Advanced Macropod Course 2016

Myopathy, Urology, Jaw Problems, Herpes Virus

Dr Rosemary Austen

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Where traumatised wildlife can recover in safety

Thank you

Thank you to all those who attended the course. It was designed to give a basic understanding of the complex biochemical processes which result in the symptoms which we observe in myopathy, as well as current information on other common and significant macropod problems.

I hope carers will find the information useful in caring for wildlife in distress.

The knowledge that wildlife carers accumulate can also assist the ongoing presence of macropod species for future generations to enjoy.

Today's abundant species is tomorrow's endangered species.

Keep up the good work and enjoy being a macropod carer.

Rosemary (February 2016)

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Advanced Macropod Course 2016

Program

- 9.00 – 10.30 – Myopathy
- 10.45 – 12.15 – Urology
- 1.00 - 1.45 – Jaw problems
- 1.45 – 2.15 – Kangaroo Herpes virus
- 2.30 – Finish – Open forum/ discussion

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Introduction

Some Guiding Principles for Wildlife Carers

- First, do no harm (*primum non nocere*)
- Ensure adequate skills & knowledge
- Do not cause unnecessary pain or distress
- Understand that evidence of treatments in wildlife medicine is often anecdotal & not proven in scientific trials

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Stress Myopathy

- **Major trigger – stress caused by fear or anxiety**
- **Risk increased by physical exertion**
- **Obvious causes – macropod caught in a fence, chased by a motor vehicle or dogs will definitely have stress myopathy. Severity varies**
- **Some causes more subtle, eg change in carer, relocation to release site or certain noises**
- **Personality of the animal also plays a role in whether stress myopathy develops**

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Important concepts

Two concepts are important in understanding the development of stress myopathy:

- Sympathetic nervous system & the hormone adrenalin
- Aerobic & anaerobic metabolism

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Fear factor

Fear & anxiety trigger the sympathetic nervous system & synthesis & release of adrenalin

Sympathetic - fight or flight	Parasympathetic – rest and digest

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Sympathetic nervous system: Effects

- Stimulates release of adrenalin
- Stimulates glucose release from liver
- Diverts blood away from gut and skin
- Enhances blood flow to skeletal muscles (1200%), brain & lungs
- Dilates bronchioles (airways) of lungs allowing better oxygen exchange
- Increases heart rate and contractility of heart cells
- Dilates cardiac blood vessels
- Dilates pupils.

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Useful reference: ***Energy Systems.*** **http://www.teachpe.com/physiology/energy_systems.php.**

The Adrenalin Rush

Adrenalin contributes to the fight or flight response by:

- increasing blood flow to the muscles
- increasing output of the heart
- pupil dilation
- increasing blood glucose

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Aerobic metabolism

Glucose

↓ Glycolysis – in cell cytoplasm

ATP (energy source) + Pyruvate + H^+ (acid)

O_2 → Krebs cycle
Electron transport chain –in cell mitochondria

↓

CO_2 (exhaled during respiration) + H_2O + ATP (energy source)

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Anaerobic metabolism

Glucose

↓

Glycolysis – in cell cytoplasm

ATP (energy source) + Pyruvate + H^+ (acid) → Lactate

OR

Creatine kinase (CK)

Creatine phosphate → Creatine + energy – in muscle cells

Phosphate + ADP → ATP (energy source)

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Useful reference: http://www.teachpe.com/physiology/energy_systems.php

Stress myopathy - consequences

Sympathetic stimulation + Adrenalin + Anaerobic metabolism due to prolonged fear or anxiety & strenuous activity

Consequences

- Tissue ischaemia due to reduced tissue perfusion
- Lactic acidosis
- Muscular ATP (energy source) depletion
- Muscle cell damage & consequent release of myoglobin & potassium
- Compartment syndrome due to muscle swelling
- Acid stimulation of nerve endings in muscles causing muscle pain
- Rapid respiratory rate due to metabolic acidosis
- Cardiac rhythm disturbance due to hyperkalemia (high potassium)
- Hyperthermia (temp > 37 deg C)
- Myoglobinuric nephrosis
- Acute renal failure if severely dehydrated
- Pulmonary oedema

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What you might observe (signs of stress myopathy)

- Hyperthermia (> 37 Deg C)
- Tachypnoea (rapid respiratory rate). $H^+ + HCO_3^- \leftarrow CO_2 + H_2O$

  Acid + Bicarbonate ion (Acidity reduced) — Carbon dioxide + Water (Exhaled during rapid respiration)
- Tachycardia (rapid heart rate)
- Brown (Coca Cola) urine
- Stiff limbs
- Pain – macropod appears uncomfortable (eg stretching hind legs)
- Muscle fasciculation
- Elevated CK (if able to do a blood test in the acute situation the CK would be significantly elevated.

