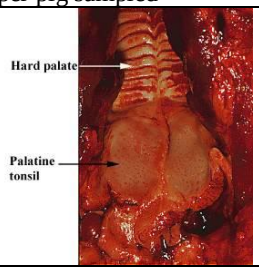
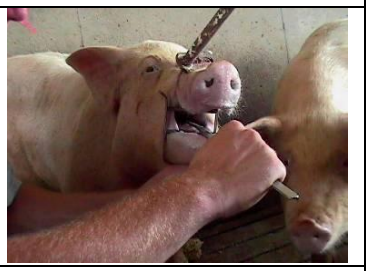
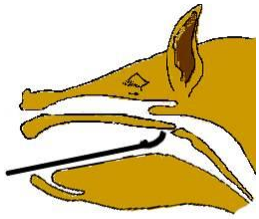
Blood cells differentiation

		
General blood smear	Erythrocycte (arrow 1) and platelet (arrow 2)	
		
Neutrophil- note the segmented nucleus	Monocycte ï Large nucleus filling cell	Eosinophil- note the purple granules Basophils ï look similar but with red granules

White blood cells are made up of the combination of Lymphocytes plus the neutrophils, monocycles, eosinophils and basophils

Tonsilar Scrape

A means to obtain tonsilar bacteria and viruses for inoculation

		
Obtain animals that are likely to be carrying the virus. For example with PRRSv or Circovirus use 30-60 kg pigs.	Have equipment ready, oral speculum, long handled spoon ï 30 cm and test tubes with 15 ml of 0.9% sodium chloride. One tube per pig sampled	Restrain the animal with a snare.
		
Place an oral speculum into the mouth	The tonsils are located at the back of the throat	Pass the long handled spoon over the tonsil 4-6 times to collect material
		
Drawing of tonsil scrape	Remove the tonsilar material from the spoon using a polyester tipped swab or Dacron Swab. Twirl the swab into a test tube containing 10 ml of 0.9% NaCl solution.	Collect a minimum of 8 pigs. About 1 pig per 25 pigs to inoculate will provide sufficient materials

 Centrifuge the tubes at 1800 revs/min for 30 minutes.	Remove the supernatant with a needle and syringe and place into a sterile 500 ml bottle Add 0.9% NaCl until sufficient solution to provide 2 ml injection for each animal to be óvaccinatedô. If viral inoculation only is required Gentamycin at 1 mg/ml is added to reduce bacterial growth.	 Inoculate all susceptible animals with 2 ml intramuscular.

This technique has been valuable in **PRRSv** stablisation of the gilt pool. Particularly useful as you are óvaccinatingô with the farm strain.

Circovirus can also be obtained to vaccinate sows 6 weeks pre-farrowing to help control PMWS by boostering colostrum levels.

Note a feedback programme is still required for acclimatisation of gilts.

Surprisingly, if the inoculate is placed intramuscularly no abscessation has been seen.

EUTHANASIA IN PIGS

Various euthanasia methods in swine

	Piglets <3 weeks old	Nursery pig < 10 weeks	Growing pig	Finishing pig	Mature Sow or boar
	Birth – 6 kg	**6-30 kg**	**30-75 kg**	**75 kg +**	
Carbon dioxide	Yes	Yes	Not practical	Not practical	Not practical
Gunshot	No	Yes	Yes	Yes	Yes
Captive bolt	No	Yes	Yes	Yes	Yes
Electrocution (USA)	Yes	Yes	Yes	Yes	Yes
Blunt trauma	Yes	No	No	No	No
For veterinarians only					
Anesthetic overdose	Yes	Yes	Yes	Yes	Yes

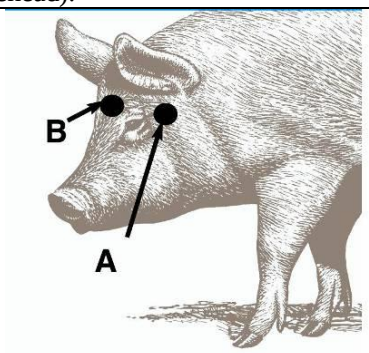
Carbon dioxide may be a suitable method to assist euthanasia of large groups of animals in the case of a serious disease outbreak.

Technical data

Carbon dioxide	
	CO_2 causes rapid onset of anesthesia with subsequent death due to respiratory arrest. CO_2 is heavier than air, therefore when constructing a container for swine euthanasia the outlet value should be located at the top so that the container can be completely filled with CO_2 while air is allowed to escape. For small pigs a garbage can with the inlet and outlet valves installed in the lid plus a plastic bag liner can be used. After checking for complete euthanasia, the bag containing the pigs can be removed
Gunshot and penetrating captive bolt	
	Training in firearms is essential. The animal should be restrained by a rope or snare over the upper jaw held by an assistant. These methods stun or kill by concussive force and penetration into the brain. In larger animals, great that 75 kg, it is recommended that carotid (neck) artery is severed once the pig is stunned. The captive bolt should be positioned against the forehead as shown. A firearm must be held 4 to 8 cm from the skull (do not press against the forehead).

A indicates recommended position for temporal method ï firearm only

B indicates recommended position for frontal method directed upwards at 20° towards the brain.
Severe carotid artery after stunning with a captive bolt gun.



Electrocution

Electrocution induces death by insensibility of the brain followed by heart failure.
Electrocution is a two step procedure:

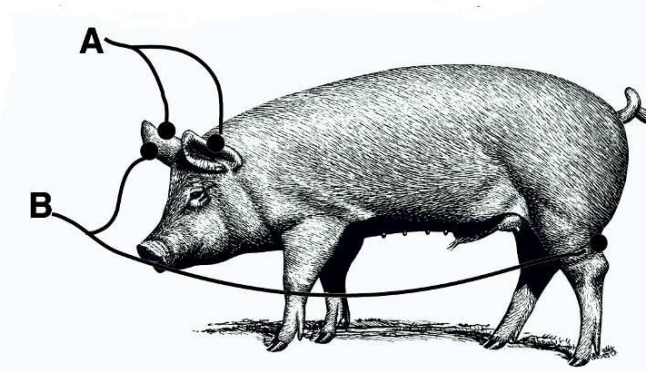
1. Pig rendered unconscious ï place electrodes on opposite sides of the head so that the current travels through the brain.
2. Pig euthanasia ï place electrodes so that the current is redirected through the heart of the unconscious pig

Large market weight hogs minimum current of 1.25A at 300v for 1 second

A indicates the correct position for Step 1 to render the pig unconscious

B indicates the correct position to induce heart fibrillation and death

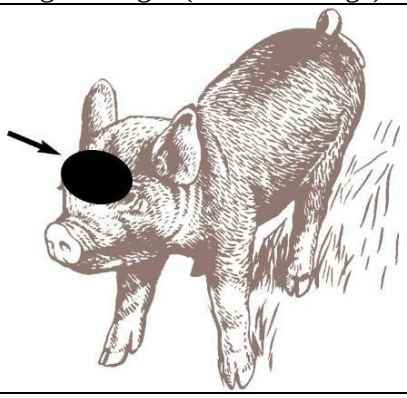
Severe the carotid artery after stunning by electrocution



Blunt trauma

A sharp, firm blow with a heavy blunt instrument on the top of the head over the brain is an efficient way of humanely killing pigs less than 6 kg in weight (3 weeks of age).

A sharp, firm blow with a heavy, blunt instrument on the top of the head. It is essential that the blow be administered swiftly, firmly and with absolute determination. If there is any doubt whether the pig is dead, the blow should be repeated. If necessary severe the carotid artery.



For more information see On farm Euthanasia of swine- options for the producer ï from the National Pork Board and the Association of Swine Veterinarians from which these notes were produced.

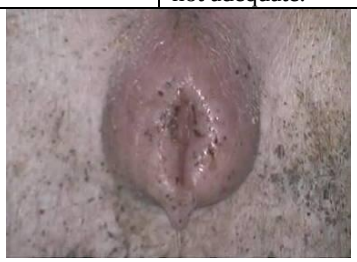
Basic Post Mortem Procedure

The following illustrates the basic procedure for a postmortem examination of a pig. The procedure described assumes the veterinarian to be right handed.
Normally, however, in the pig it is also vital that the health of the herd (remaining pigs) is determined. The production diseases/conditions to be noted are highlighted in red.

It may be necessary to euthanase the pig prior to the postmortem examination.

Select an area where the postmortem can take place where it is not too visible and biosecurity can be maintained. Above is not adequate.

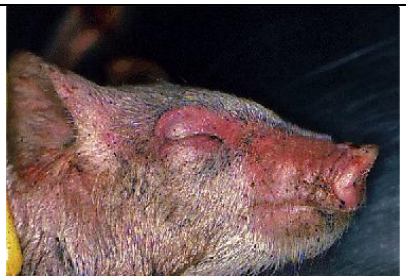
Place the dead pig in lateral recumbency. Note the sex, body condition and weight. Note any skin blood **Swine Fever** or jaw swelling **Anthrax**



Examine the anus and external genitalia for evidence of estrus or discharges

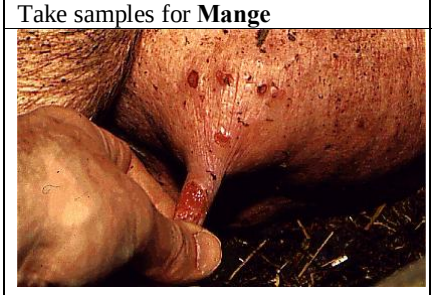
Examine the external surface of the pig for evidence of **fighting** and **septicemia.** Note any skin lesions ï **Erysipelas.** Note any distortions ï **Atrophic rhinitis**

Note the presence of wax in the ear. Take samples for **Mange**

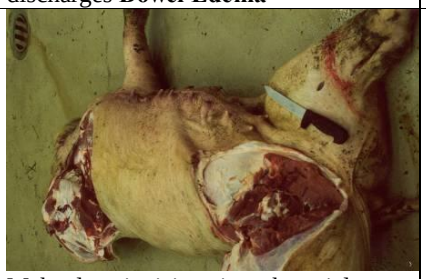


Examine the eyes for dehydration and discharges **Bowel Edema**

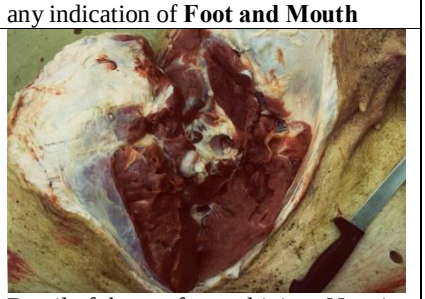
Examine the legs and feet. Look for any indication of **Foot and Mouth**



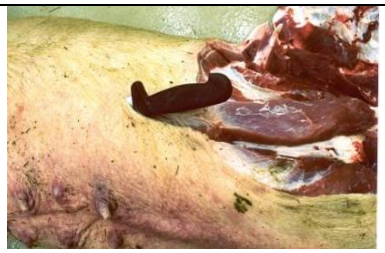
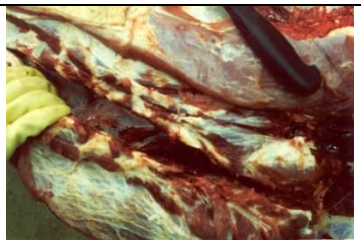
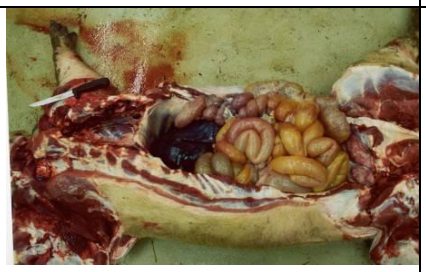
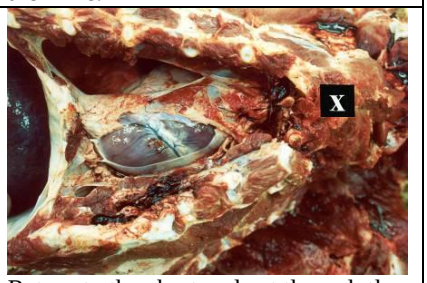
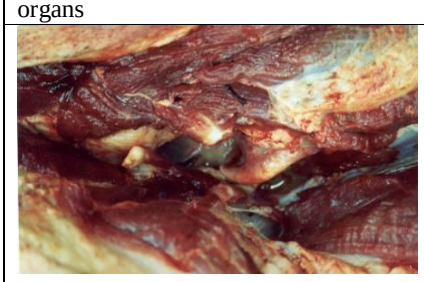
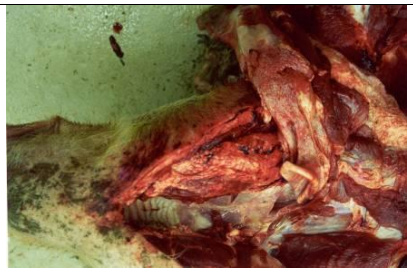
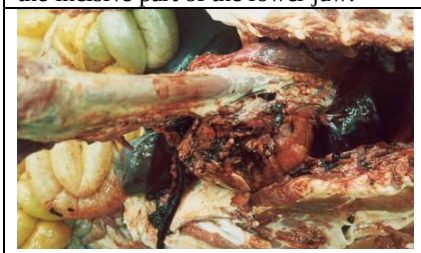
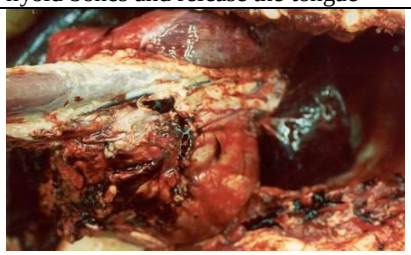
Examine the mammary glands

