



Swine
Anatomy, Physiology, and Diseases
May 2012

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- All information is deemed reliable and correct
 - No warranty for accuracy
- No information presented is known to be specifically included in ACLAM Board examinations

Taxonomy

Animalia
Chordata
Mammalia
Artiodactyla-even toed
Suidae
Sus
Sus scrofa domestica



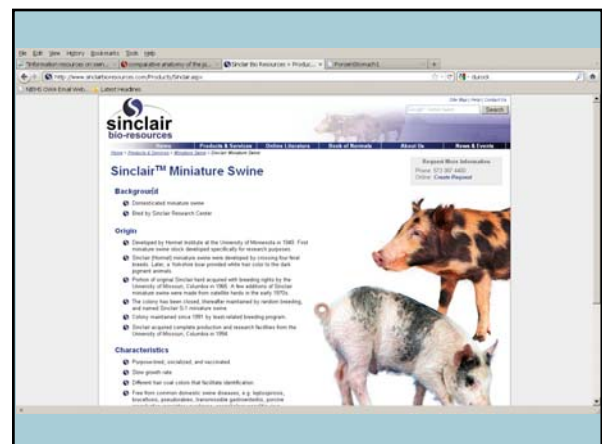
Terms

Piglet-young, before weaning
Shoat-weaned animal
Gilt-young female
Sow-sexually mature female
Boar-sexually mature male
Barrow-castrated male
Farrowing-parturition

Information from Dr. Judy Nielson, UNC

Commercial breeds
bred for rapid growth
size vs length of time
epiphyses do not close until after 3 years
variable health status

Mini/micropigs
generally better health status when bred for research
some strains are bred for specific research
slower growing
smaller size



Commercial Swine Breeds



Yorkshire



Landrace

Commercial Swine Breeds



Hampshire



Duroc



Poland China

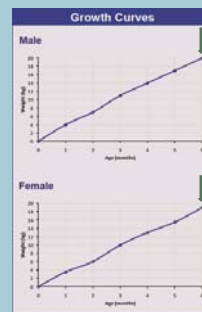
Mini and Micro Breeds



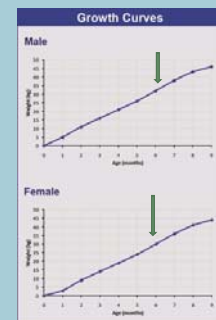
Yucatan
Dark, very little hair
Wattles



Line developed for ventricular septal defect



Micro Yucatan miniature



Yucatan miniature



Sinclair Mini
First mini developed (black)
Come in different colors now
Long pointy snout
20 kg at 5 months



What tumor did original black ones get?



Malignant melanoma (regresses)





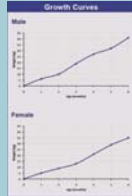
Gottingen pig
10-15 kg 5 mo

--originally bred at the University of Göttingen (Germany), from a crossing between the Minnesota minipig and the Vietnamese potbelly swine

--**gyrencephalic**, relatively large brain
what is the opposite of gyrencephalic?



Hanford
30-40 kg, elongated snout
White



Gottingen pig
10-15 kg 5 mo

--originally bred at the University of Göttingen (Germany), from a crossing between the Minnesota minipig and the Vietnamese potbelly swine

--**gyrencephalic**, relatively large brain
what is the opposite of gyrencephalic?

lissencephalic



Hanford
30-40 kg, elongated snout
White



Metabolic Syndrome and Coronary Artery Disease in Ossabaw Compared with Yucatan Swine

Zachary F Neeb, Jason M Edwards, Mouhamad Allouash, Xin Long, Eric A McKelvie, and Michael Sturik

Ossabaw
Ossabaw Islands in GA
Tolerance to heat, humidity, food scarcity
Model of type II diabetes
Indiana University



<http://news.ums.purdue.edu/html4ever/2006/060331.Krisher.swine.html>

Characteristic	Yucatan	Ossabaw
1. Obesity	No	Oss>Yuc
2. Insulin resistance	No	Yes
3. Glucose	No	Yes
4. Dyslipidemia (↑LDL/HDL)	Yes	Yes
5. Dyslipidemia (↑ triglycerides)	No	Yes
6. Hypertension	No	Yes
7. Cardiovascular disease, atherosclerosis	Yes	Yes
8. Small stature	Yes	Yes

Your investigator in NC wants to ship some of his transgenic pigs to a collaborator in WV