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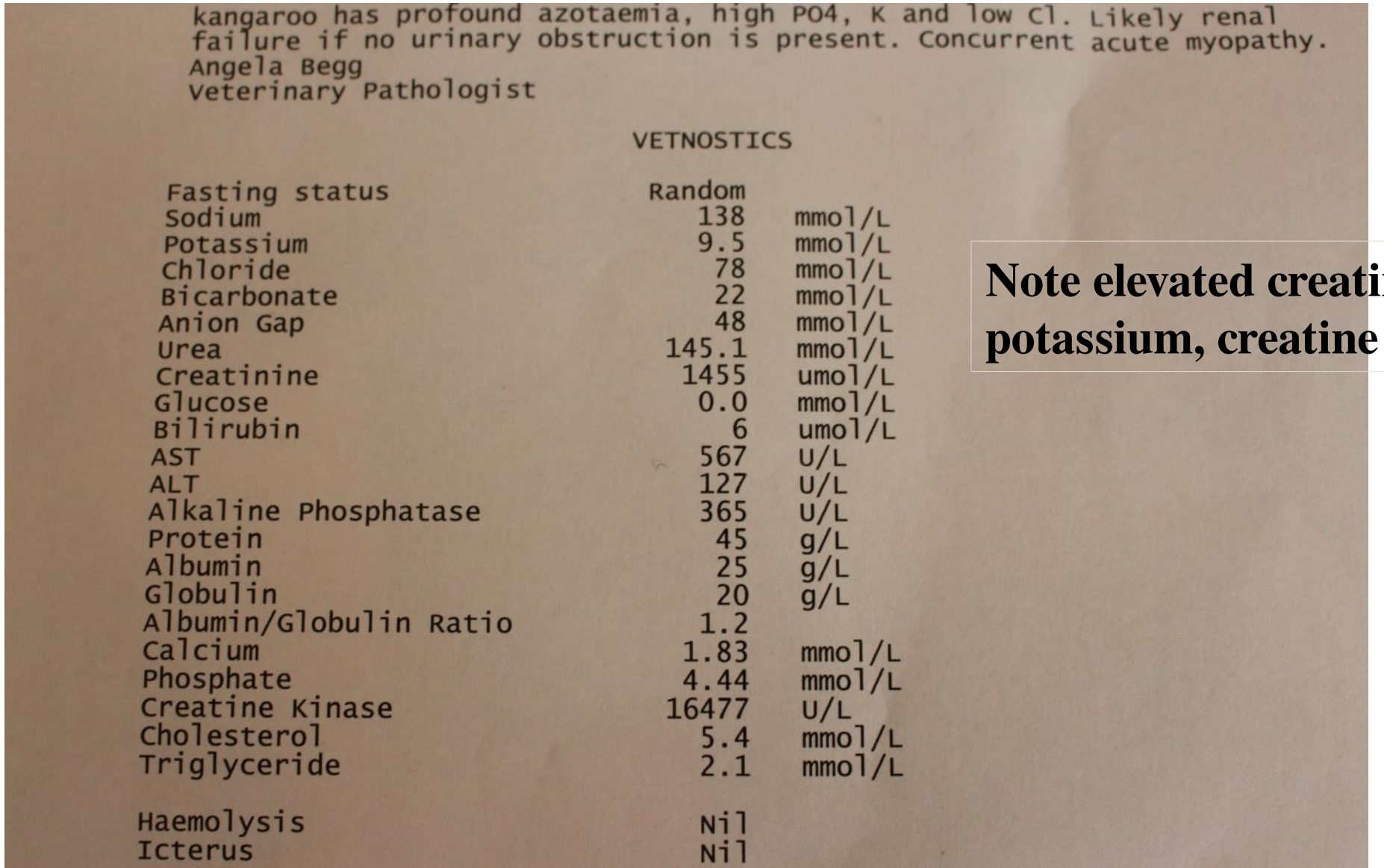
Biochemistry: Ellie - Myopathy & Renal failure



kangaroo has profound azotaemia, high PO4, K and low Cl. Likely renal failure if no urinary obstruction is present. Concurrent acute myopathy.
Angela Begg
Veterinary Pathologist

VETNOSTICS

Fasting status	Random	
Sodium	138	mmol/L
Potassium	9.5	mmol/L
Chloride	78	mmol/L
Bicarbonate	22	mmol/L
Anion Gap	48	mmol/L
Urea	145.1	mmol/L
Creatinine	1455	umol/L
Glucose	0.0	mmol/L
Bilirubin	6	umol/L
AST	567	U/L
ALT	127	U/L
Alkaline Phosphatase	365	U/L
Protein	45	g/L
Albumin	25	g/L
Globulin	20	g/L
Albumin/Globulin Ratio	1.2	
Calcium	1.83	mmol/L
Phosphate	4.44	mmol/L
Creatine Kinase	16477	U/L
Cholesterol	5.4	mmol/L
Triglyceride	2.1	mmol/L
Haemolysis	Nil	
Icterus	Nil	

Note elevated creatinine, urea, potassium, creatine kinase, AST

Treatment of stress myopathy

- Diazepam (0.25mg/kg IM or SC) – anxiolytic & muscle relaxant
- Check temperature (tympanic thermometer - ear)
- Offer water – warm or cool, + /- glucose
- If hyperthermia (> 37) - cool animal (eg wet towel & fan). Cool IV fluids most effective but not normally necessary
- If hypothermia (< 35) – warm animal (eg electric throw rug)
- If still tachypnoeic after Diazepam & cooling give sodium bicarbonate – sterile infusion 8.4% – 1ml/kg made up to 60ml with normal saline and given SC – see equilibrium equation earlier slide
- Analgesia – Tramadol (1mg/kg IM) or Painstop (1ml/ 2kg oral).