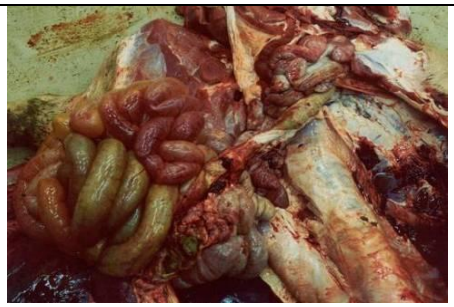


Make deep incisions into the axial on the left leg. Move to the left hind leg and cut into groin area exposing the femoral joint

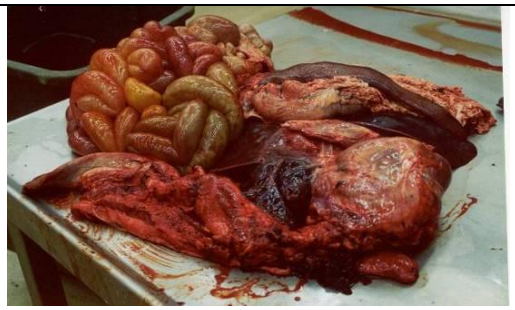


Detail of the cut femoral joint. Note in young animals the femoral head may separate along the epiphysis

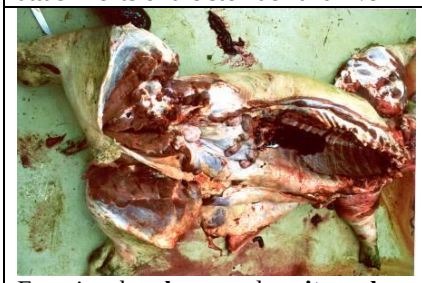
 Continue to the right hind leg and the right axial. Lay the animal out as shown in dorsal recumbency. Note the inguinal lymph nodes **PMWS**	 Make a deep transverse cut into the throat just cranial to the manubrium	 Stand on the left. On the right hand chest make a cut along the line of the costocondral junction cartilages
 Continue the cut under the skin towards the groin area. Place the sharp edge under the skin	 Return to the chest the cut though the right caudal costochondral junctions	 Carefully part the opened chest so that internal organs are not penetrated with the knife.
 Cut carefully into the peritoneal cavity. Do not puncture any of the abdominal organs	 Lay the ventral body wall over to the left side to reveal the visceral contents	 Return to the chest and cut through the front ribs (x). Open up the chest by physical force breaking the ribs
 Cut up the lateral side of the throat to the incisive part of the lower jaw.	 Continue the dissection through the hyoid bones and release the tongue	 Note the condition of the tonsils **Pseudorabies/ Aujeszky's**
 Gripping the tongue pull caudally and release from the carcase by cutting any dorsal attachments	 Pull the contents of the chest caudally to the diaphragm	 Continue the cut until the lungs and heart is removed from the pleural cavity. Note any **pleural adhesions**



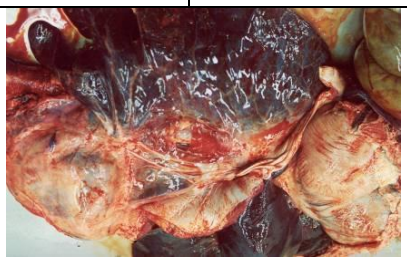
Carefully cut through the diaphragm and dorsal attachments of the stomach and liver



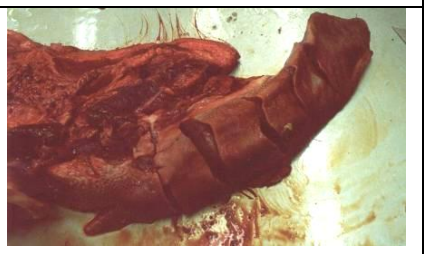
Remove the viscera to a place of further investigation



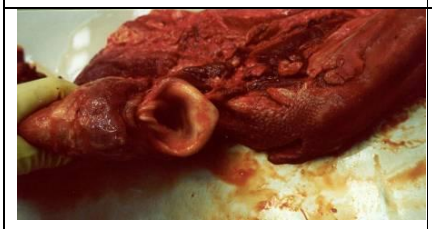
Examine the **pleura** and **peritoneal** cavity for adhesions



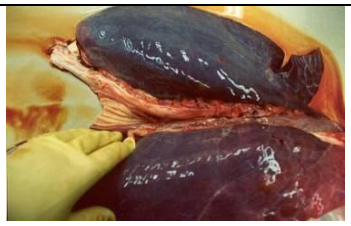
Examine the distal esophagus. If there is no evidence of pathology separate the lung and heart from the stomach and liver



Examine the tongue and mouth check for **Foot and Mouth**

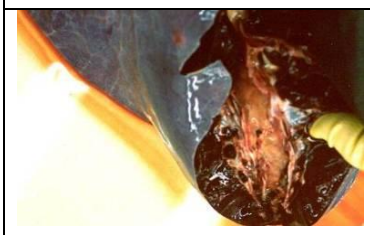


Examine the throat

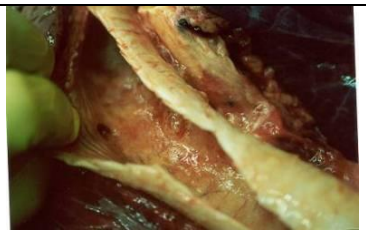


Cut along the length of the esophagus

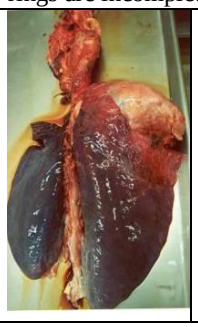
Open up the trachea, note the tracheal rings are incomplete



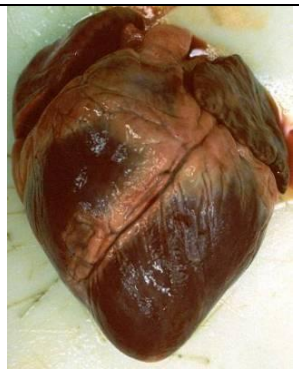
Continue the cut down the bronchi to the end of the diaphragmatic lobe of the lung



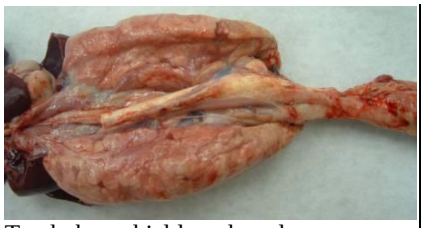
Remember to open the tracheal bronchus into the right apical/cranial lobe



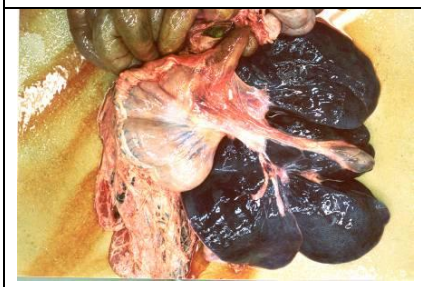
Examine the lungs in detail.
The particular diseases to note are **Mycoplasma pneumonia, Pleuropneumonia, Glasser's, Pneumonic abscessation**.



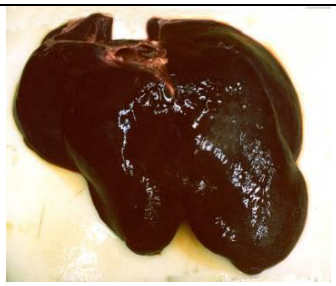
Examine the heart. Examine the pericardial surface for pericarditis **Glasser's.** Examine the internal surfaces by opening up the right auricle, through the right AV valve. Open the right ventricle along the interventricular septa. Find the pulmonary artery and cut though the valve. Turn the heart over and repeat the same with the left. Examine the heart valves - **Endocardiosis**



Trachobronchial lymph node
PMWS PRRSv

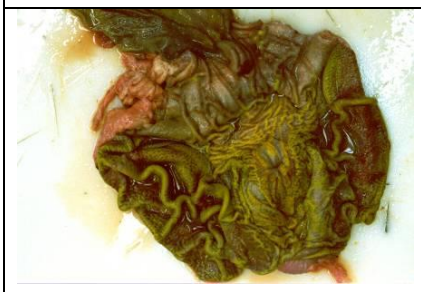


Return to the abdominal viscera. Examine the gall bladder

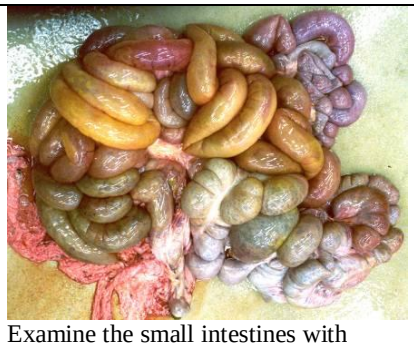


Examine the liver- **White spot Aujeszky's Disease**

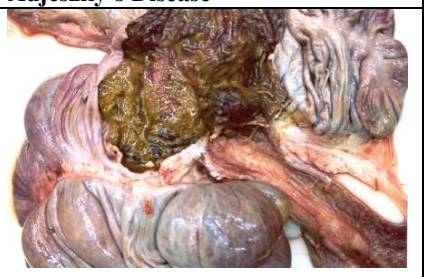
Examine the greater omentum and examine the spleen
Aujeszky's Disease



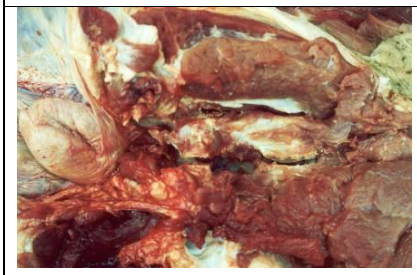
Remove the stomach mid duodenum. Open the great curvature. **Gastric ulceration**



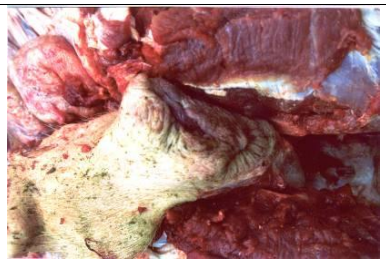
Examine the small intestines with multiple incisions ï note lymph nodes **Salmonellosis**



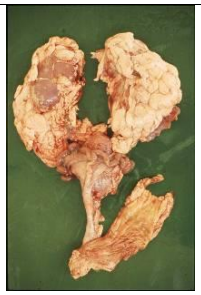
Examine the distal ileum, caecum and colon. **Ileitis, Swine Dysentery, Colitis**



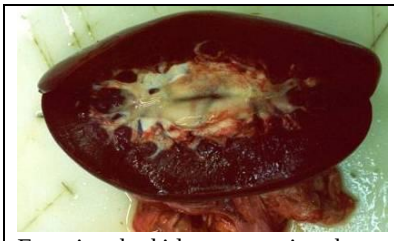
Return to the carcase. Split the pelvis to allow removal of the urogenital tract and remaining rectum can be removed.