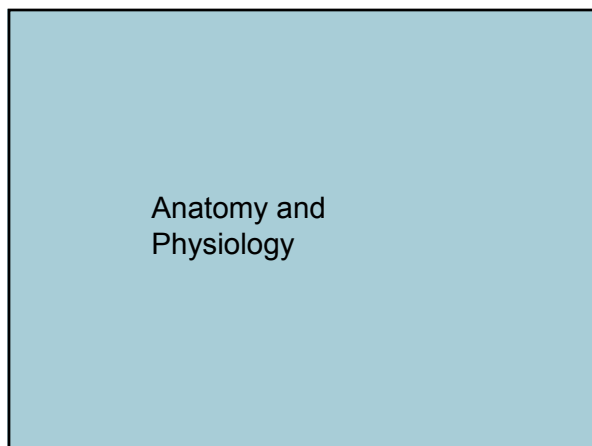
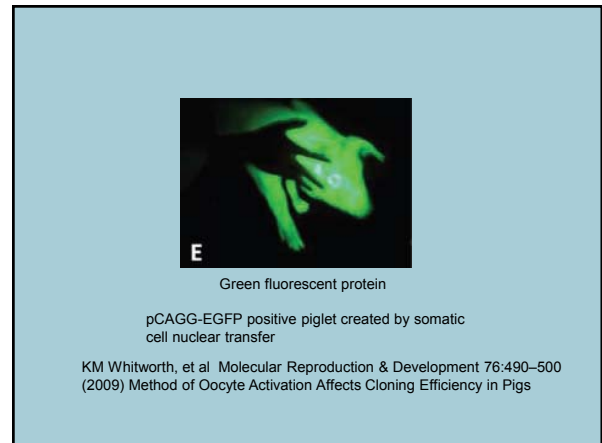
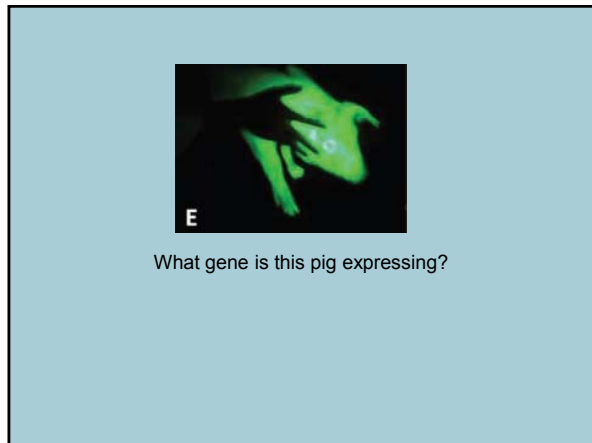
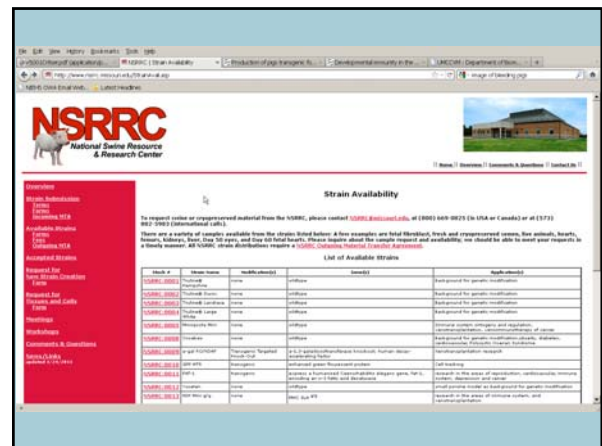
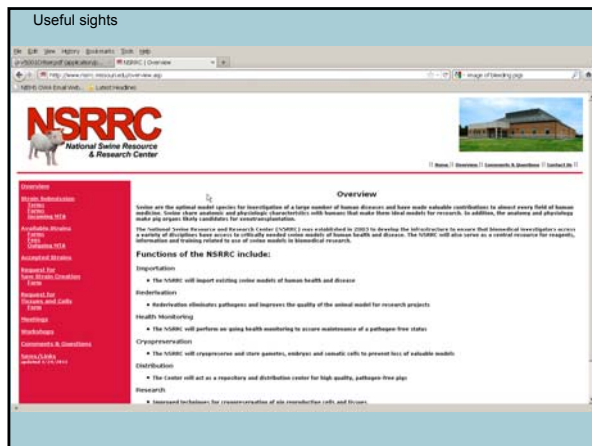
What National Veterinary Accreditation Program (NVAP) level do you need to sign a health certificate?

How many hours of CE do you need for each renewal period?

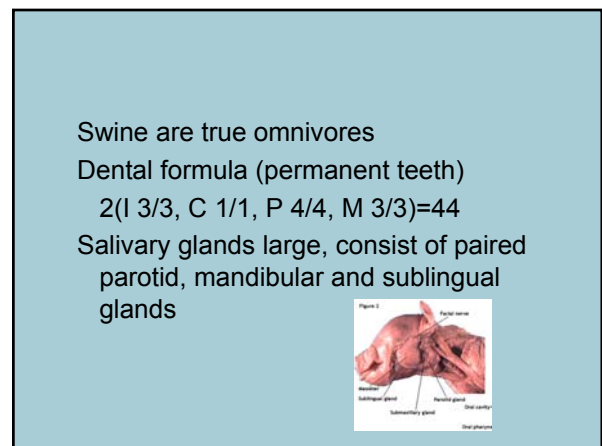
Your investigator in NC wants to ship some of his transgenic pigs to a collaborator in WV

What National Veterinary Accreditation Program (NVAP) level do you need to sign a health certificate? **Category II**

How many hours of CE do you need for each renewal period? **6 hours**



Anatomy and Physiology



- Diffuse thymus
- Diffuse tonsils



The mesenteric vessels form a **vascular arcade** in the subserosa rather than in the mesentery as in other species.

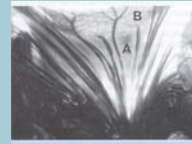
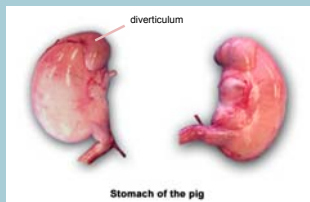


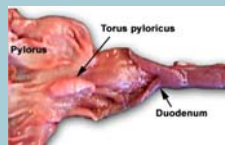
Fig. 5. Transilluminated view of the small intestine and mesentery. A-Mesentery, B-Small intestine and mesenteric vascular arcades.

<http://www.nal.usda.gov/awic/pubs/swine/fig5.jpg>

Stomach
cardiac-nonglandular (white)
fundus- glandular
diverticulum set off by spiral fold (line)
pylorus-torus pyloricus = fleshy mass (not tumor)



http://www.onemedicine.tuskegee.edu/DigestiveSystem/Stomach/Porcine_Shape.html



Mucus from Pig Stomachs Is Effective as Anti-Viral Agent: May Be Useful in Cosmetics and Baby Formula

ScienceDaily (Apr. 25, 2012)

[Mucin biopolymers as broad-spectrum antiviral agents](#)

Oliver Lieleg, Corinna Lieleg, Jesse Bloom, Christopher B Buck, and Katharina Ribbeck

Biomacromolecules, Just Accepted

Publication Date (Web): April 4, 2012 (Article)

<http://pubs.acs.org/doi/pdfplus/10.1021/bm3001292>



Stuffed Pig's Stomach (Hog Maw)

It might sound like an oddity, but pig stomach is so good. Ever since I can remember, it was my birthday dinner of choice. <http://teriskitchen.com/padutchpigstom.html>

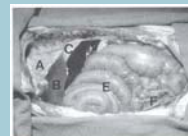
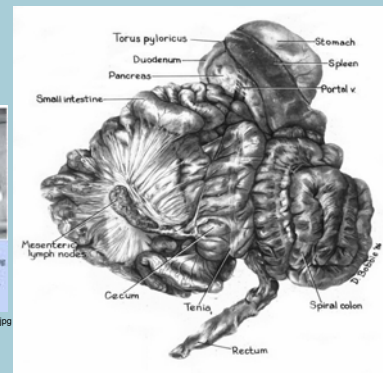
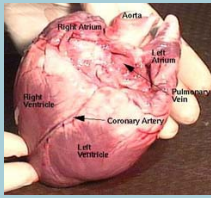


Fig. 4. View of the abdominal and part of the thoracic viscera from the left side after removing the body wall. A-Left caudal lobe of the lung, B-Liver, C-Stomach, D-Spleen, E-Spiral colon, F-Small intestine.