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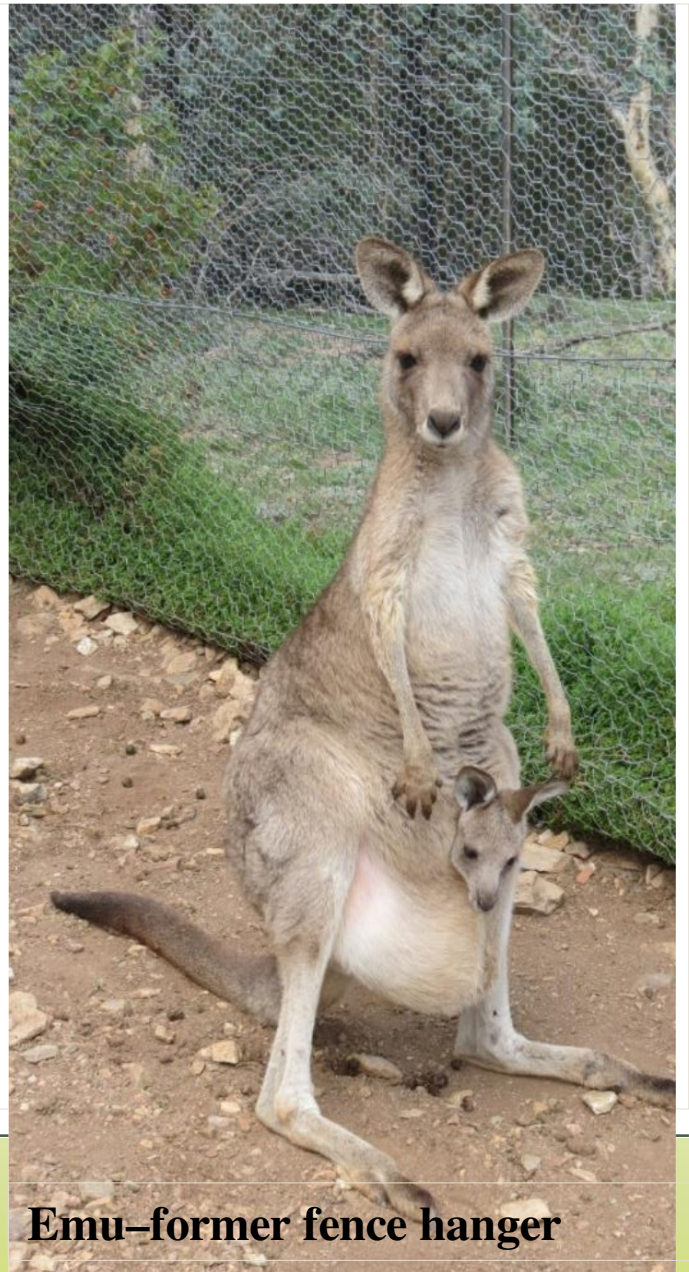


Emu–former fence hanger

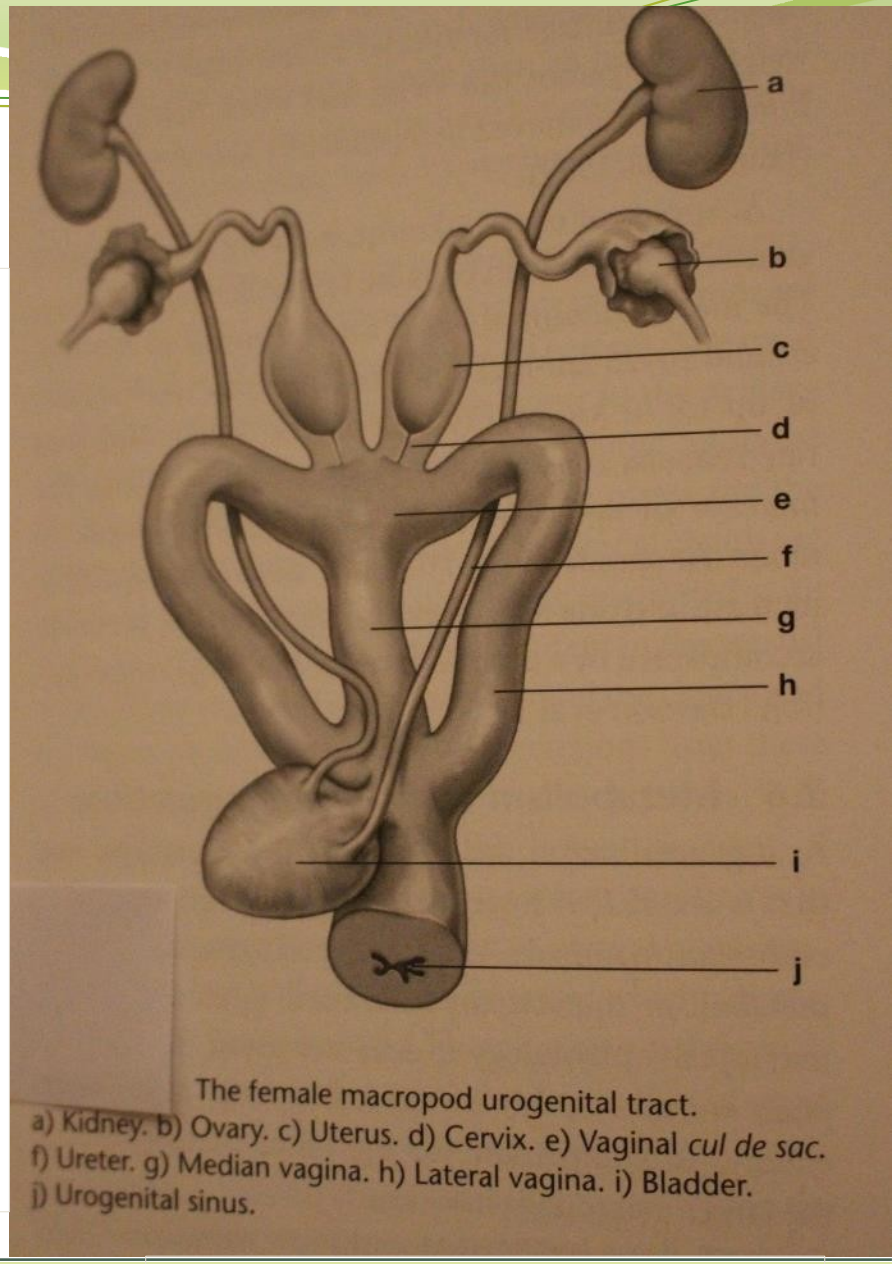
Treatment of stress myopathy (Cont)

- Glucose – 1% (1gm/ 100ml water) oral or in fluids
- Fluids – 30% by weight SC fluids – normal saline or 4% glucose + 1/5 normal saline
- Antibiotics – Betamox LA (0.1 – 0.3ml/ kg SC) &/ or Oxytetracycline (1ml/ 10kg IM)
- Vitamin E/Selenium – (0.02 – 0.05ml/ kg IM) if physical exertion involved
- Optional – Fluphenazine (Modecate), steroid (Dexamethasone), Frusemide (Lasix) sometimes used
- Dantrolene Sodium (1ml/ kg IV) is mentioned in some texts as a skeletal muscle relaxant but is expensive.