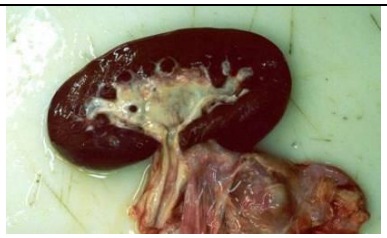
Remove the urogenital tract from the caudal end to the bladder. Dissect from the kidneys to the bladder to retain the ureter intact



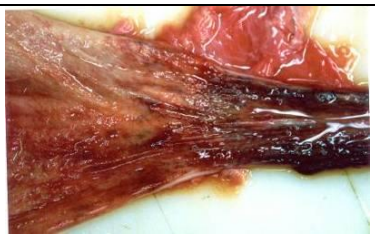
Layout the urogenital tract on a separate surface



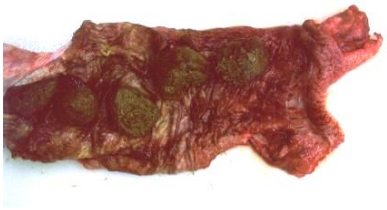
Examine the kidneys, opening the pelvis from the lateral edge



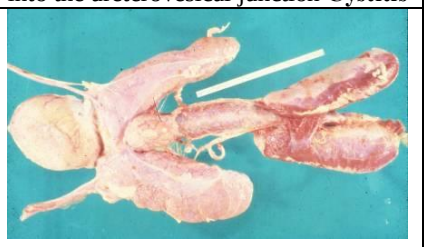
Open the kidney to examine the pelvis and ureter -**Pyelonephritis**



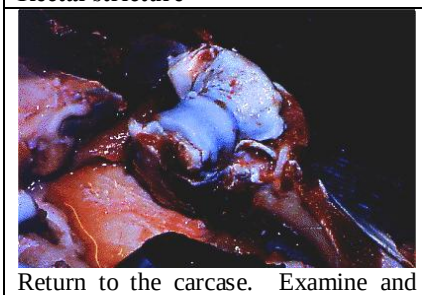
Open and examine the bladder from the ventral surface taking care not to cut into the ureterovesical junction **Cystitis**



Remove and examine the rectum ï **Rectal stricture**



Examine the genital tract noting phase of reproduction
The left picture is the female reproductive tract the right male **Brucella**



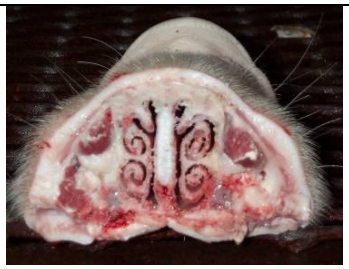
Return to the carcase. Examine and open the elbow and carpus joints of both front legs. Open the stifle and hock joints of both hind legs. **Arthritis**

Examine lymph nodes and incise ï superficial inguinal lymph node **PMWS**

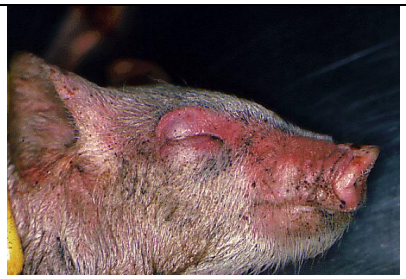
Mandibular and parotid lymph node **Tuberculosis.** Note the large submandibular salivary gland

The popliteal lymph nodes

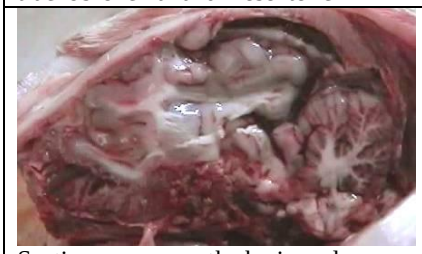
Note previous examined ï trachobronchial and mesenteric



Section the snout at the level of the lateral commissure of the mouth. Examine for evidence of **Atrophic rhinitis**



Incise the skin over the forehead and look for edema **Bowel edema**

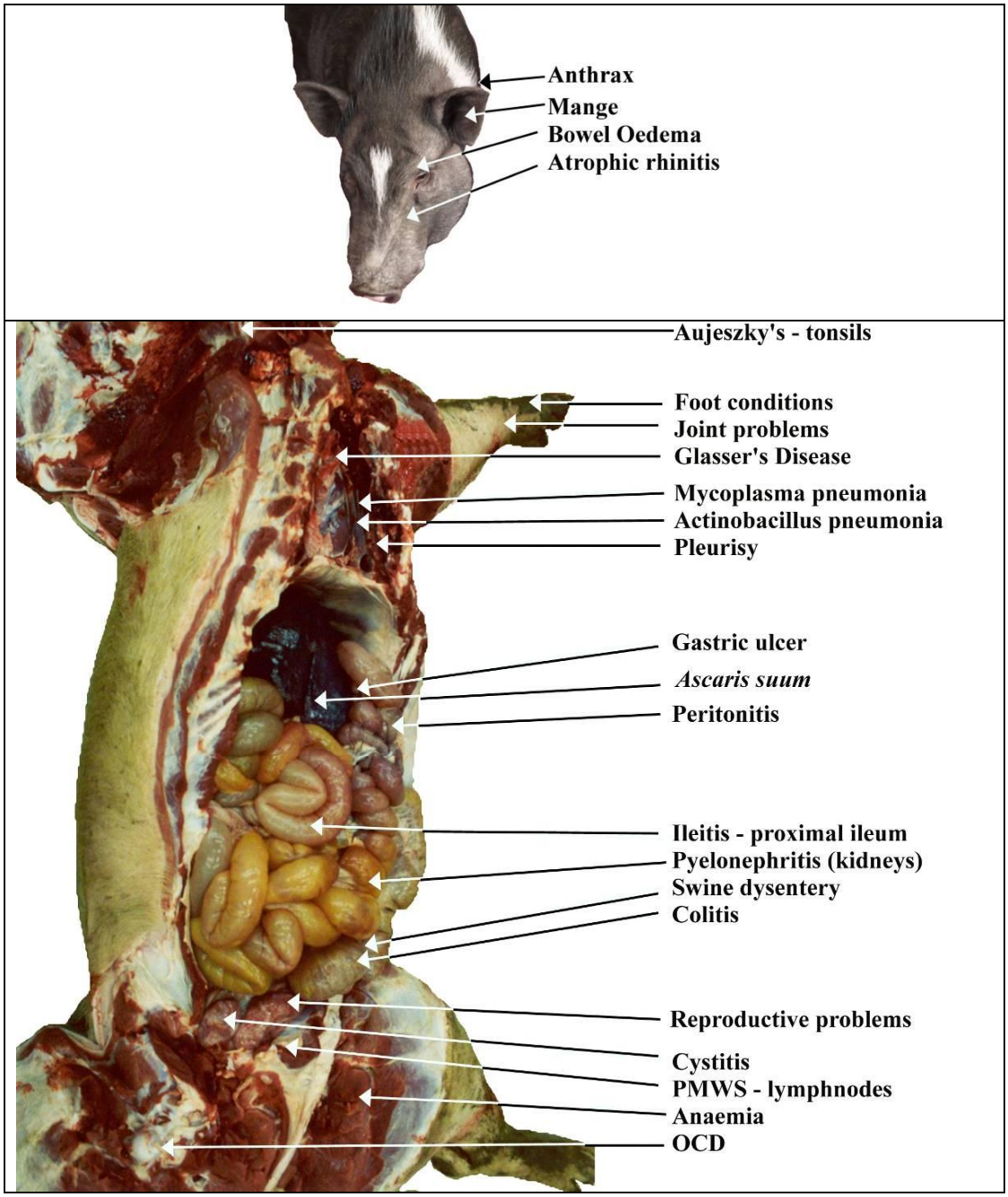


Section or remove the brain and examine the cranial cavity

Review your postmortem and ensure that any samples taken are properly marked.

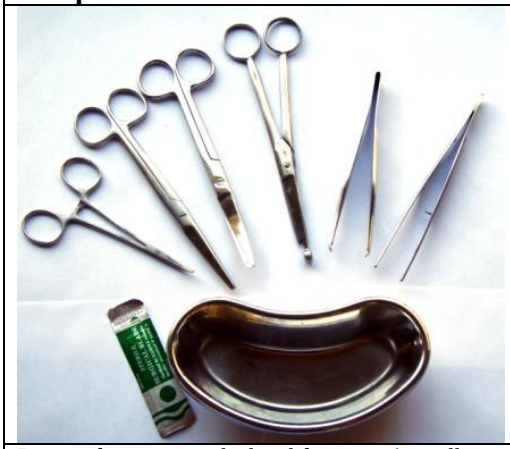
Post-mortem overview

Record the presence or absence of each production condition



Field Post-mortem Box

Large Animal – Pigs

Personal hygiene	Animal and sample identification
	
Wear protective gloves. Wash hands before and after post-mortem. Disinfect equipment	Identification of animals and samples is a vital part of a successful post-mortem. A water proof camera is essential.
Starting the post-mortem and gaining access to body cavities	
	
To gain access to major body cavities. A sharp knife and knife sharpener is required. Note also protective gloves ï chain mail or kevlar for the none knife hand	To gain access to the chest, head and pelvis a saw and bone cutting tools may be necessary
Sample collection and retrieval	
	
Range of scissors, scalpel and forceps. A small tray to hold samples prior to processing can be extremely useful	Samples collection capabilities should include blood tubes ï clotted and unclotted blood, microscope slides for blood smear etc. Litmus paper for pH exam. Syringe and needle for aspiration. Swab and liquid collection vessel. Swabs: aerobic, anaerobic and viral collection. Plastic bag for whole organ collection. Note ruler scale. Wear ear protection when collecting samples from live pigs

Post-mortem box

The box needs to be easily cleaned and disinfected. All items should be placed in plastic bags to help keep them clean in the field. The photographs illustrate one such example.

Biosecurity

Biosecurity is the most important aspect of carrying out a field post-mortem. It is vital that pathogens are not transferred between farms by yourself, the post-mortem box or equipment

Additional equipment

Not shown are euthanasia equipment where required.	Samples need to be stored and transferred to the laboratory for further examination. Additional equipment may be necessary to ensure this transfer occurs while maintaining tissues and biosecurity. Comply with all local postal regulation when transferring samples to a laboratory.

Describing Pathological Findings

A morphologic diagnosis includes the following:
Severity, time, distribution, anatomic site and lesion
Example - Severe acute multifocal renal infarct

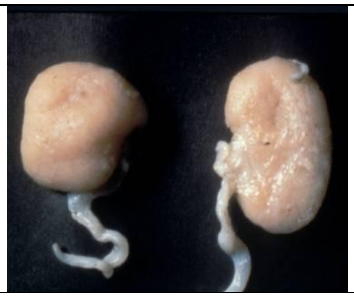
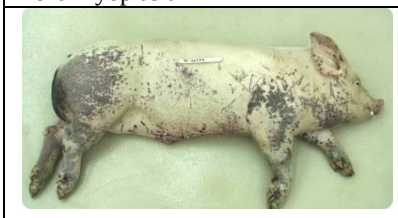
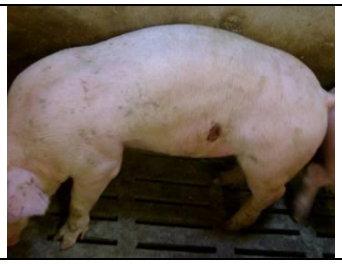
Severity

Mild	Moderate	Severe

Time

		
Peracute Sudden death with APP	Acute Pig with Erysipelas	Chronic Rectal stricture