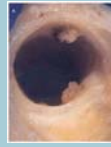
<http://www.nal.usda.gov/awic/pubs/swine/fig4.jpg>



<http://www.sincclairresearch.com/PDF%20Files/comparative%20anatomy%20of%20the%20pig%20%2806-2003%29.pdf>



atlaslearninglibrary.org



<http://www.revespcardiol.org/es/node/2027539>

40-50 kg miniature pig heart about size human heart
Coronary system similar in anatomy and function to 90% humans
Develop atherosclerotic plaques over time (fed/not fed high fat diet)
Variations between breed and age of swine
blood pressure differences in breed and age

Comparative Medicine
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by the American Association for Laboratory Animal Science

Vol 63, No 5
October 2013
Pages 445-452

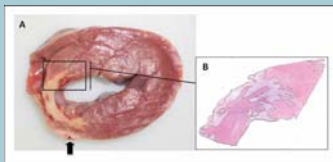
Original Research

Surgical Porcine Myocardial Infarction Model through Permanent Coronary Occlusion

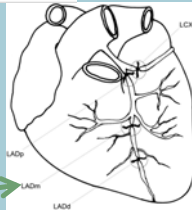
Maria R Munz,^{1,*} Miguel A Faria,² Joana R Monteiro,³ Artur P Aguiar,⁴ and Maria J Amorim⁵

Using domestic pigs as an animal model, we have validated a reproducible and standardized myocardial infarction (MI) surgical model, to achieve the largest possible infarct extent with the lowest morbidity and mortality. To this end, we included several anesthetic and perioperative precautions to minimize surgical complications. Mortality and morbidity rates were compared among groups of pigs that underwent permanent occlusion at different locations of either the left circumflex or left anterior descending artery. In addition, to compare the resulting MI between groups, data were collected by using cardiac biomarkers including troponin T, electrocardiography, and echocardiography. These data were correlated to the final mean infarct size calculated by microscopic studies. Proximal occlusions lead to high mortality rates, whereas distal occlusions induced rather small MI areas. The optimal occlusion site in terms of morbidity, mortality, and lesion extent was the midpoint of the left anterior descending artery. In this group, only one pig died, and group cardiac data showed a rise in biomarker levels, marked left ventricular dysfunction on electrocardiography and echocardiography, and well-defined transmural MI in both ventricles. Infarct size quantified through histologic studies revealed an average 15% ventricular lesion. Because interanimal variability in results from this group was negligible, we consider that the induced myocardial injury of this model is reliable.

Male mixed-breed Landrace pigs (*Sus scrofa domestica*; n = 17; age, 3 mo; weight, 30 to 42 kg) were used in this study. The pigs were supplied from a local commercial swine producer (Ferjosa, Aveiro, Portugal). Vaccinated and dewormed....



Munz, MR et al Comp Med 61(5): 445-452



Left anterior descending artery

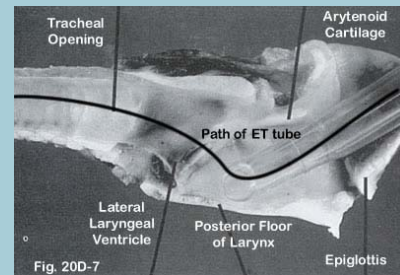


Fig. 20D-7

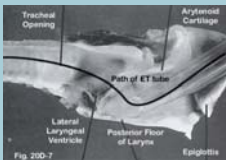
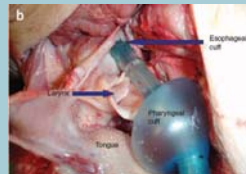


Fig. 20D-7



Lab Animal - 37, 8 (2008) Feasibility of the laryngeal tube airway for artificial ventilation in pigs and comparison with the laryngeal mask airway
Torsten Birkholz, Andrea Irouschek, Peter Kessler, James Allen Blunk, Dirk Labahn, & Joachim Schmidt

Laryngeal tube

Laryngeal mask



<http://www.labanimal.com/labanimal/v37n8/full/lab0808-371.html>

Technical Bulletin
Anesthesia and Analgesia in Swine
M. Michael Swindle, DVM, Professor and Chairman, Department of Comparative Medicine, Medical University of SC, Charleston, SC 29425

Introduction
Anesthesia and analgesia is frequently required for swine in research due to the nature of the invasive procedures that are performed. Their use as preclinical models (translational research) frequently involves surgical implantation of devices, major invasive surgery and creation of disease conditions, such as heart failure. Selection of an appropriate protocol which considers the physiologic effects of the pharmacologic agents for anesthesia/analgesia is an important aspect of designing an experiment. This article seeks to provide a practical guide to anesthetizing swine in the laboratory. More detail is provided in recent reference books.¹⁻³ This manuscript is complementary to other fact sheets on this website.⁴ Dosages of all agents in the text are in the tables at the end of the manuscript. For IV infusion protocols for all agents the infusion dosage in the tables

protocol for acute pain management:
Step 1: Peripheral nerves (nociception) transmit the pain impulse to dorsal lamina neurons. NSAIDs, given preemptively decrease the sensitivity and local anesthetics can be used to block the signal.
Step 2: Dorsal lamina neurons transmit the signal to first order neurons in the CNS. NSAIDs, opioids, and α_2 agonists would be effective at this level of pain control.
Step 3: Second order neurons may be stimulated. This may result in postinjury facilitation by non-nociceptive neurons (windup phenomenon). NMDA receptor antagonists may be necessary to inhibit transmission if this occurs.
Step 4: Conscious perception of pain or anxiety may develop in individual animals. Drugs that alter consciousness and anxiety, such as tranquilizers, may be required in the postoperative period by some

<http://www.sinclairbioresearch.com/Downloads/TechnicalBulletins/Anesthesia%20and%20Analgesia%20in%20Swine.pdf>

Technical Bulletin
Anesthesia and Analgesia in Swine
M. Michael Swindle, DVM, Professor and Chairman, Department of Comparative Medicine, Medical University of SC, Charleston, SC 29425