Bea – fence hanger - required one dose of bicarbonate SC

Urology

- Females – the bladder opens into the urogenital sinus with vaginae. The external opening is in the cloaca rostrally
- Males – the urethra in male macropods has valve like cusps about 2-3cm proximal to the external opening. Free margin directed towards external urethral opening – makes catheterisation very difficult even when not blocked by crystals.



The female macropod urogenital tract.
a) Kidney. b) Ovary. c) Uterus. d) Cervix. e) Vaginal *cul de sac*. f) Ureter. g) Median vagina. h) Lateral vagina. i) Bladder. j) Urogenital sinus.

Vogelnest & Woods, p.140

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Urinalysis – Multistix 10 SG

Test name	Description
LEU (Leucocytes)	White blood cells. Positive can indicate infection
NIT (Nitrites)	Not normally present in urine. Positive can indicate infection
URO (Urobilinogen)	Usually present in small amounts in urine. Strong positive can indicate red blood cell breakdown
PRO (Protein)	Positive can indicate kidney pathology, eg renal failure
pH	Macropods eating grass or Lucerne have a strongly alkaline urine (High pH 8.0 – 8.5). Joeys on formula have a lower pH urine
BLO (Blood)	Positive can indicate infection, renal failure or myoglobinuria
SG (Specific gravity)	High SG (1.030) can indicate dehydration. Normal SG (1.010 – 1.020). Low SG (1.000) can indicate renal failure
KET (Ketones)	Ketones are a product of fat breakdown, eg. Low carbohydrate diet or starvation. Also seen in poorly controlled diabetes
BIL (Bilirubin)	Positive can indicate liver damage or hepatic duct blockage
GLU (Glucose)	Positive can indicate diabetes, steroid treatment or glucose in fluids

Crystalluria - causes

- Underlying problem is dehydration – diarrhoea, overheating, inadequate water in their diet

- Often affects joeys commencing on solids. Grass and Lucerne result in a more alkaline urine.

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Crystalluria - signs

- First sign – often joey scratches at cloaca. With observation - straining to pass and dribbling of urine noted
- Urine analysis usually shows alkaline (high pH) urine. Can also be blood and leucocytes
- **Need to treat quickly to prevent complete blockage of the urethra**
    - Crystals can cause severe inflammation in the urethra and the penis can become red, tender and swollen.

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Crystalluria treatment

- Fluids – oral or sub-cutaneous
- Acidify urine – to dissolve crystals. Vitamin C – ascorbic acid 100mg oral 4 X daily. IM more effective but invasive – ascorbic acid (500mg/ ml) 0.5 – 1.0ml IM twice daily. Check pH of urine – need to get pH below 7 (5-6 better)
- Ilium Neocort (lignocaine, neomycin, hydrocortisone) to penis. Haemorrhoid cream (non-prescription) OK (eg. Proctosedyl ointment). To expose penis apply gentle pressure to base of cloaca
- Buscopan (Hyoscine butylbromide). Oral - crush 1 tablet, suspend in 3ml boiled water. Use 0.1ml/ kg 4 times daily. SC – Buscopan or Spasmogesic 0.1ml/ kg twice daily.

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Crystalluria treatment Cont

- Diazepam 0.05ml/kg (0.25mg/kg) SC. Oral – crush ½ tablet and suspend in 3ml boiled water. Use 0.3ml/kg three times daily if needed
- Tamsulosin (Flomaxtra) relaxes smooth muscle in urethra allowing crystals to pass. Crush ¼ tablet and add 15ml boiled water. Use 0.1ml/kg oral single dose
- Antibiotic – Betamox LA 0.1 – 0.3ml/ kg SC
- Emergency treatment – suprapubic tap (removal of urine via abdomen using small gauge 23G needle and great care – veterinary procedure).

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Urinary tract infection

- **Joey can appear uncomfortable when passing urine, pass urine frequently, dribble urine and wet its bag**
- **Urinalysis can show leucocytes, blood, protein**
- **Treat with increased fluid intake and antibiotics Gentamicin best but animal needs to be hydrated and IV access required. Can also use Trivetrin, Baytril or Betamox SC or IM.**

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Abnormal Urinalysis: Other causes

- **Myopathy. Myoglobinuria (positive for blood), acid pH**
- **Renal failure. Urinalysis can show blood, protein and low SG (1.000). Always do urinalysis in joeys showing failure to thrive**
- **Snake bite. Rhabdomyolysis results in myoglobinuria (positive for blood)**
- **Trauma. MVA can result in blood in urine. Can be microscopic haematuria (positive for blood on urinalysis) or macroscopic haematuria (seen on visual examination).**

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Mouth & Jaw Problems

- Malocclusion
- Tooth problems
- Mouth infection
- Lumpy jaw
- Trauma
- Deformity