Distribution

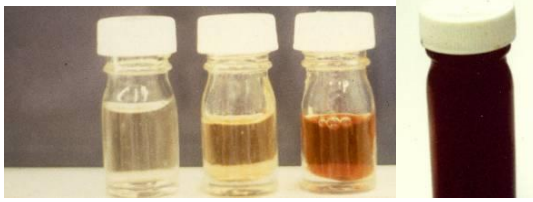
		
Bilateral Renal hyoplasia	Diffuse Greasy Pig Disease	Focal Melanoma of the skin
		
Multifocal PDNS	Patchy Mange along the dorsum	Unilateral Flank biting

Anatomic site ï which organ is affected

Lesion description – pathological description

Lesion can then be characterised using the following descriptive terms

Colour - describe what you see ï do not use food analogies



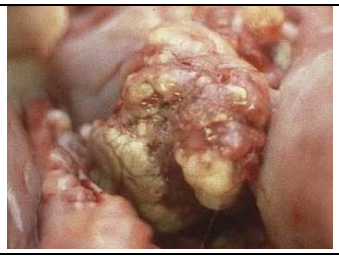
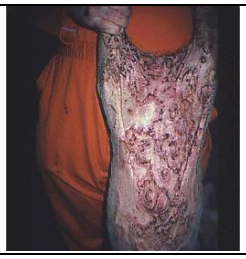
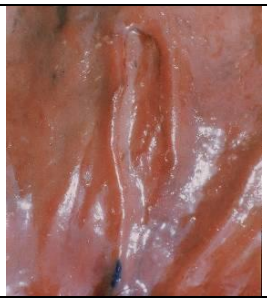
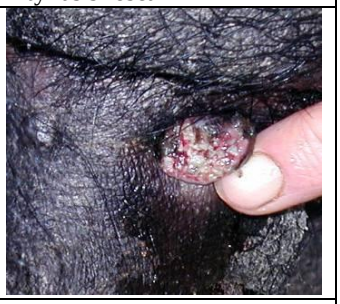
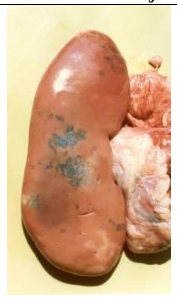
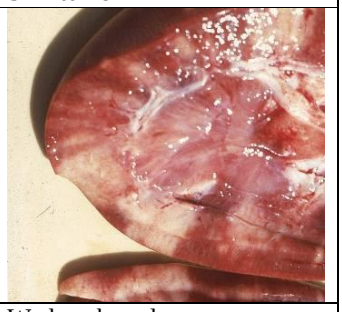
1 2 3 4

Variety of urine colours ï left to right

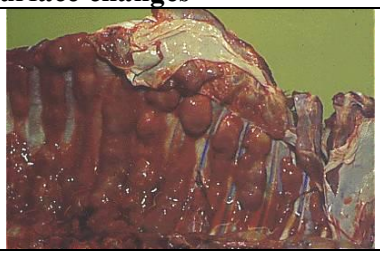
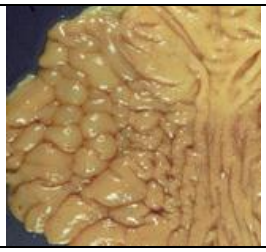
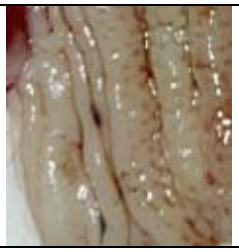
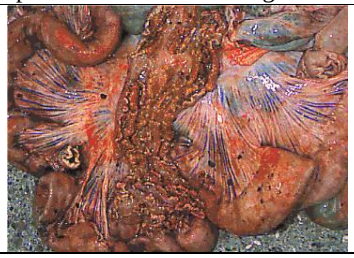
1. Normal 1
2. Normal 2
3. Cystitis
4. Pyelonephritis

Size ï be accurate ï use a ruler

Shape

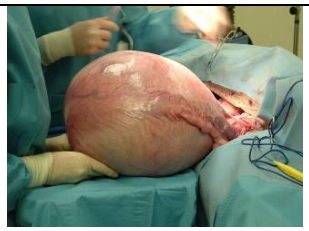
		
Botryoid ï shaped like grapes Endocardiosis	Circular ï flat Ringworm	Irregular Pityriasis rosea
		
Oblong Tearing of the ureterovesical junction	Ovoid Congenital swine pox lesions	Polypoid ï polyp like Skin tumor
		
Reniform ï shaped like a kidney	Spheroid Cystic ovaries	Wedge-shaped Pyelonephritis

Surface changes

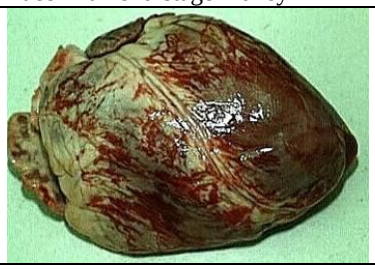
		
Bulging Lymphosarcoma in the rib cage	Cobblestoned Stomach with bowel oedema	Corrugated In ileitis
		
Crusted Necrotic ileitis	Eroded ï skin only Carpal erosions in piglet	Granular Borrelia granuloma

Pitted
Surface in an end-stage kidney

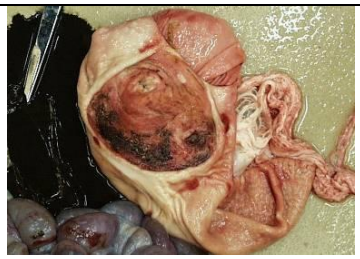
Rough
Chronic mastitis in a sow



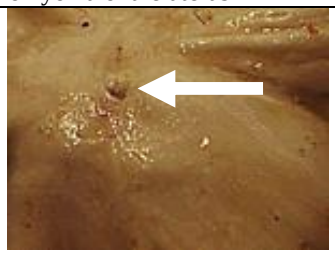
Smooth
Leiomyoma of the uterus



Striated
Mulberry Heart Disease



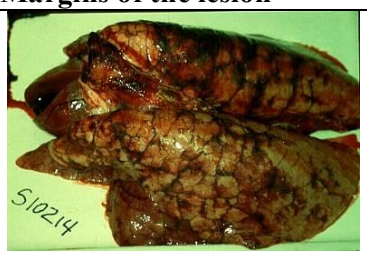
Ulcerated
Gastric ulceration



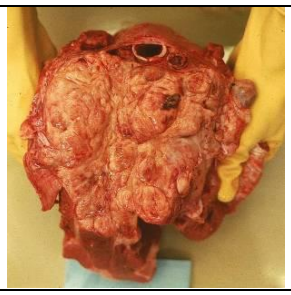
Umbilicated
Oesophageal stricture

Verrucous
Nasal tumour

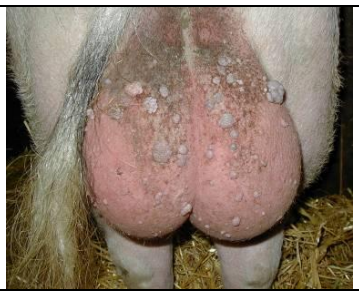
Margins of the lesion



Indistinct
Salmonella choleraesuis in the lung



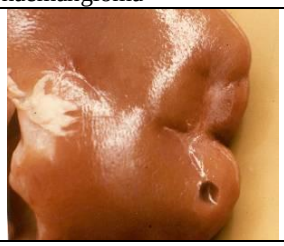
Infiltrative
Thymic tumour



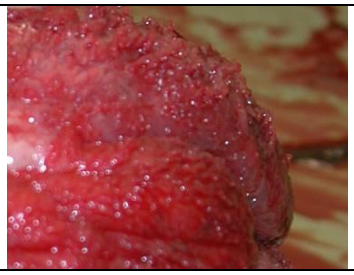
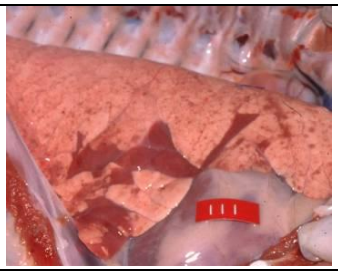
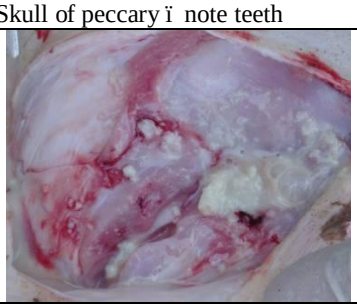
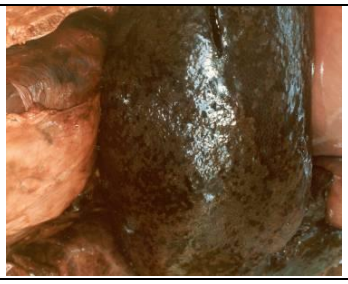
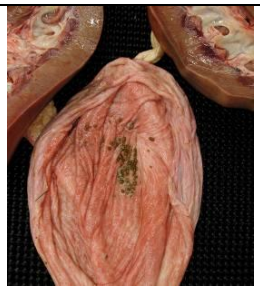
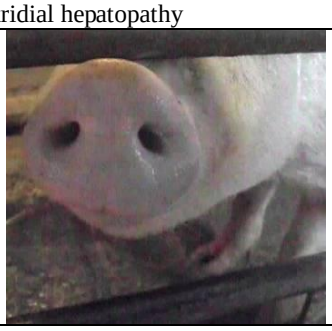
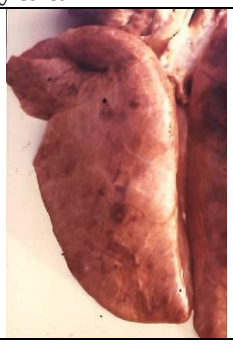
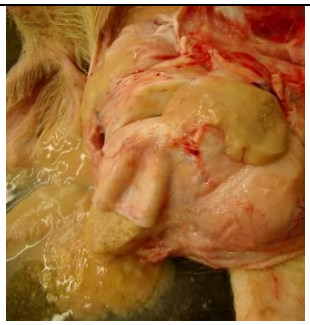
Papillary
Scrotal haemangioma

Pedunculated
Chronic mastitis

Serpinginous ï wavy
Purulent dermatitis



Serrated
Embryonic folding - kidney

		
Sessile ï broad base attachment Skin tumour	Villous ï finger like Pericarditis	Well-demarcated Mycoplasma pneumonia
Consistency ï be precise		
		
Hard Skull of peccary ï note teeth	Firm Normal faecal pellet	Soft Colitis feaces
		
Caseous Streptococci abscess	Fluid Fluid filled abscess	Friable Clostridial hepatopathy
		
Gritty Urinary calculi	Leathery Chronic mange	Resilient The normal nose
		
Rubbery PRRSv in lungs	Spongy Udder oedema	Viscous Shoulder abscess

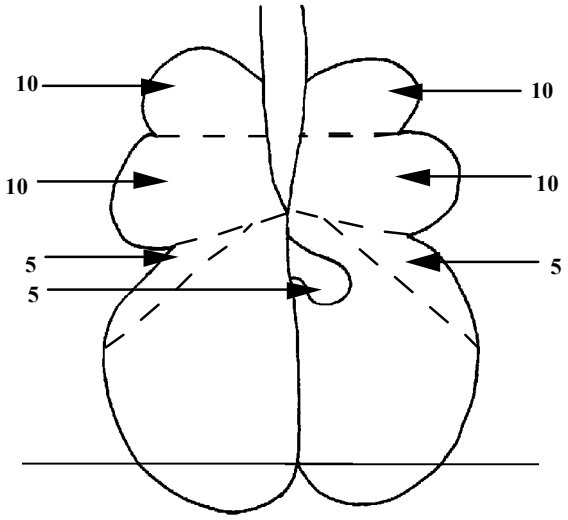
Slaughterhouse report

Report/findings for Slap mark:
Detail of results is shown in the supplemental report.