Selected Drug Dosages*

I. Dissociative Agents and Combinations
Ketamine 11-33 mg/kg IM, SC, IV[†]
Ketamine 10-33 mg/kg IV infusion
Ketamine 22-33 mg/kg Acetylpromazine 1.1 mg/kg IM, SC[†]
Ketamine 16 mg/kg: Azaperone 2 mg/kg IM, SC
Ketamine 20 mg/kg: Clonazepam 0.5 - 1.0 mg/kg IM, SC
Ketamine 16 mg/kg: Diazepam 2 mg/kg IM, SC[†]
Ketamine 1 mg/kg: Medetomidine 0.1 mg/kg IM, SC
Ketamine 5 mg/kg IV: Medetomidine 10 µg/kg IV infusion
Ketamine 33 mg/kg: Midazolam 500 µg/kg IM, SC
Ketamine 3-10 mg/kg IV: Propofol 6.5-10 mg/kg IV infusion
Ketamine 20 mg/kg: Xylazine 2 mg/kg IM, SC
Ketamine 2 mg/kg: Xylazine 2 mg/kg: Oxybupropion 0.075 mg/kg IV (2x dose for 1 MI)
Ketamine 10-20 mg/kg PO qid
Buprenorphine 0.1-0.3 mg/kg IM qid
Buprenorphine 0.01-0.05 mg/kg (range 0.005-0.1 mg/kg) IM q 6-12 h[†]
Carprofen 2.5-3.5 mg/kg IM q 2h 30-100 µg/kg/hour IV drip
Fentanyl 0.2 - 0.5 mg/kg IM q 2h 30-100 µg/kg/hour IV drip
Fentanyl transdermal patches 5 µg/kg/hour topical (highly variable)
Flunixin 1.4 mg/kg SC, IM, sub or oral[†]
Ketoprofen 1.0-3.0 mg/kg IM, SC, PO bid[†]
Ketorolac 1.0 mg/kg IM, SC, PO bid[†]
Meclofenoxam 0.4 mg/kg IM, SC bid[†]
Naproxen 2-10 mg/kg IM qid
Morphine epidural 0.1 mg/kg
Morphine 0.15 mg/kg IM qid
Pentazocine 1.5 - 3.0 mg/kg IM qid
Phenylbutazone 4-10 mg/kg PO bid and qid[†]

Name the condition as seen in A and C

Name the condition as seen in A and C
Horner's syndrome
eyelid ptosis, pupillary miosis, facial anhydrosis

Case Report
Horner Syndrome After Carotid Sheath Surgery in a Pig: Anatomic Study of Cervical Sympathetic Chain
Peng Ding,^{1,2} Ralph P Tufano,¹ Regina Campbell-Malone,¹ Wallace Feng,³ Sang Jun Kim,⁴ and Rebecca Z German¹

In an experimental model, iatrogenic Horner syndrome developed after a right carotid sheath surgery in an infant pig (*Sus scrofa*). Horner syndrome is a classic clinical triad consisting of ipsilateral eyelid ptosis, pupil miosis, and facial anhydrosis. This syndrome results from cervical sympathetic chain (CSC) paresis and usually is acquired in humans. To determine whether the development of Horner syndrome in this situation could be attributed to pig anatomy, we compared the anatomy of the CSC in pigs and humans, by using 30 infant pigs, 1 to 3 old pig cadavers. The CSC and cranial cervical sympathetic ganglion (CCG) were dissected bilaterally under a surgical microscope. These structures were consistently within the carotid sheaths of the pigs. In contrast, the CSC and CCG are outside the carotid sheath in humans. Awareness of the anatomic variation of the CSC and CCG

Located within carotid sheath (like dog, unlike humans)

Lungs

right:
cranial which is ventilated separately from rest lung. A bronchus cranial to bifurcation of the trachea
middle
caudal
accessory

Left:
cranial
caudal

<http://www.manteega.com/packlunch/gallery.htm>

A Model of Hemorrhagic Shock and Acute Lung Injury in Landrace–Large White Swine

Theodoros T Xanthos,^{1,2} Xanthippi A Baikamou,¹ Konstantinos I Stroumpoulis,¹ Ioannis N Pantazopoulos,¹ Georgios I Rokas,¹ Georgios D Aggogiannis,¹ Georgios T Itriopis,¹ Theano D Demestiba,¹ and Panagiotis N Skandalakis¹

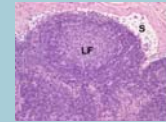
Traumatic injury is a leading cause of death worldwide for people between 5 and 44 yr of age, and it accounts for 10% of all deaths. The incidence of acute lung injury, a life-threatening complication in severely injured trauma patients remains between 30% and 50%. This study describes an experimental protocol of volume-controlled hemorrhage in Landrace–Large White swine. The experimental approach simulated the clinical situation associated with hemorrhagic shock in the trauma patient while providing controlled conditions to maximize reproducibility. The duration of the protocol was 9 h and was divided into 5 distinct phases—stabilization, hemorrhage, maintenance, resuscitation, and observation—after which the swine were euthanized. Lung tissue samples were analyzed histologically. All swine survived the protocol. The hemodynamic responses accurately reflected those seen in humans, and the development of acute lung injury was consistent among all swine. This experimental protocol of hemorrhagic shock and fluid resuscitation in Landrace–Large White swine may be useful for future study of hemorrhagic shock and acute lung injury.

Landrace-large white swine, 19+/- 2 kg, 10-15 weeks age
Conventional microbiologic status

Lymph nodes

The typical cortex and medulla are reversed with the germinal centers being located in the interior of the gland

rhinoceros, dolphin and the elephant similar



Dog lymph node



Pig lymph node

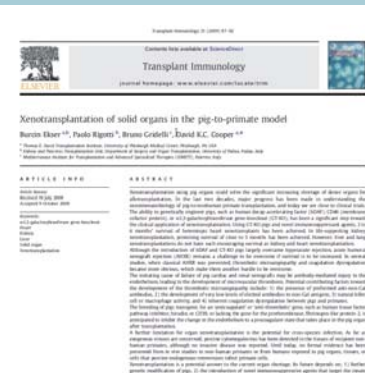
Kidneys



Fig. 8. Kidney split along the midline. A-Renal cortex, B-Medulla and collecting system.

<http://www.nal.usda.gov/iawic/pubs/swine/fig8.jpg>

J Biomed Biotechnol. 2011;2011:532127. Epub 2011 Mar 3.
Contribution of large pig for renal ischemia-reperfusion and transplantation studies: the preclinical model.
Giraud S, Favreau F, Chatauret N, Thuillier R, Maiga S, Hauet T.



New Zealand firm to trial pig cells to treat Parkinson's

100 people recommend this for the best of your friends.



(Reuters) - A New Zealand company plans to implant pig cells in the human brain in a clinical trial to treat Parkinson's disease.