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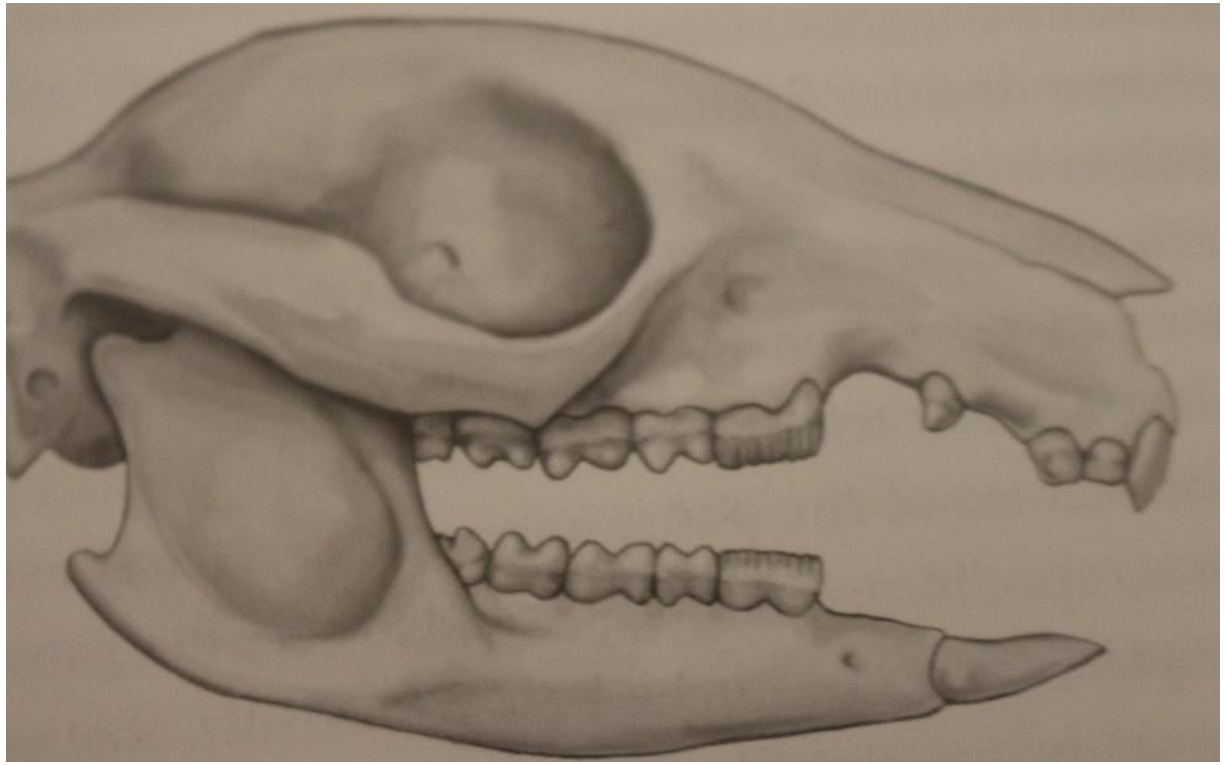
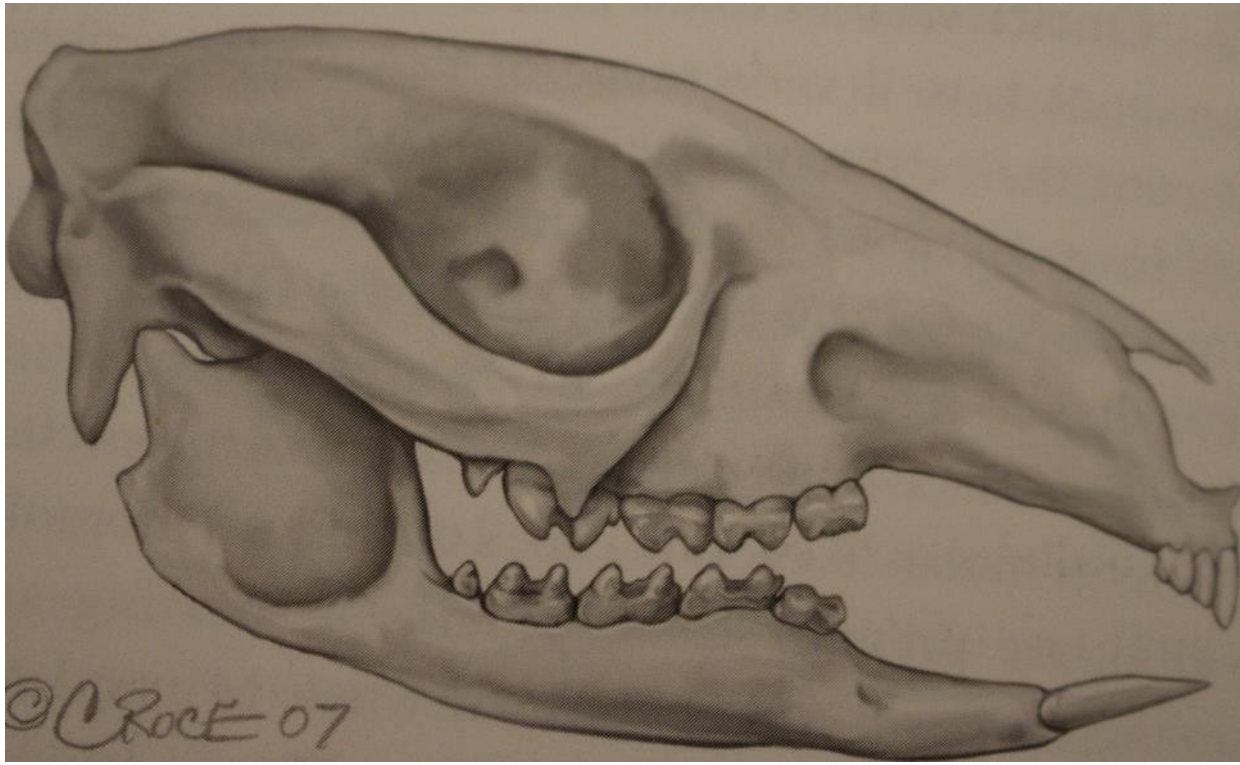
Macropod Skull & Dentition