Lung

Enzootic pneumonia score

Score	Severity	Number
0	Absent	
1-14	Mild	
15-29	Moderate	
30-55	Severe	
	Total N° Lungs	
	Cumulative Score	



Enzootic pneumonia lung scoring system

Interpretation:
A score greater than 15 is likely to result in an economic loss of performance

Current average	
Previous average	

Pleuropneumonia:

Score	N°.
Absent	
Possibly present	

Pleurisy:

Score	N°.
Absent	
Mild	
Severe	

Other lung conditions:

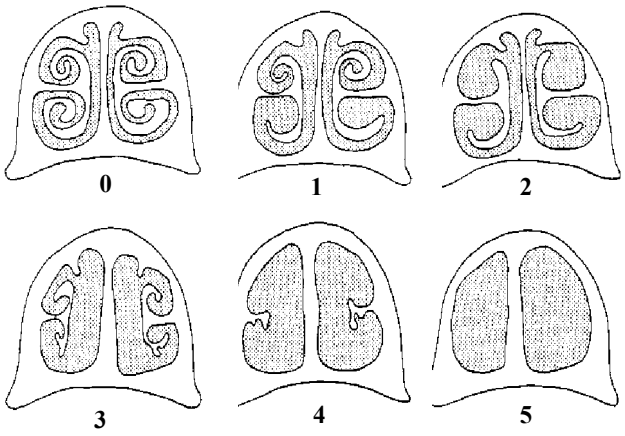
Snout

The following results were obtained:

Grade	N°.	Score
0		
1		
2		
3		
4		
5		
Average		
Previous		

Interpretation:
A score of less than 1.5 is not significant. Rapid changes in the score may necessitate further investigation to demonstrate toxigenic *Pasteurella multocida.*

Snout grading



Heart

Pericarditis:

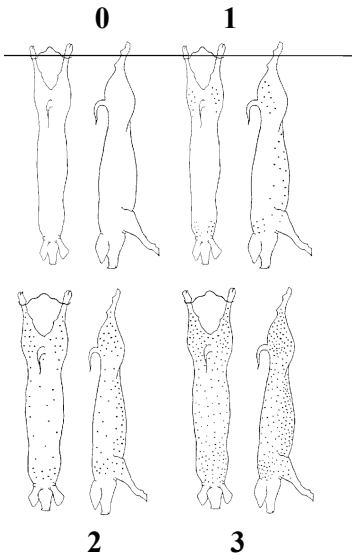
Score	Nº.
Absent	
Mild	
Severe	

Liver - White spot

Score	Nº.
Absent	
Mild	
Severe	

Mange:

Possibly present, note biting flies can produce similar lesions.



Interpretation of results:

Score	Nº.
0 - Absent	
1 - Mild	
2 - Moderate	
3 - Severe	

Any other significant findings:

Further action:

Slaughterhouse examination

Lung, heart and liver check sheet

Lab Ref No **Copy to:**

Examined at..... **By.....**

Date **Slap Mark:** **Sheet ..... of .....**

Was Slap Mark clear.....

Pig	Lung					Heart		Liver
	Enzootic pneumonia	Pleuropneumonia	Pleurisy	Lung abscess	Other	Pericarditis	Other	White spot
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								

Worm Egg Count

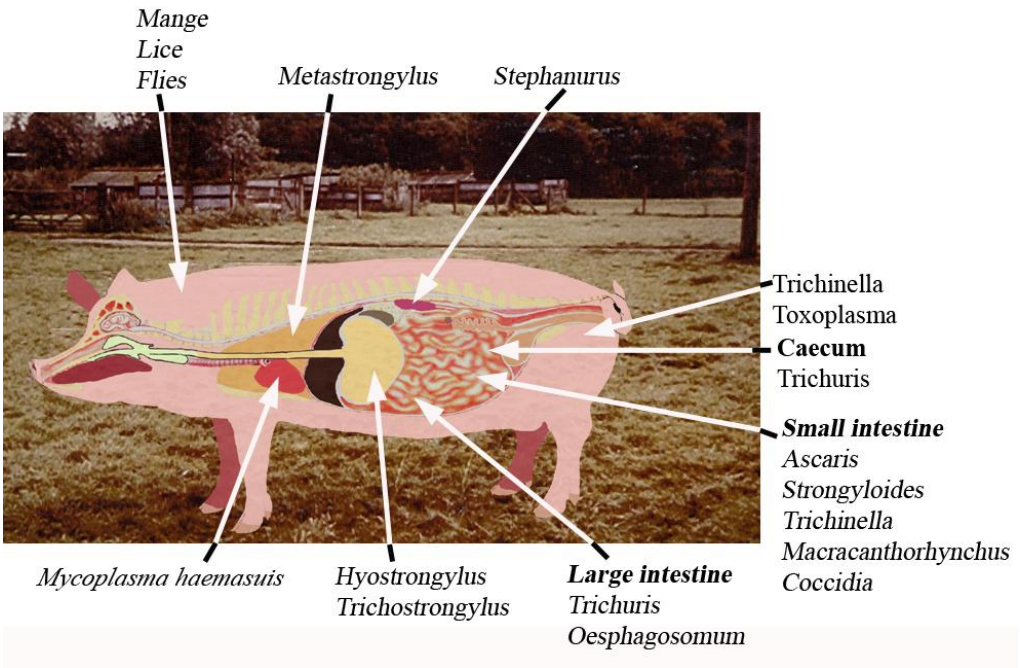
Requirements		
	McMaster slide ï this provides a simple counting chamber	
	Make flotation solution	**Super saturated sugar solution:**
		200 ml water
		Heat to boiling
		Add sugar, until no more will dissolve
		Pour off the sugar solution into a glass container. This will keep
		Zinc Sulphate solution: ï as above but with $ZnSO_4$
	100 ml bottle with top and small glass beads to assist mixing	
	Fresh faeces	
Method		
	Mix 2g of fresh faeces with 58 ml of flotation solution or: Mix 2g of fresh faeces with 2.5 ml of 0.1% methylene blue solution (aids visualisation) and 55.5 ml of floatation solution	
	Allow the mixture to settle for 5 minutes	
	Using a pipette place 0.3 ml of mixture into each of the 3 chambers in the McMaster slide	
	View down the microscope and count the number of worm eggs in each chamber	
	Using the 0.3 ml McMaster slide the number of eggs per gram is the number visible x 100	
	$\frac{\text{Volume of sample (faeces + 0.1\% methylene blue) + volume of flotation solution}}{\text{Volume of sample x volume per chamber}}$ [2 + 58 (or 2.5+55)] Divided by (2*0.3) = epg*100 In this example volume = weight ie 1 ml = 1 g	
	The zinc sulphate salt solution is used for *Ascaris suum* eggs, which do not float in saturated sugar solutions	

Example of pig worm egg count results ï not to scale ï coccidian are small

		
Strongyle egg ï cannot distinguish species	*Trichuris suis* egg	*Strongyloides ransomi* has a larvae inside the egg - piglet
		
Metastrongylus eggs (Note larva in egg)	*Ascaris suum* egg	Coccidiosis (much smaller than worm eggs) ï *Isospora suis*

Pig Parasites General

The major sites where the parasites of the pig can be found



Basic Swine Bacteriology

Enteric Pathogens

Escherichia coli

Blood agar
Most pathogenic strains will be ß haemolytic or smooth and mucoid

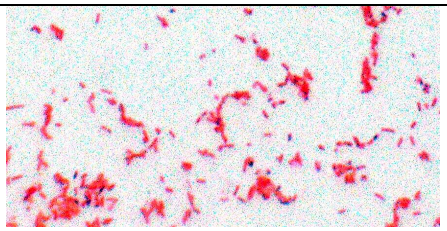
MacConkeyøs
Pink colonies ï lactose fermenter

Tergitol
Yellow- gold colonies lactose fermenter

A B C

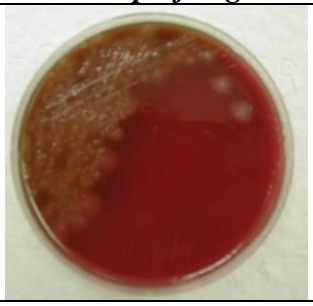
Tests ï

A ï Urease ï ve yellow
B ï Simmøs + ve red colour
C ï Kliglerøs +ve with gas



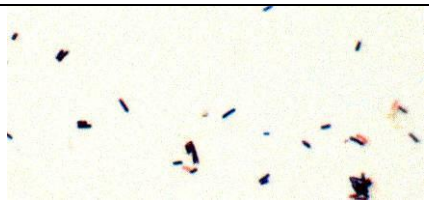
Gram negative rod

Clostridium perfringens



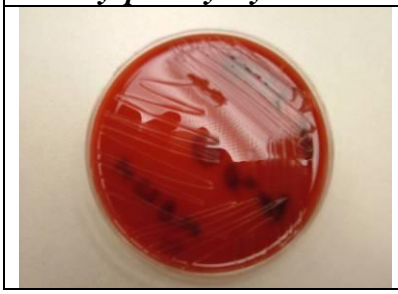
Blood agar

Requires **anaerobic** culture. Note flat spreading colony shape. Double zone of haemolysis.

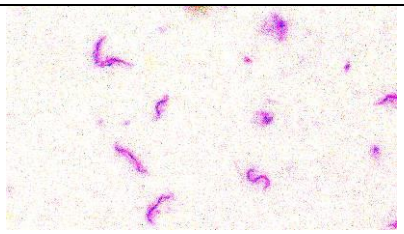


Gram positive rods ï vegetative and solid rods some spore formation

Brachyspira hyodysenteriae and *Brachyspira pilosicoli*



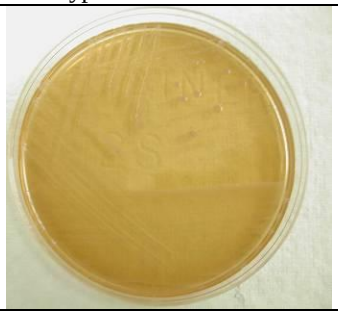
Requires **anaerobic** culture and 42C. A filmy surface growth is typical, rather than distinct individual surface colonies. ß haemolytic Bacteria lie under the surface.



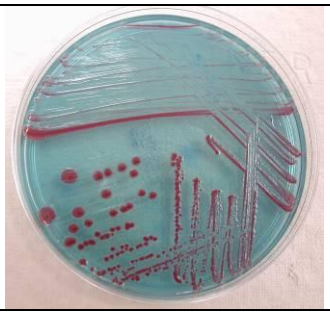
Weakly Gram positive spirochaetes.

Salmonella spp. There are over 2300 types of salmonella

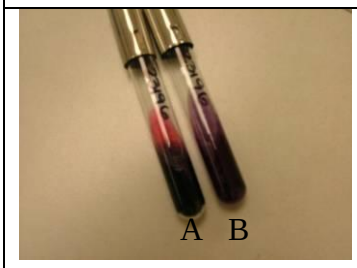
Blood agar Salmonella strains are non-haemolytic on blood agar



MacConkeyôs
A non-lactose fermenter

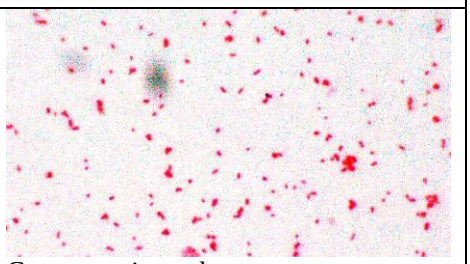


Tergitol ï a non-lactose fermenter



Tests ï

A ï Kliglerôs Iron agar ï H_2S + Lactose Blue colour
B - Lysine Iron Agar + ve Blue colour



Gram negative rod

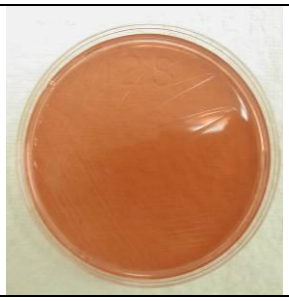
Lawsonia intracellularis

Note *L. intracellularis* requires **cell culture**. It will not grow on agar media

Respiratory pathogens

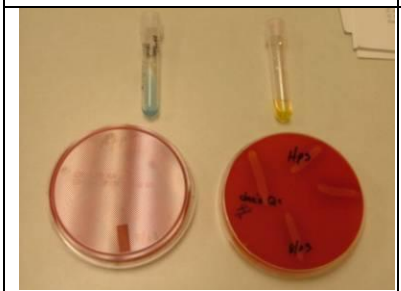
Actinobacillus pleuropneumoniae

Blood agar
Requires staphylococcus streak - Haemolytic - satellitism



MacConkeyôs ï
No growth

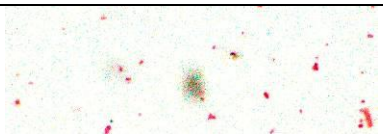
Tergitol - No growth



APP left, HPS right plates

Differentiation between APP and HPS by cultural characteristics and urease positive ï blue coloration and is CAMP positive.

Haemolytic colonies



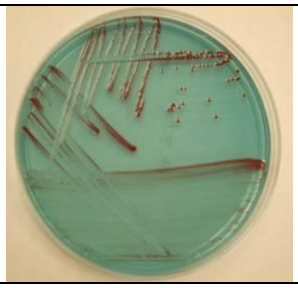
Gram negative rods and coccobacillary forms

Organism generally **requires NAD** (Nicotinamide adenine dinucleotide to grow ï V factor) ï supplied by a Staphylococcus streak.