The cells are taken from the brain tissue of newborn pigs from a special "clean" herd, because of the risks of diseases from modern pigs. The company uses pigs descended from a herd that was left isolated in the 1850s on an abandoned whaling station in the Auckland Islands, some 465 km (290 miles) south of New Zealand.

Reproductive
Sexual maturity 4-6 months miniatures
3-7 months others

Male:
corkscrew penis
preputial diverticulum
accessory glands
vesicular glands-most prominent
prostate
bulbo urethral

Female

21 day cycle
estrus 48 hours



Spirette



Pregnancy diagnosis
 failure to return to estrus 18-24 days after mating
 ultrasound 30 days
 progesterone >1ng/ml after 19 days gestation
 estrone sulfate 23-30 days gestation



Diffuse, epitheliochorial placenta

Gestation 114 days



Litter size

8-12/litter= commercial swine

4-6/litter= miniature swine

Neonate: require iron



Behavior

Highly social and intelligent
 Poor eyesight, good sense of smell

Group housed
 Bedding to aid natural rooting behavior
 Enrichment devices



Lab Animal - 37, 9 (2008) **The foraging ball as a quick and easy enrichment device for pigs (*Sus scrofa*)**
 Mary E. Huntsberry, Debbie Charles, Kristina M. Adams, James L. Weed



<http://www.labanimal.com/labanimaljournal/v37/n9/full/labano908-411.html>



Lab Animal - 36, 3 (2007) **A playroom as novel swine enrichment** Blair Casey, Dawn Abney & Evelyn Skoumbordis

Blood Collection

Auricular
 Cephalic
 Saphenous
 Milk vein
 Jugular
 Cranial vena cava *

* On right side to avoid left phrenic nerve



Injection sites

IM-hip, neck
 SQ-flank, neck
 IV-ear, femoral, cephalic, abdominal (milk)



<http://www.sincalresearch.com/Downloads/TechnicalBulletins/Handling,%20Husbandry%20&%20Injection%20Techniques%20in%20Swine.pdf>



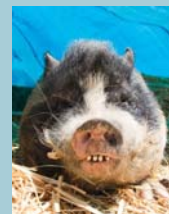
What is this?



Panepinto sling

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

Diseases and Conditions



<http://www.cfsph.iastate.edu/Species/swine.php>

The screenshot shows a web browser window with the URL <http://www.cfsph.iastate.edu/Species/swine.php>. The page is titled "Swine Diseases and Resources" and features a sidebar with navigation links such as "Swine Diseases", "Swine Health", "Swine Nutrition", "Swine Welfare", "Swine Production", "Swine Research", "Swine Education", "Swine Training", "Swine Outreach", "Swine Policy", "Swine Legislation", "Swine International", "Swine History", "Swine Future", "Swine Industry", "Swine Economics", "Swine Environment", "Swine Society", "Swine Culture", "Swine Art", "Swine Literature", "Swine Media", "Swine Music", "Swine Film", "Swine Theater", "Swine Sports", "Swine Games", "Swine Puzzles", "Swine Quizzes", "Swine Trivia", "Swine Facts", "Swine Statistics", "Swine News", "Swine Events", "Swine Calendar", "Swine Directory", "Swine Glossary", "Swine Index", "Swine Search", "Swine Feedback", "Swine Privacy", "Swine Terms", "Swine Contact", "Swine About", "Swine Home". The main content area includes a section titled "Swine Diseases and Resources" with a list of diseases and conditions, a section titled "Swine Health" with a list of health issues, and a section titled "Swine Nutrition" with a list of nutritional concerns.

The screenshot shows a web browser window with the URL <http://www.sinclairbioresources.com/Download/Products/Health-4-10.pdf>. The page is titled "Miniature Swine Production Herd Health Profile 2010" and features a table summarizing the serology testing performed at the University of Missouri for the health monitoring of the Sinclair, Hanford, and Yucatan miniature swine colonies. The table lists various pathogens and their prevalence in each colony as of October 12, 2010.

Pathogens	Sinclair	Yucatan	Hanford
APF	0/78	0/157	0/74
Brucella	0/78	0/157	0/74
Pseudotuberculosis	0/78	0/157	0/74
PRRS (Porcine Reprod Resp Synd virus)	0/10	0/20	0/10
TGE (Transmissible Gastroenteritis)	0/10	0/20	0/10
Leptospirosis*	0/10	0/20	0/10
L. Canicola	0/10	0/20	0/10
L. Grippus	0/10	0/20	0/10
L. Hardjo	0/10	0/20	0/10
L. Icterohaemorrhagiae	0/10	0/20	0/10
L. Pomona	0/10	0/20	0/10
L. Brimleyi	0/10	0/20	0/10
Indians	0/10	0/20	0/10
VSV (Vesicular Stomatitis Virus)	0/10	0/20	0/10
Influenza	0/10	0/20	0/10



Brucellosis suis

- Nonmotile, small gram negative aerobic bacillus/coccobacillus
- Infertility, placentitis, metritis, abortion, orchitis
 - DDx: Parvovirus
 - PRRV (porcine reproductive respiratory virus)
 - Leptospirosis
- Spondylitis weanling piglets
- **Zoonotic**
- **Reportable**



http://www.koevl.com/courses/vpat5215_1/vpat5310/fetus/fet07.htm

Leptospirosis

Abortion (late-term)
weak piglets
kidney disease
shed long periods

DDx:

Brucellosis
Parvo
PRRV



Placentitis

<http://www.merckvetmanual.com/mvm/html/bcigenip03.htm>



Interstitial nephritis

<http://www.merckvetmanual.com/mvm/html/bcigenip02.htm>

Porcine Parvovirus

Reproductive disease
smaller litters, abortions
deaths of a litter different ages
delayed return to estrus

Antigen test



Porcine Reproductive Respiratory Syndrome

arterivirus

Two phases

1) fever, anorexia, late term abortion
weak, stillborn pigs
no milk production

2) respiratory problems in post weanlings with
diffuse enlargement of lymph nodes



<http://www.cabi.org/lsc/compid=5&dscid=68596&loadmodule=datasheet&page=481&site=144>

Susceptibility marker found to PRRS. The marker is a quantitative trait locus, or QTL, on swine chromosome 4 that is associated with the animal's resistance to PRRS virus infection.

<http://www.porknetwork.com/pork/features/Breaking-the-PRRS-Code-145998725.html>

Stomach ulcers



pars esophaga area (stratified squamous)

Gastroguard



Disease that manifests with exposure to these agents?