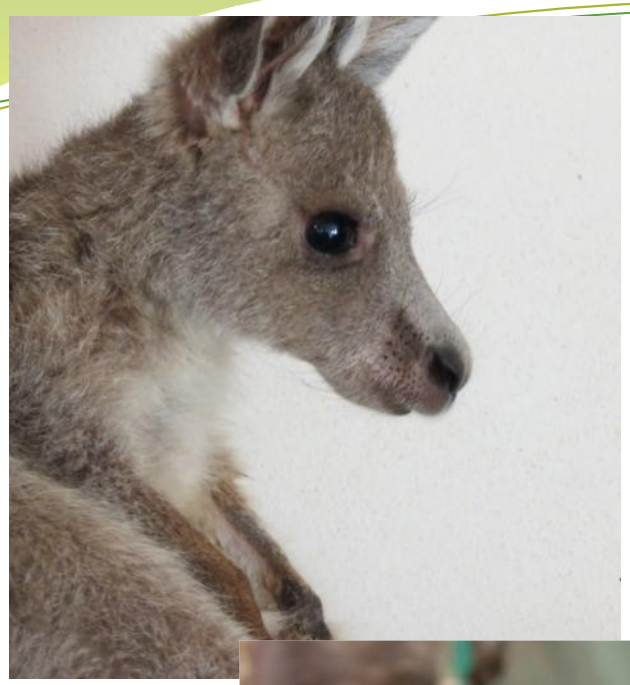
Macropod browser (eg Swamp Wallaby)



Macropod grazer (eg Eastern Grey Kangaroo)

Vogelnest & Woods, p.136

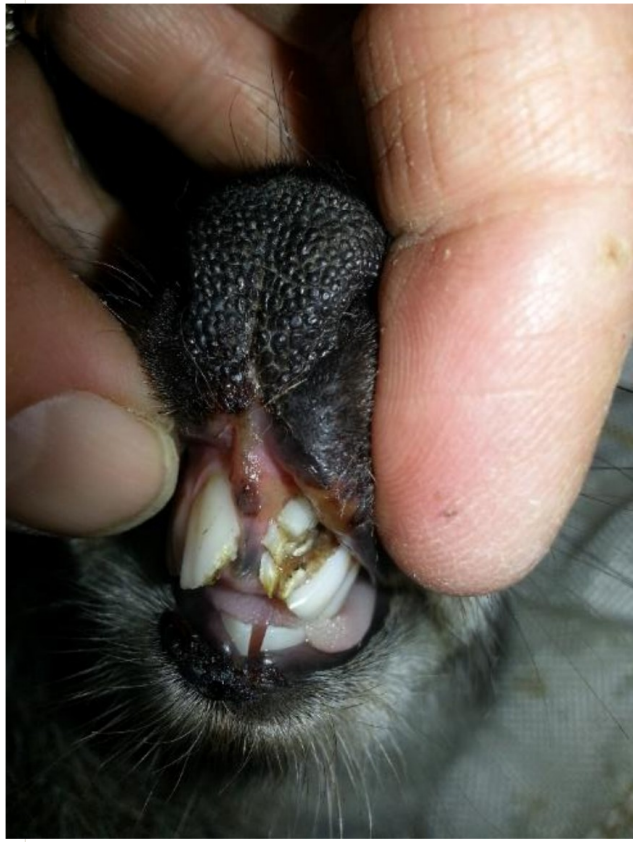
Malocclusion - Spencer

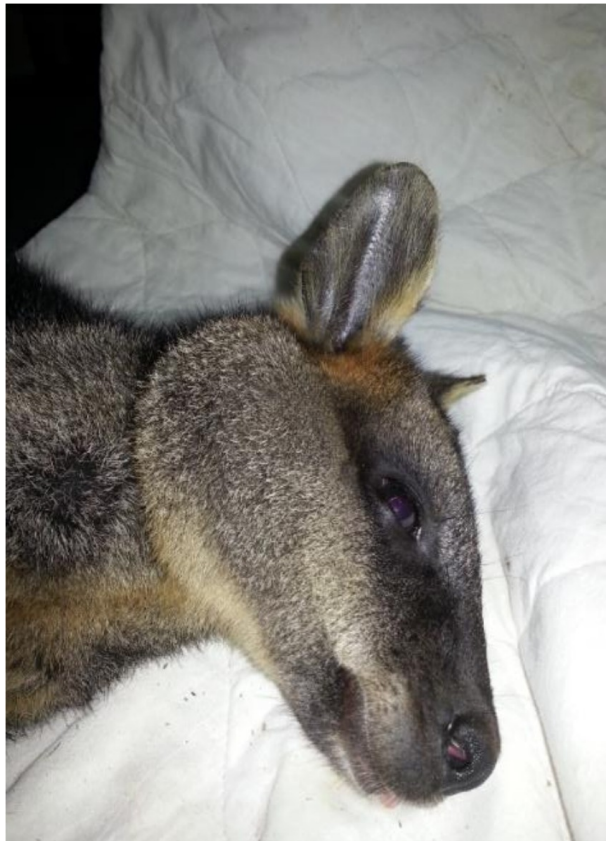


- Misalignment or incorrect relation between teeth of upper & lower jaw as the jaws close
- Seen in small joeys, especially if they suck part of the body eg toe, wrist or tail causing their mouth to be held open for long periods
- Normally joeys would be attached to the teat and sucking most of the time
- Bandaging can discourage joeys from sucking body parts. Some joeys will accept teats as a dummy. Offer joeys grass with roots attached
- Once joey starts eating hard food and stops sucking the body part malocclusion will normally resolve. Rarely do the teeth need to be filed.

Tooth Problems

- Broken teeth. It is recommended that loose or severely broken teeth are removed because of the risk of infection at a later date eg after release
- Infected teeth (Mickey). Lump developed on face over one week. X-Ray showed a dental abscess. Tooth extracted, pus drained and antibiotics given - Oxytetracycline IM for 1 month and Metronidazole oral (60mg/kg) for 6 months. No reoccurrence after I year.





Photos courtesy of Helen Stevens

Mouth Infection - trauma - Marley

- Marley 30kg male. Given Gentamicin 2mg/kg IM single dose, Metronidazole 20mg/kg SC single dose, Oxytetracycline 1ml/ 10kg IM every three days for three doses, Betamox LA 0.3ml/ kg SC second daily for 3 doses, Metacam 0.4 mg/ kg SC single dose .
  Rapid recovery seen.