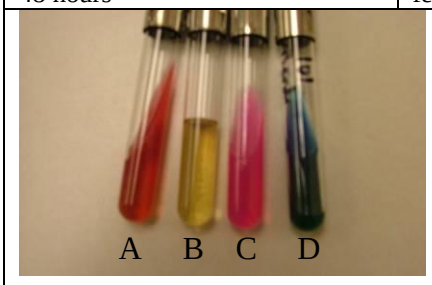
Bordetella bronchiseptica

Blood agar - Incubate for at least 48 hours

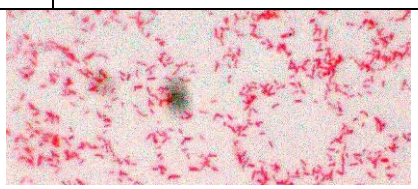
MacConkeyôs - non lactose fermenter



Tergitol ï non lactose fermenter

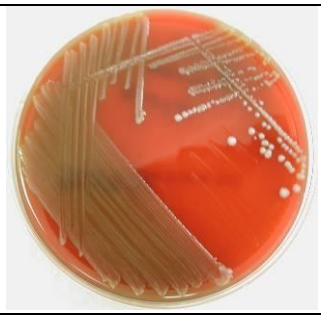


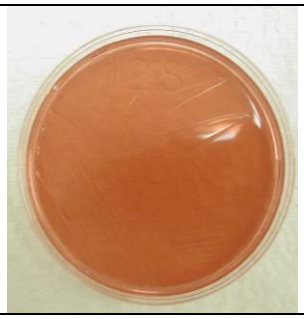
Tests ï
A ï Kliglerôs ï ve red
B ï Simmôs ï Poor reaction little growth
C- urease ï Strong positive ï pink slant
D - Simmonôs citrate agar ï positive ï blue color



Small gram negative coccobacilli

Pasteurella multocida



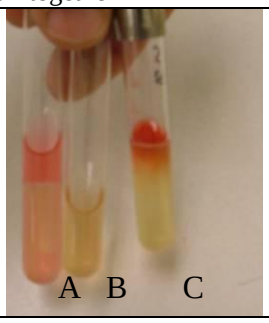


Blood agar assisted with Staphylococcus streak to distinguish A and D by producing mucoid colonies

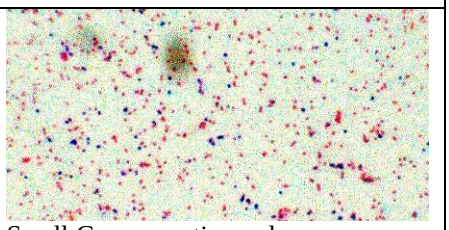
P. multocida A mucoid colony - may run together

P. multocida D non mucoid ï dry colony

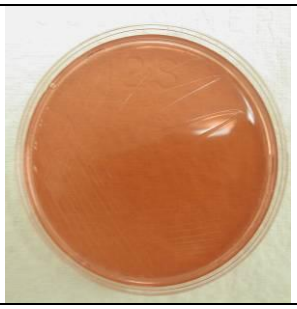
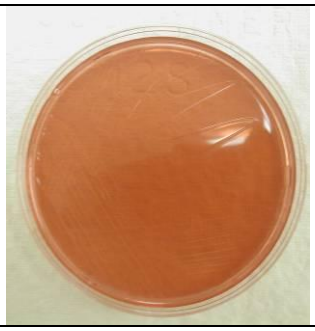
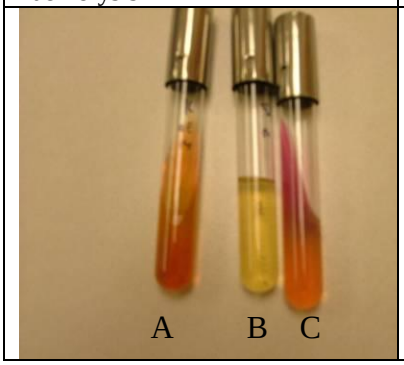
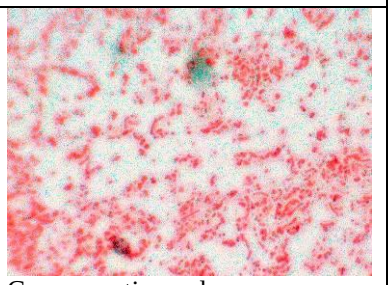
MacConkeyôs ï no growth
Tergitol ï no growth



Tests ï note distinctive odor ï musky
A ï Dextrose Broth - +ve red no gas.
B ï Lactose ï ve yellow
C - Indole positive red
In addition - urease negative

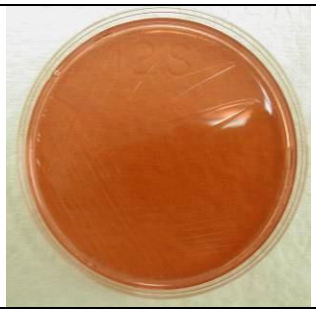


Small Gram negative rod or coccobacillus

Salmonella choleraesuis *See enteric pathogens for growth characteristics*		
Streptococcus suis		
		
Blood agar	MacConkeyôs ï no growth	Tergitol ï no growth
Actinobacillus suis		
		
Blood agar ï wide zone of ß haemolysis	MacConkeyôs ï no growth Sometimes very small	Tergitol ï no growth
	Tests ï No growth on MacConkeyôs or Tergitol important differential from *E. coli* A - Kliglerôs ï Lactose +ve Dextrose +ve red B ï Simmôs ï difficult little reaction C ï Urease +ve red	 Gram negative rod

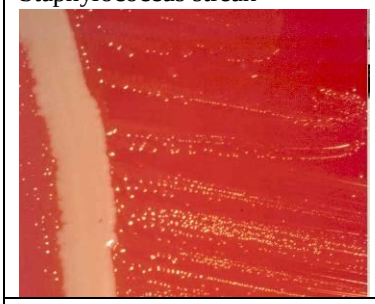
Haemophilus parasuis

Blood agar ï very small colonies around the Staphylococcus streak

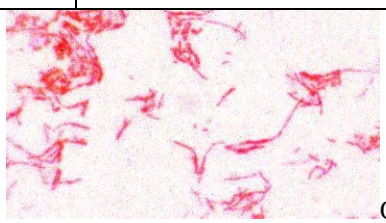


MacConkeyôs ï no growth

Tergitol ï no growth

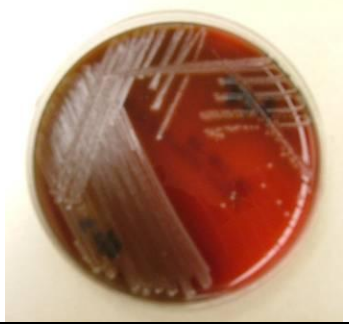


Can be difficult to grow ï requires **NAD**.
Reputedly Grows best under **CO_2** on **chocolate agar**.
It is urease negative - yellow ï useful to distinguish from APP positive - blue.

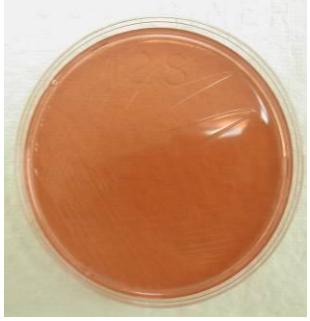


Gram negative coccobacillus

Arcanobacterium pyogenes

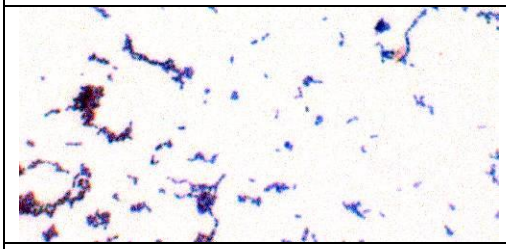


Blood agar
Catalase -ve



MacConkeyôs ï no growth

Tergitol ï no growth



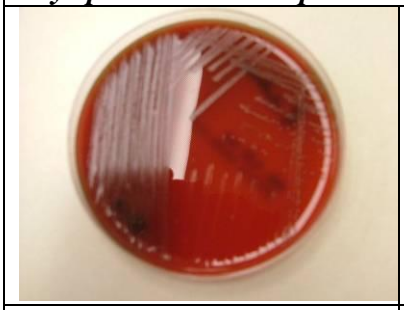
Gram positive pleomorphic rods ï ñChinese lettersò

Mycoplasma hyopneumoniae

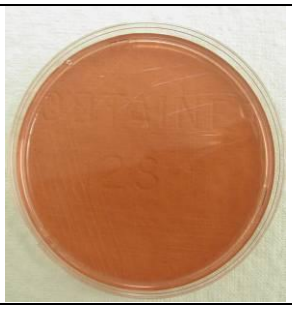
Mycoplasmas require **special media**. *M. hyopneumoniae* requires a very long incubation period and a specialized laboratory to grow the organism, which even then is frequently overgrown with other mycoplasma spp.

Other pathogens

Erysipelothrix rhusiopathiae



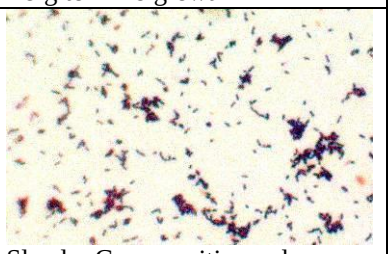
Blood agar ï small colonies



MacConkeyôs ï no growth

Tergitol ï no growth

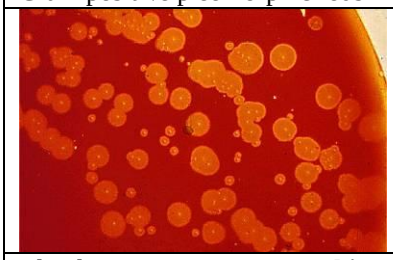
Tests - Produces hydrogen sulfide (black streak) along stab line in Kliglerôs iron agar.



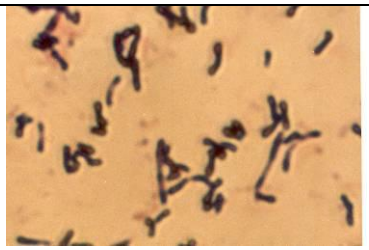
Slender Gram positive rod

Actinobaculum suis (Eubacterium suis)

Gram positive pleomorphic rods



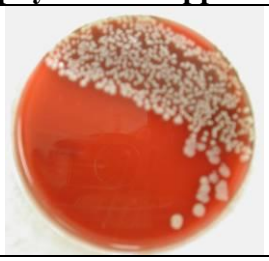
Blood agar ï requires **anaerobic** culture. Flat colonies fried egg shaped