Disease that manifests with exposure to these agents?
Porcine Stress Syndrome



Disease that manifests with exposure to these agents?
Porcine Stress Syndrome

Mutation in calcium-release channel protein (ryanodine receptor-RYR)

Autosomal recessive with variable penetrance

Landrace and Pietrain especially

Signs include: dyspnea, reddened skin, increased body temperature, cyanosis, muscle rigidity and collapse

Cull

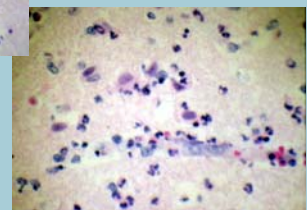
Pre-treat with dantrolene (decreases release of calcium)

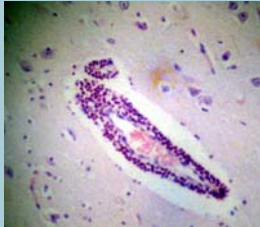


Newly received pig found appearing tense with ears erect. Before treatment could be initiated, pig went recumbent and paddled continuously so was euthanized.

Histology of the brain

Most likely cause?





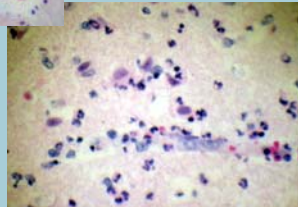
Pig found appearing tense with ears erect. Before treatment could be initiated, pig went recumbent and paddled continuously so was euthanized.

Histology of the brain

Most likely cause? Water deprivation/salt toxicity

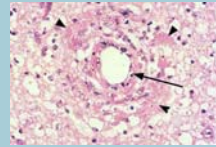
DDx of signs:

pseudorabies
hog cholera
edema disease
Streptococcus meningitis



• Edema disease-hemolytic E. coli

- Enterotoxemia (E. coli)
- Recently weaned
- Death, moribundity, ataxia, stupor



Fibrinoid degeneration vessel (arrow)

Perivascular edema (the pink staining material at arrow head)

http://www.koenvi.com/courses/vpat5215_2/vpat5320/noframes/VAS/vas07.htm

Pseudorabies

Mad cow itch
Commercial swine free of it
Concern in wild/feral swine
Other species infected die, pigs can be carriers

Neonates—CNS signs, posterior paresis, death
Older (9 weeks or older) —more respiratory signs-sneeze, nasal discharge, cough (ddx: influenza, porcine respiratory corona virus)

Reportable, aim to eradicate



Ear of pig



Dog is now scratching



<http://www.icb.usp.br/~marcelcp/imagens/carr27.jpg>

Found on scraping of pig



sarcoptic mange, Sarcoptes scabiei
zoonotic



Name the louse?
Is it sucking or chewing?
Vector for what?



Name the louse? Haematopinus suis
Is it sucking or chewing? Sucking
Vector for swine pox and Eperythrozoon suis



Greasy pig
Exudative epidermitis
Staphylococcus hyicus
Groin, axillae, behind ears and spreads

DDx:
acariasis
swine pox
ringworm
pityriasis rosea (now called porcine juvenile pustular psoriaform dermatitis)

Ringworm (uncommon)



<http://www.aasv.org/shape/issues/v13n2/v13n2p66.html>

Microsporum nanum

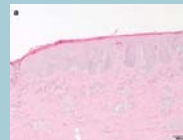
porcine juvenile pustular psoriaform dermatitis

Old name: pityriasis rosea
Partially hereditary
Not pruritic
Resolves 6-8 weeks

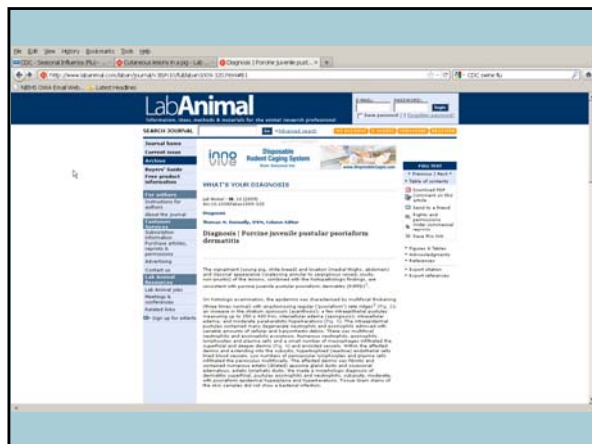
Can get secondary *S. hyicus* infections



<http://www.merckvetmanual.com/mvman/index.jsp?cfile=html/bc/73000.htm>
Courtesy of Dr. Ranaki D. A. Cameron



<http://www.labanimal.com/labanimaljournal/v38/n10/full/labani1009-320.html#B1>



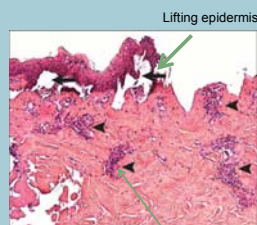
Lab Animal - 38, 7 (2009)
Blistering dermatosis in a Yucatan minipig
 Gregory O. Voronin, William P. Porter & Zadok Ruben



1.5 year old Yucatan minipig
 Castrated
 Colony of six-only one with lesions
 Been there 8 months
 Pens sanitized every two weeks
 Standard feed
 Lesions along dorsal midline 1.5 cm

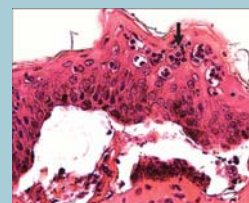
<http://www.labanimal.com/labanimal/v38n7/full/lab0709-230.html>

Lab Animal - 38, 7 (2009)
Blistering dermatosis in a Yucatan minipig
 Gregory O. Voronin, William P. Porter & Zadok Ruben



Diagnosis?

<http://www.labanimal.com/labanimal/v38n7/full/lab0709-230.html>



Spontaneous Bullous pemphigoid

<http://www.labanimal.com/labanimal/v38n7/full/lab0709-230.html>



From: Merck Manual, Courtesy of Dr. Ranald D. A. Cameron

A group of 2 1/2 month old feeder pigs are presented with non-pruritic keratinized skin lesions and mild lethargy. One severely affected animal is depressed and anorexic. What treatment is most appropriate for the presumptive diagnosis?