30 January 2016

5 February 2016

Mouth infection - grass seed abscess - Venus

- Venus 20kg female
- Surgical debridement indicated a grass seed caused the problem
- Given Trivetrin 1ml/ 5kg and Noroclav 1ml/ 20kg SC daily for 2 weeks.

MICROBIOLOGY REPORT - VETERINARY CULTURE

SITE: Tooth

SPECIMEN: Swab

GRAM STAIN: Few leucocytes
Scant gram positive cocci
Moderate gram positive bacilli
Moderate gram negative bacilli

CULTURE Heavy growth of
Org 1: Pasteurella species
Org 2: Mixed anaerobes

SUSCEPTIBILITY	-1-	-2-		-1-	-2-
Ampi/Amoxycillin	S		Sulpha/Trimeth		S
Cephalexin	S		Enrofloxacin		S
Gentamicin	R		Clavulan/Amox	S	
Tetracycline	R				
Marbofloxacin	S				

Please note that sensitivity testing of anaerobic isolates is not routinely performed since currently available methods may not give reliable results. Anaerobes are predictably susceptible to metronida or alternatively Augmentin can be used.

Final report

etnostics North Ryde NATA Accreditation Number: 14599

BETAMO

Lumpy Jaw

- Lumpy jaw is an infection of the bone of the jaw – osteomyelitis
- EG kangaroos particularly prone
- Initial cause ? Trauma to the soft tissue of the mouth
- Bony hard deformity of the jaw evident
- There can be a sinus tract
- Surgical debridement and long term antibiotics required.

Lumpy jaw - Blanket

- Brought back from release site 18 months after release
- Treatment - Surgical debridement and long term antibiotics (Metronidazole 20mg/kg IV daily 1 week, Noroclav1ml/20kg daily SC 1 month and Oxytetracycline 1ml/ 10kg every 5 days IM 3 months.

Doug Hayward
Veterinary Pathologist
See microbiology report below.
Bruce Duff
Veterinary Pathologist

MICROBIOLOGY REPORT - VETERINARY CULTURE

SITE: jaw

SPECIMEN: Swab

GRAM STAIN: Few leucocytes
No organisms seen

CULTURE Scant growth of
Mixed anaerobes

Please note that sensitivity testing of anaerobic isolates is
routinely performed since currently available methods may not
reliable results. Anaerobes are predictably susceptible to met
or alternatively Augmentin can be used.

Final report (09/02/2014)

Vetnostics North Ryde NATA Accreditation Number: 14599

Lumpy Jaw - Sassy

- Presented with a bony hard lump rostral mandible. Pus noted to be discharging from a sinus at base of lower incisor
- Treatment - surgical debridement and long term antibiotics (Metronidazole 20mg/ kg IV daily 1 week, Noroclav 1ml/20kg SC daily 1 month and Oxytetracycline 1ml/10kg IM every five days 3 months).

GRAM STAIN: Moderate leucocytes
Numerous gram negative bacilli

CULTURE Heavy growth of
Org 1: Aeromonas hydrophila
Org 2: Mixed anaerobes

SUSCEPTIBILITY	-1--2-		-1--2-
Amikacin	S	Tetracycline	S
Ampi/Amoxycillin	R	Timentin	S
Ceftazidime	S	Enrofloxacin	S
Cephalexin	R	Sulpha/Trimeth	S
Gentamicin	S	Clavulan/Amox	R

Supplementary report 04/05/15 Please note mixed anaerobes isolated after extended inc ubation.

Please note that sensitivity testing of anaerobic isolates is not routinely performed since currently available methods may not give reliable results. Anaerobes are predictably susceptible to metronidazole. Alternative agents include clindamycin and Augmentin.