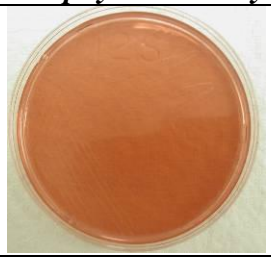
Pleomorphic rods

Tests ï urease positive

Staphylococcus spp. – Example - *Staphylococcus hyicus*

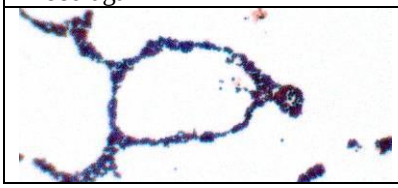


Blood agar



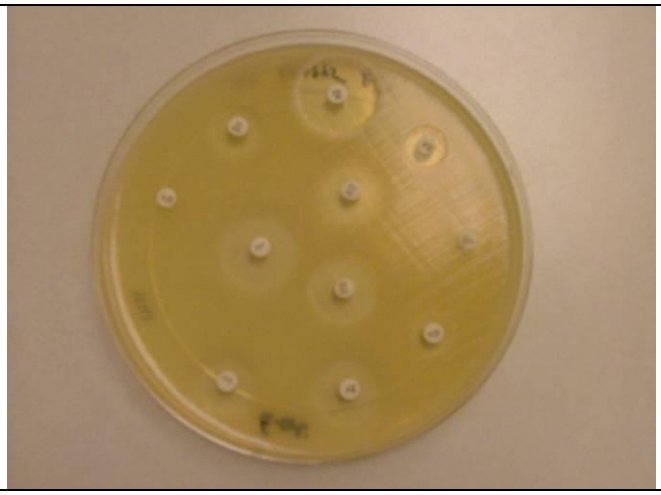
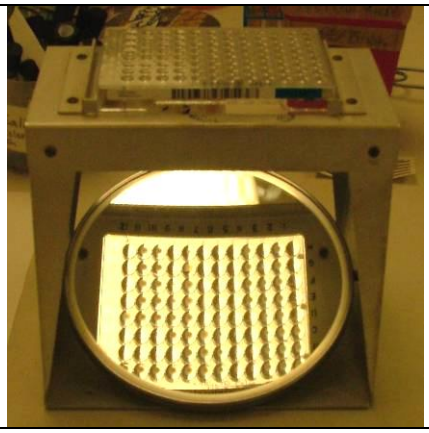
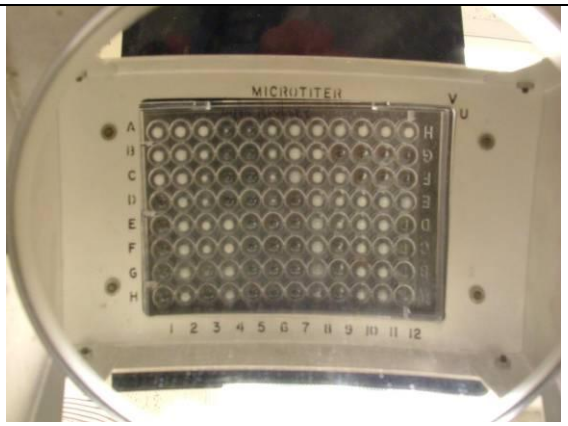
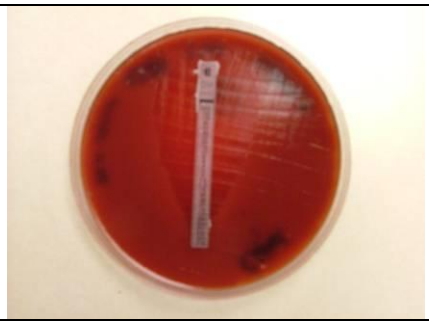
MacConkeyôs No growth

Tergitol No growth



Gram positive cocci ï in clumps resembling grapes

Catalase positive

Basic antimicrobial tests	
Kirby-Bauer	
	Note each disc has its own zone of inhibition
Minimum Inhibition Concentration - MIC	
	
Automated system	View of the plate ï demonstrating growth (white areas) and inhibition (clear)
	E test MIC strip. The zone of clearing visibly seen on the plate.

Specific Tests:

Gram's Stain:
Always place organisms in centre and always use ñfrosted side upò
1. Make a thin smear of the organism with a tiny droplet of water on a slide
2. Dry ï best if air dried
3. Fix by gently hearing 2-3 times through the flame
4. Flood smear with Crystal violet for 5 seconds, hold side perfectly level, then dump
5. Wash with distilled water
6. Flood smear, with Gramôs iodine for 5 seconds
7. Wash with distilled water
8. Decolorise with acetone-alcohol about 3 seconds
9. Wash with distilled water
10. Counterstain with saffron for 5 seconds
11. Wash with distilled water
12. Blot slide dry; face down on a paper towel.

Acid Fast: Zeil-Neilson
1. Make a thin smear of the organism with a tiny droplet of water on a slide
2. Fix by gently hearing 2-3 times through the flame
3. Flood smear with Carbol fuchsin
4. Heat flooded slide over flame for 2-3 minutes
5. Wash with distilled water
6. Decolorise with acetone-alcohol about 3 seconds
7. Wash with distilled water
8. Counterstain with methylene blue for 30 seconds
9. Wash will distilled water
10. Blot slide dry; face down on a paper towel.

Catalase Test:
1. Dip a capillary tube into 3% H_20_2
2. Touch a colony
3. Observe the tube for bubble indicating a positive reaction

Do not contaminate the bacterial colony with blood agar as red blood cells contain catalase thus resulting in a false result. Old cultures can lose their catalase activity.

Oxidase Test:
1. Hold a piece of oxidase test paper with forceps and touch onto an area of heavy growth
2. Rapid (within 10 seconds) purple positive. If within a minute delayed positive

Note an oxidase organism will also be catalase positive

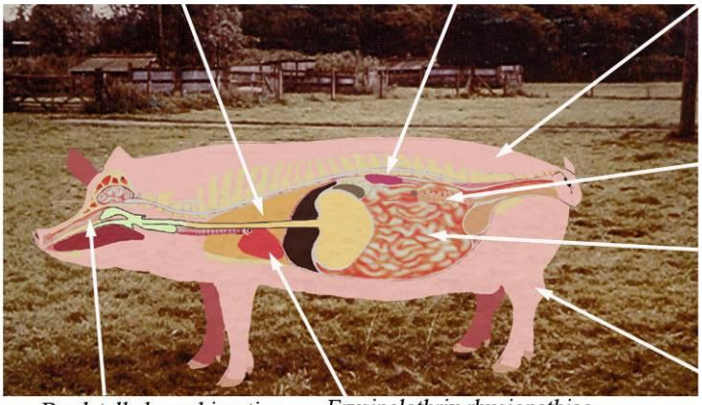
Basic Swine Bacteriology – Summary Table

Organism	Gram Stain	Growth				Sugars and reactions									
		Anaerobe only	Haemolytic Blood agar	MacConkey	Tergitol	Catalase	Oxidase	Dextrose broth	Kliglers	Kiglers iron	Lactose	Lysine	Simms	Simms Citrate	Urease
Actinobaculum suis	+B	+	N	-	-	-	-								+
Actinobacillus pleuropneumoniae	-CB		Y	-	-	V	V								+
Actinobacillus suis	-B		β	-	-	+	V	+			+			P	+
Arcanobacterium pyogenes	+B		N	-	-	-	-								
Bordetella bronchiseptica	-CB		N	+NL	+NL	+	+		-				P		+
Brachyspira	+S	+	β	-	-	-	-								
Clostridium perfringens	+B	+	Y	-	-	-	-								
Erysipelothrix rhusiopathiae	+B		N	-	-	-	-			+					
Escherichia coli	-B		N+β	+L	+L	+	-		+G				+		-
Haemophilus parasuis	-CB		N	-	-	+	-								-
Pasteurella multocida	-CB		N	-	-	+	+	+			-			+	-
Salmonella	-B		N	+NL	+NL	+	-			+		+			
Staphylococcus	+C			-	-	+	-								
Streptococci	+C		α/ β	-	-	-	-								

Code:
+ and green = Positive. ï and red = Negative.
Gram stain: B = Bacillus/coccobacillus. C = Coccoid. CB = Coccobacillus. S = Spirochaete.
Sugars and reactions: V= variable G = Gas. P = Poor L = Lactose NL= Non Lactose
Haemolytic Y = Yes and type Ŭor ɓ. N= No.

Pig Bacteria General

The major sites where bacteria of the pig can be found



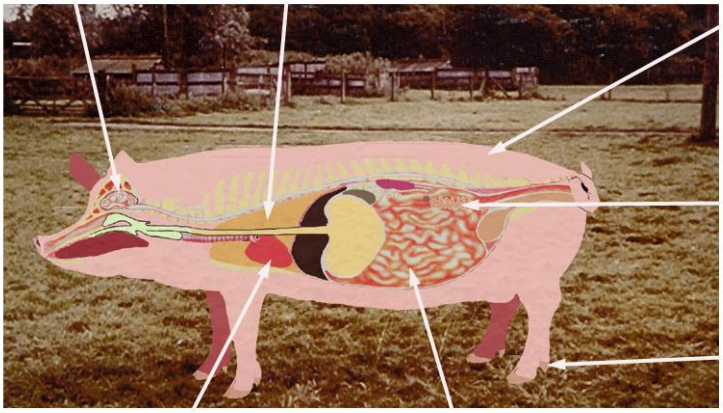
Erysipelas rhusiopathiae is blood borne.
Most of the respiratory bacterial pathogens may also be isolated from the nasopharynx.

The major virus diseases of pigs

Virus name	Family	Genetic	Envelope	Comments
Adenovirus	Adenoviridae	DNA D	+ ve	
African Swine Fever	Un-named	DNA D		Insect borne
Aujeszkyôs Disease	Herpes Virus	DNA	+ ve	Pseudorabies
Blue Eye Virus	Paramyoxoviridae	RNA	+ ve	
Circovirus	Circoviridae	DNA S	- ve	Two types I and II
Classical Swine Fever	Flaviviridae	RNA	+ ve	CSF Hog Cholera Note BVD and Borderôs can infect. Pestivirus
Coronavirus	Coronaviridae	RNA	+ve	Several types, TGE, PRC, ED, HEV
Cytomegalovirus	Herpesviridae	DNA	+ ve	
Eastern Equine Encephalomyelitis	Togaviridae	RNA S	- ve	Also similar West Nile Virus
Encephalomyocarditis virus	Picornaviridae	RNA	- ve	
Enterovirus	Picornaviridae	RNA	- ve	Numerous types ï Talfan, Teshen, SMEDI
Foot and mouth	Picornaviridae	RNA S	- ve	FMD
Hepatitis E virus	Caliciviridae?	RNA S	- ve	
Japanese Encephalomyelitis virus	Flaviviridae	RNA	+ ve	
Nipah virus	Handra virus	RNA S	+ ve	Paramyoxoviridae
Menangle Virus infection	Paramyxovirus	RNA	+ ve	
Parvovirus	Parvovirus	DNA S	- ve	
Porcine Mycocarditis virus	Bungowannah	RNA	+ve	Related to Pestivirus
Porcine Reproductive and Respiratory Syndrome Virus	Arterividae	RNA	+ ve	PRRSv
Rabies	Rhabdoviridae	RNA	± ve	
Reovirus	Reoviridae	RNA	- ve	
Rinderpest	Paramyxovirus	RNA	+ve	
Rotovirus	Reoviridae	RNA	- ve	Mainly type A
Swine Influenza	Orthomyxoviridae	RNA Segmented	+ ve	SIV Several types based on H and N antigens.
Swine Vesicular Disease	Picornaviridae	RNA S	- ve	An enterovirus
Swine Pox	Poxviridae	DNA D	+ ve	
Torovirus	Torovirus	RNA	+ve	Related to Coronavirus
Torque Teno Virus	Anellovirus	DNA	- ve	Related to Circovirus
Vesicular exanthema	Caliciviridae	RNA S	- ve	
Vesicular stomatitis	Rhadboviridae	RNA S	± ve	Affects horses as well
West Nile Virus	Flaviviridae	RNA	+ ve	

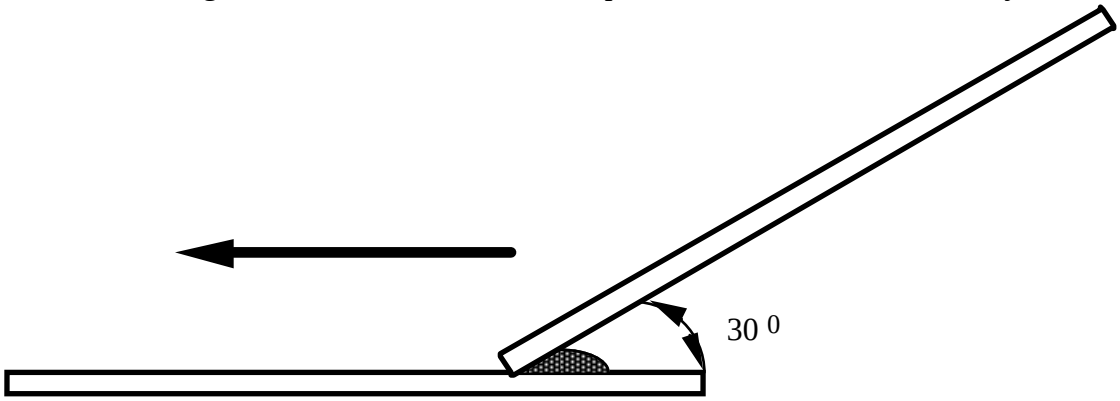
Pig Viruses General

The major sites where viruses of the pig can be found

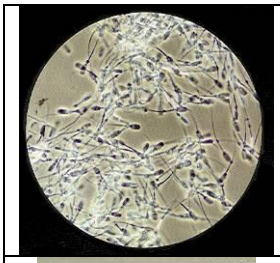
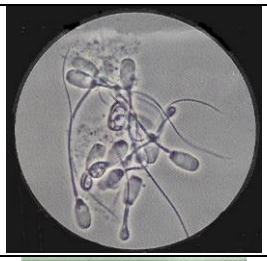
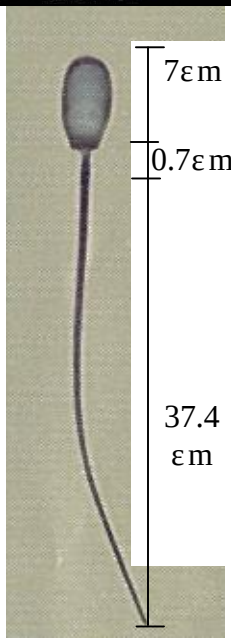