- ☐ A - Spray with malathion (0.05%)
- ☐ B - Supplement dietary zinc
- ☐ C - Copper sulphate bath or sprays
- ☐ D - Ivermectin SQ now, repeat in 2 weeks
- ☐ E - High dose trimethoprim-sulfonamide 7-10 days



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Zinc deficiency= parakeratosis
 4-6 month old swine
 Slower growth rate and skin lesions

In pigs, zinc deficiency causes **parakeratosis**. Zinc supplementation will resolve clinical signs.
 Starter diets should contain 125 ppm zinc (and 0.9% calcium)
 Grower diets should contain 75 ppm zinc (and 0.60-0.65% calcium)
 Finisher diets should contain 50 ppm zinc (and 0.45 to 0.50% calcium)

DDx:
 greasy pig disease-younger, suckling pigs
 sarcoptic mange

Swine pox

usually 3-6 weeks of age
 rarely fatal
 midwest US
 swine pox virus



<http://www.merckvetmanual.com/mvm/index.jsp?cfile=html/bc/71106.htm>

Courtesy of Dr. Paul Gibbs



<http://www.thepigsite.com/swinenews/12352/nadis-pig-veterinary-report-and-forecast-september-2006>

Most likely disease?

Is it zoonotic?



heart



<http://www.thepigsite.com/swinenews/12352/nadis-pig-veterinary-report-and-forecast-september-2006>

Most likely disease? Erysipelas

Is it **zoonotic**? yes



<http://www.thepigsite.com/articles/1/pig-health-and-welfare/250/erysipelas-why-is-it-still-a-problem-after-100-years>



heart

<http://www.thepigsite.com/articles/1/pig-health-and-welfare/250/erysipelas-why-is-it-still-a-problem-after-100-years>



Differential for this lesion?



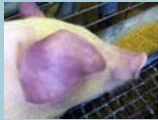
Bacterial septicemia-hog cholera, Salmonella (choleraesuis), Erysipelas, Streptococcus (suis) Haemophilus



<http://www.thepigsite.com/articles/3119/glassers-disease>



http://www.pig333.com/glasser_disease/clinical-and-pathologic-diagnosis_1589/

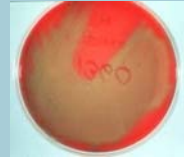


Haemophilus parasuis
 opportunistic with swine influenza
 DDx: Mycoplasma (M. hyorhinis) polyserositis, arthritis
 Salmonella, Strept (suis), Erysipelus with septicemic signs

Streptococcus suis

Meningitis, arthritis, serositis, and endocarditis
 Post weaning, growing pigs (5-16 weeks age)
 Alpha hemolytic Streptococcus
Zoonotic

Suppurative meningitis, polyarthritis
 Fibrinous bronchopneumonia



<http://www.merckvetmanual.com/mv/index.jsp?file=html/bo/54302.html&word=Streptococcus%2csuis>

Courtesy of Dr. John Prescott

Salmonella choleraesuis

mostly pig adapted-disease in immunocompromised humans
 acute septicemia in swine
 death with cyanotic skin, hemorrhagic lymph nodes and spleen,
 fluid filled lungs

DDx: other septicemia Erysipelothrix rhusiopathiae,
 Streptococcus suis, or Actinobacillus suis, A. pleuropneumoniae,
 edema disease (E. coli), mulberry heart disease, hog cholera



Other diseases of xenotransplantation concern:

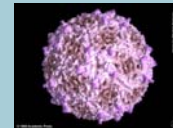
Cytomegalovirus



Hepatitis E

EMCV-encephalomyocarditis virus

Gamma lymphotropic herpes virus

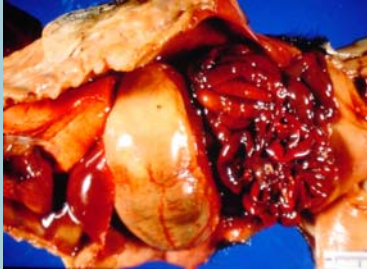


Differential Diagnoses?



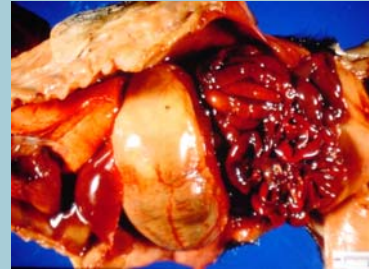
Differential Diagnoses?
 Salmonella (S. typhisuis)
 Hog cholera

2 day old piglet; gas distended stomach and fibrinous
necrohemorrhagic enteritis-what do you suspect?



2 day old piglet; gas distended stomach and fibrinous
necrohemorrhagic enteritis-what do you suspect?

Clostridium perfringens C

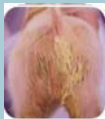


Differential Diagnoses for Neonatal Diarrhea

Clostridial enteritis (*C. perfringens* Type C)-death, necrotic,
hemorrhagic diarrhea
TGE-coronavirus-profuse watery diarrhea, mortality high in pigs less
one week of age
Coccidiosis (*Isospora suis*)
Rotavirus
E. coli (colibacillosis)



http://www.beycox.es/44/Isospora_suis_Taxonomy_and_Life_Cycle.htm



http://www.bayervet.net/vz_008_02.html



<http://www.merckvetmanual.com/mvm/index.jsp?file=htm/b/222303.htm> Courtesy of Dr. J Glenn Songer

Post weaning enteritis

Salmonella
TGE
Swine dysentery-- *Brachyspira hyodysenteriae*
Colibacillosis-enteropathogenic *E. coli*
Porcine Proliferative Enteritis
Whipworms (*Trichuris suis*)



<http://www.rvc.ac.uk/review/parasitology/pigEggs/Trichuris.htm>



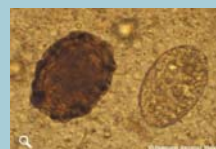
<http://www.thepigsite.com/articles/2764/swine-dysentery>



<http://www.merckvetmanual.com/mvm/index.jsp?file=htm/b/222311.htm>
Courtesy of the Department of Pathobiology, University of Guelph

Porcine Proliferative Enteritis

Lawsonia intracellularis
Ileum/colon
Acute death, mucoid/hemorrhagic diarrhea
R/O: Salmonella, Whipworms



Ascaris suum



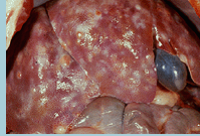
Strongyloides ransomi



Strongyle



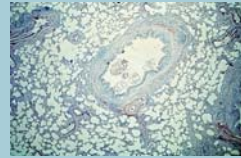
Stephanurus dentatus
Kidney worm
Egg found in urine



Lesions from migrating kidney worm



<http://vetpda.ucdavis.edu/parasitology/Parasite.cfm?ID=132>



Metastrongylus
M. elongatus
Earthworm = intermediate host



<http://vetpda.ucdavis.edu/parasitology/Parasite.cfm?ID=94>



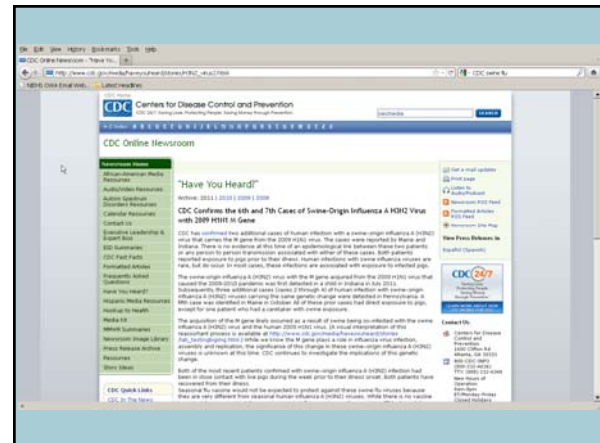
http://uk.merial.com/products/swine/woe/woe_04.asp



Swine Influenza

new animals in herd
high morbidity, low mortality
ddx: bacterial pneumonia
signs: fever, conjunctivitis, barking cough, open mouth breathing,
reluctant to move
resolves 5-7 days

Zoonotic!



Name the condition.

Name 3 bacterial agents implicated in the cause



Name the condition. Atrophic rhinitis

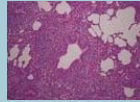
Name 3 bacterial agents implicated in the cause
Pasteurella multocida
Bordetella bronchiseptica
Haemophilus parasuis



Mycoplasma hyopneumoniae

Usually older pigs (3-6 months)

PRRS-virus is known to aggravate *M. hyopneumoniae*
Secondary bacterial infections common



<http://www.respig.com/diseases/m-hyo.asp>

Actinobacillus pleuropneumoniae

fibropurulent pneumonia
older (8-16 weeks)
acute-fever, labored breathing, inactivity
peracute-death
chronic-cough, decreased weight gain



<http://www.respig.com/diseases/app.asp>

What product/factor is required to grow this agent in vitro?

Actinobacillus pleuropneumoniae

fibropurulent pneumonia
older (8-16 weeks)
acute-fever, labored breathing, inactivity
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chronic-cough, decreased weight gain



<http://www.respig.com/diseases/app.asp>

What product/factor is required to grow this agent in vitro?

Factor V or Nicotinamide adenine dinucleotide (NAD)

Can co-culture with *Staph aureus* (which produces NAD)—
what results when colonies of this agent are grown near beta
toxicogenic *S. aureus*?

Actinobacillus pleuropneumoniae
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older (8-16 weeks)
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<http://www.respig.com/diseases/app.asp>

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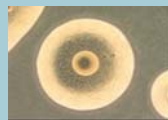
Christie-Adkins-Munch-Peterson (CAMP)
phenomenon—increased zone of hemolysis greater than the partial lysis created by the *S. aureus*



<http://www.vetbact.org/vetbactblog/page3>



What is the etiologic diagnosis?



<http://hpacultures.org.uk/services/mycotesting/education/mycocultureisolation.jpg>

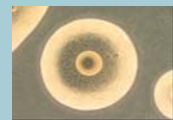


Serofibrinous arthritis

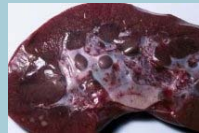
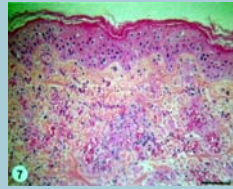
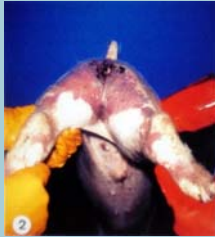
What is the etiologic diagnosis?

Mycoplasma hyorhinis

Polyserositis and Arthritis



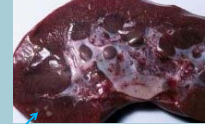
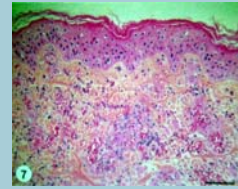
<http://hpacultures.org.uk/services/mycotesting/education/mycocultureisolation.jpg>



Seen towards end of weaning
Vasculitis, erythema
Kidneys congested with white foci

What is the condition?

<http://www.porcilis-pcv.com/pcvd/pdns.asp>

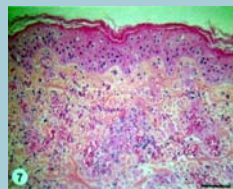


Seen towards end of weaning
Vasculitis, erythema
Kidneys congested with white foci

What is the condition?
Porcine dermatitis and nephropathy syndrome

What is the suspected agent?

<http://www.porcilis-pcv.com/pcvd/pdns.asp>



Seen towards end of weaning
Sporadic in group
Vasculitis, erythema
Kidneys congested with white foci

What is the condition?
Porcine dermatitis and nephropathy syndrome

What is the suspected agent?
Porcine Circovirus 2

<http://www.porcilis-pcv.com/pcvd/pdns.asp>

Porcine Circovirus II
pneumonia
wasting, anemia
8-20 weeks age



Red, wet, heavy
lungs

Pigs difficulty breathy
Necropsy: pulmonary edema

Feed looks like this.

What is your top differential?



Pigs difficulty breathy
Necropsy: pulmonary edema

Feed looks like this.

What is your top differential?

Fumonisin toxicosis
Mycotoxin of Fusarium spp

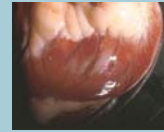




You see these lesions in a swine colony. What are you going to do?
What diseases are you thinking of?

All vesicular diseases **reportable**

Foot and Mouth Disease
heart lesions, cloven hoofed
exotic
Aphthovirus



Swine Vesicular Disease
enterovirus
only swine

Vesicular Stomatitis-
Vesicular virus
endemic, zoonotic

Vesicular Exanthema
Virus indistinguishable from VE has been found in what
species causing what disease?

Vesicular Exanthema
Virus indistinguishable has been found in what
species causing what disease?



Vesicular Exanthema
Virus indistinguishable has been found in what
species causing what disease?

San Miguel sea lion virus disease

-isolated from throat and rectal swabs from 4-mo-old
California sea lion pups, weanling northern fur seal pups,
and nursing northern elephant seal pups.
-isolated from commercial seal meat produced in Alaska
and some kind of fish
-SMSV isolated from both fish and marine mammals is
capable of producing VES in pigs.