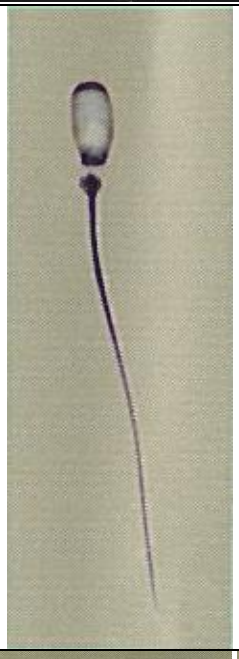
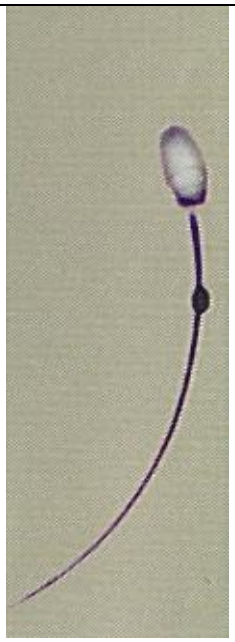
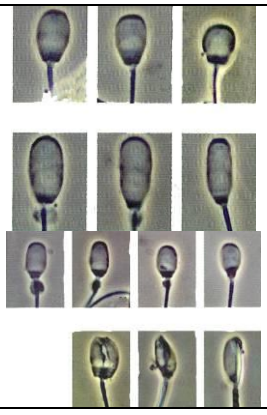
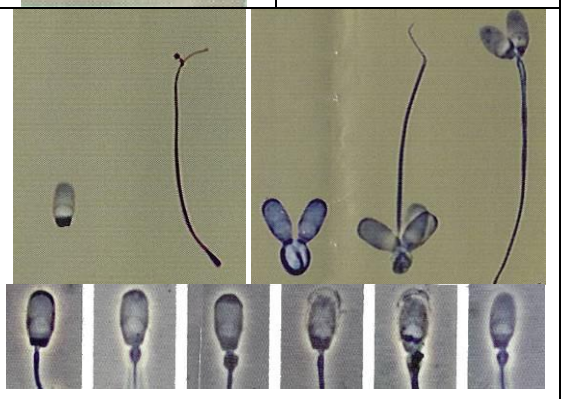
Note African Swine Fever and Classical Swine Fever are blood borne
Porcine Circovirus 2 will be found in lymph nodes throughout the animal

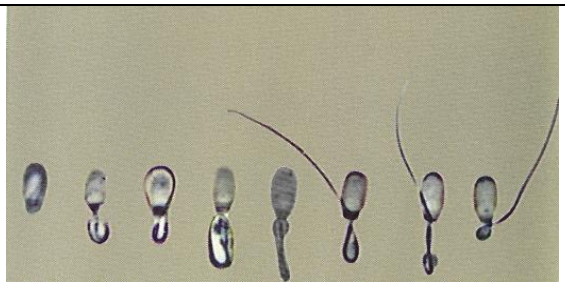
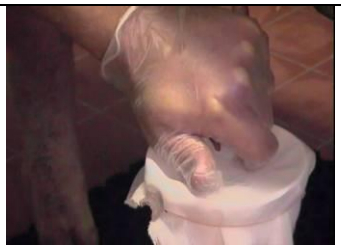
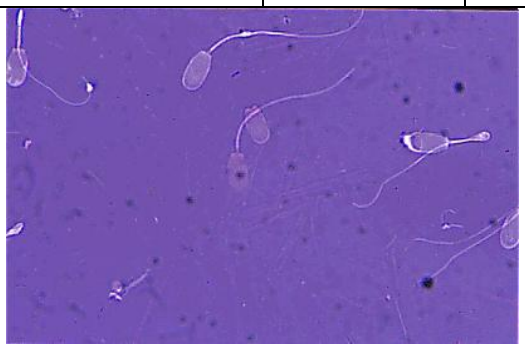
Semen Morphology

Morphology checks	
1	Once the boar is in training, check the semen morphology for the first three collections
2	Assuming that all three have less than 30% abnormalities, re-check every four collections
3	If more than 30% abnormalities check until two clear samples are produced
4	If more than 50% abnormalities occur re-consider the entire future of the boar
Morphology procedure	
1	Obtain nigrosin/eosin stain. Keep in a refrigerator and purchase new supplies monthly
2	Add 7 drops of nigrosin/eosin into a stain tube and place in the float in the water bath at 30^{O}C for 5 minutes
3	Add 7 drops of diluted semen into the nigrosin/eosin stain
4	Replace into the water bath for at least 5 minutes
5	Mark a microscope slide with the boar's number
6	Make a smear and leave to dry Place a drop of the mixture using a warmed pipette on the end of a clean warm slide and draw out a thin film using the end of another slide as a spreader. Allow the smear to dry naturally. 
7	Examine at X400 and X1000 (oil) for dead and abnormalities. Sperm that were alive when you made the smear remain unstained (white), while dead sperm take up the stain and appear red
8	Examine 100 sperm at random, counting with the hand counter
9	Record abnormalities

Sperm Morphology Photographs

<table>
<tr>
<td>  </td>
<td>Down the microscope the sperm should be seen to be active with forward motion. In very good samples wave motion is seen</td>
<td>  </td>
<td>In contaminated samples agglutination of sperm can be seen. This can also occur with chilling</td>
</tr>
<tr>
<td> 
</td>
<td>The normal sperm with a tail central to the head. The tail is straight without any kinks. The head is a smooth even head.

On the right we see proximal and distal cytoplasmic droplets. This may have little significant impact on fertility. The are more common in immature sperm. The droplet comes from the acrosome/head cover which uncovers at ejaculation and then runs down the tail</td>
<td>  </td>
<td>  </td>
</tr>
<tr>
<td>Head abnormalities are not common. The photographs illustrate a range of abnormalities. Detached heads can be common in certain boars. If the head is abnormal attachment in the oviduct and to the egg will be impaired.</td>
<td>  </td>
<td>  </td>
</tr>
</table>

Tail abnormalities are common with the variety of bent and coiled tails. Deformities of the tail interferes with the sperms ability to swim in the oviduct and through the zona pellucida			
Poor semen collection techniques will result in increased contamination of the sample. This may be recognised by the clear presence of bacteria in the sample		Review collection routines. Note preputial fluid will kill semen. The semen sample may also smell	
Using stains such as Eosin/Nigrosin stain the sperm may be clearer. Some of the stains also allow an assessment of whether the sperm were alive or dead.		The sample on the left contain a dead sperm in the middle, one detached head, one bent tail and two normal sperm	
What are the abnormalities you can see in the sample on the right?			

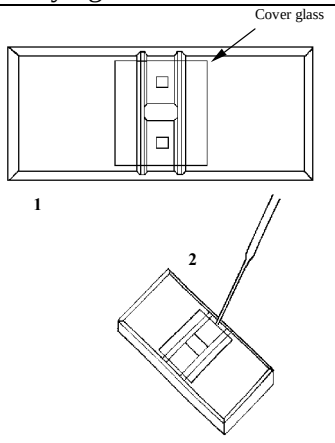
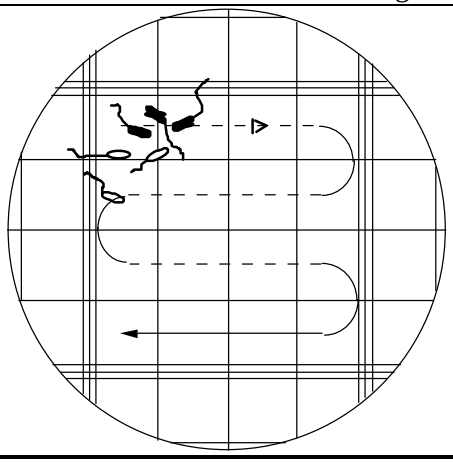
While semen morphology is interesting, please note that only in extreme cases can fertility be affected by abnormal sperm cells. Second samples should be examined if more than 30% of the sperms cells examined are abnormal.

Also note that a single examination may be almost meaningless. The identification of a sub-fertile boar takes several serial semen samples and record analysis

The female filters out many of the abnormal sperm as they enter the oviduct. It has been shown that in the horse, despite being inseminated with semen samples with 85% abnormal sperms, this resulted in 90% normal sperm in the oviduct.

Remember you are examining the population of sperm not the individual

Sperm number per ml

The Haemocytometer	
The procedure for using the improved Neubauer double counting chamber model (BS478) is as follows:	
1	Make a 1:100 dilution of the semen sample by accurately pipetting 0.1 ml of semen sample into 9.9 ml of 3.6% sodium citrate buffer solution (in a glass colorimeter tube for convenience when calibrating colorimeter).
2	Add one drop of formalin to the tube to immobilise the spermatozoa. Note any health and safety requirements of formalin
3	Clean the glass haemocytometer and special coverslip thoroughly with a soft tissue. Press the coverslip onto the slide so that Newton's rings are clearly visible on the contact surfaces.
4	Ensure that the diluted semen sample is thoroughly mixed. A drop is then expelled gently into the chamber from a fine pipette so that the entire cavity is filled with diluted semen. The process is repeated for the second counting chamber. Excess semen should not be allowed to flow into the grooves bounding the two chambers.
Loading the haemocytometer	
	The counting chamber is a flat rectangular, glass block with a central recess, i.e. an area slightly lower than those on either side from which it is separated by grooves. When in use, this recess is bridged over by cover glass. On the recessed area are engraved fine rulings to mark out the small areas in which the sperm cells are to be counted. It is usual for two identical ruled areas to be engraved on the same counting chamber, separated by a longitudinal groove.
1.	Upper surface, showing the cover glass in position on the ruled areas
2.	Method of filling the counter chamber with a Pasteur pipette. The tip of the pipette (held at 45^{o} to the vertical) is applied to the gap between the cover glass and the underlying recessed area, and a small amount of semen is then discharged.
	 

Counting the sperm numbers	
	Haemocytometer chamber viewed under the microscope right picture above
1	Allow the cells to settle for 5 minutes then examine the slide with the microscope (x100). Locate the block of 25 squares and count the number of spermatozoa in 5 of these large squares, e.g. one at each corner of the block and the centre one. Each large square is divided into 16 smaller squares. Count the heads of the spermatozoa using a hand tally counter. Some of the cells will lie across the lines at the edges of the square; to avoid counting the same cell twice, count any spermatozoa on the top and right lines and ignore those on bottom and left lines. Repeat the count on the second chamber and use the mean of the two counts for the calculation of the concentration. One large square of the counting grid of a haemocytometer chamber is shown below. The arrow indicates the direction to follow when counting spermatozoa in each of the 16 small squares; only those heads shown in black would be counted in square 1.
2	Calculation of the number of spermatozoa per ml; - where 5 large squares (each divided into 16 small squares) have been counted. One small square has an area of 1/400 sq mm and a depth of 0.1 mm. Thus the volume of one small square is 1/4000 cu mm. Where N is the mean count from the two chambers.
	Sperm concentration = (N/80) x 4000 x 1000 x 100 (dil rate) i.e,(original semen) = (per small sq) x (per cu mm) x (per ml) x (per ml original). = 5N x 10^6 sperm per ml.
3	For greater accuracy, count the sperm in all 25 large squares. The formula will then be: Sperm concentration = N x 10^6 sperm per ml.