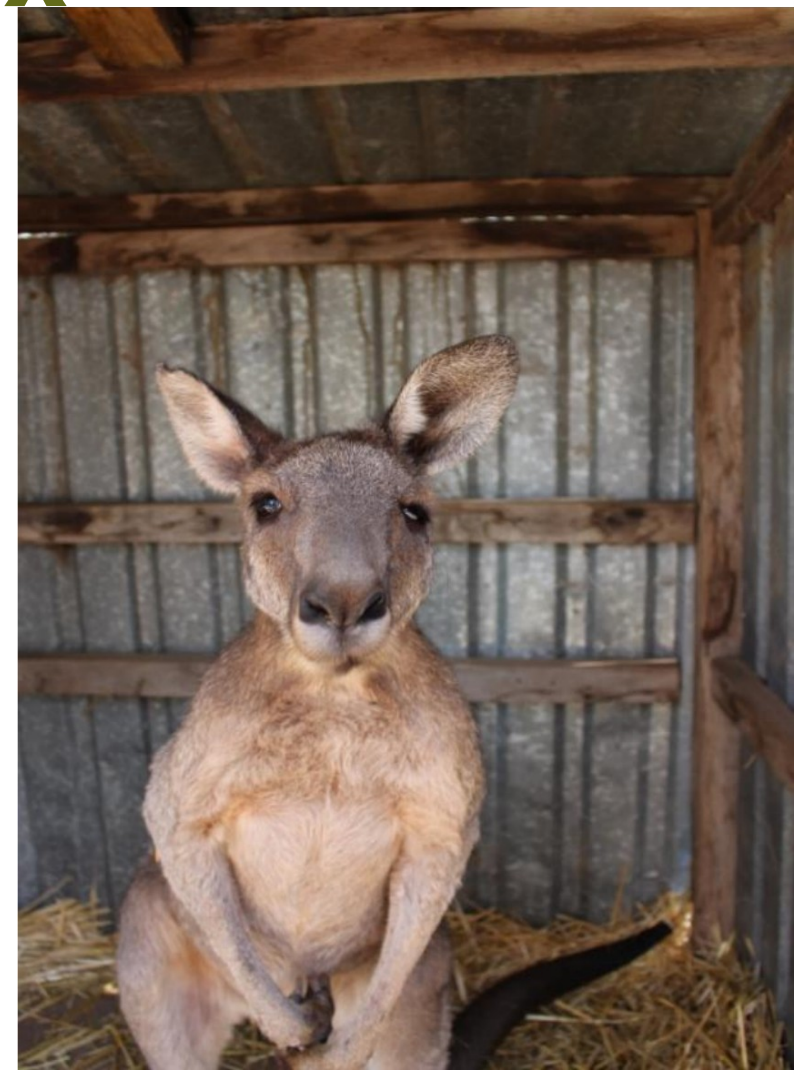
Trauma - Gunshot - Lindy

Lindy – gunshot wound to face, cornea lacerated

Ian – Lindy's severely dehydrated and malnourished joey

Trauma - MVA - Max

Oxytetracycline 1ml/10kg every five days IM – four doses given. One dose of Modecate (50mg IM) and Dexamethasone (7mg SC) at rescue



Max – fractured zygoma, orbit and hard palate, corneal abrasion and

Mad Max 2 months later, eating well and feeling much better. Now released

Jaw Deformity - Winston

Jaw deformity developed after his release ten years ago. Still doing well.

Macropod Herpes Virus

- Herpes viruses in humans cause unpleasant diseases such as cold sores, genital herpes, chicken pox, shingles and glandular fever
- In macropods both alpha (two strains MaHV – 1 and MaHV – 2) and gamma herpes viruses have been isolated
- A Herpes virus PCR indicated that an illness with predominantly respiratory tract symptoms and high mortality rate in small in-care joeys was due to a Herpes virus (see report for Heidi).

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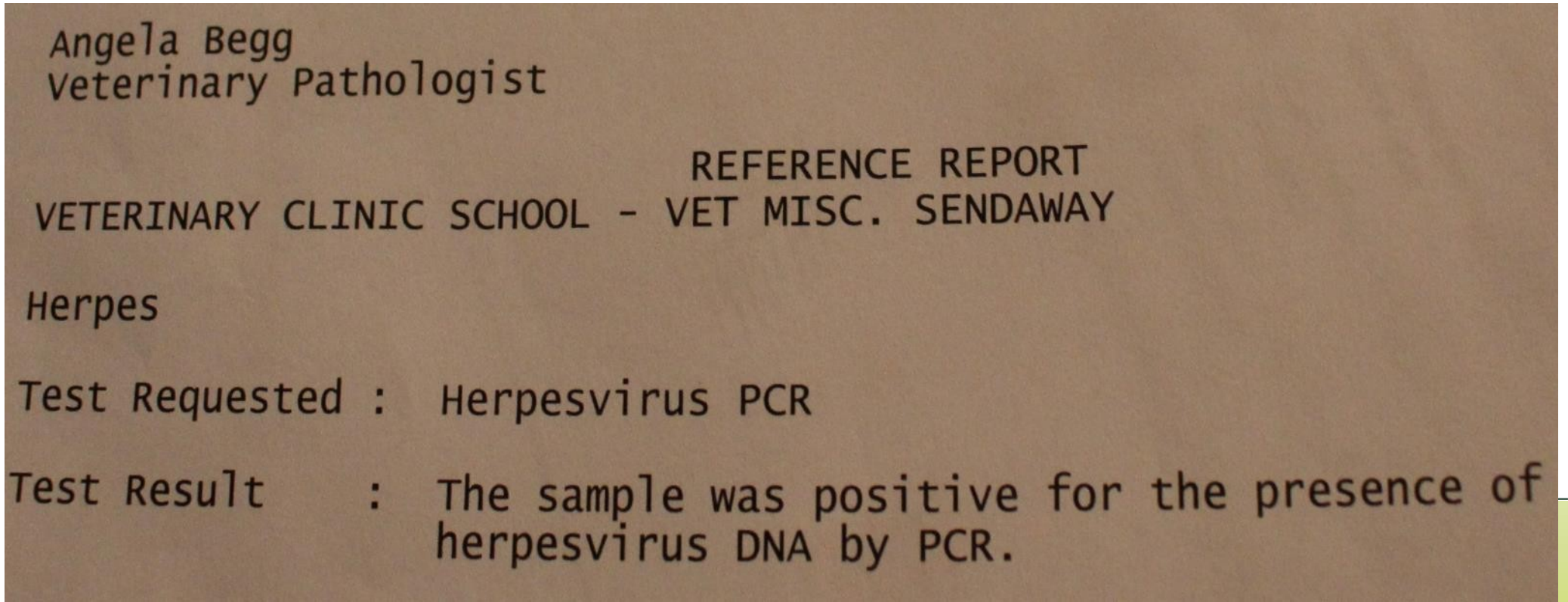

Angela Begg
Veterinary Pathologist

REFERENCE REPORT

VETERINARY CLINIC SCHOOL - VET MISC. SENDAWAY

Herpes

Test Requested : Herpesvirus PCR

Test Result : The sample was positive for the presence of herpesvirus DNA by PCR.

Macropod Herpes Virus

- Symptoms – fever, lethargy anorexia, nasal and eye discharge, sneezing, wheezing and respiratory distress
- Treatment – Valaciclovir. Crush 1 tablet and suspend in 15ml boiled water. Use 0.5ml/ kg three times a day for seven days
- Valaciclovir inhibits viral replication
  so it must be used at the first sign of illness – usually sneezing, watery eyes, runny nose.

Heidi -12 months after Valaciclovir treatment and recovery from Herpes virus

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Macropod herpes virus

- Joeys who have not been treated with Valaciclovir early in the illness can be treated symptomatically with the following medications – Panadol, Fess nasal saline, Bromhexine, Salbutamol
  Ventolin via nebuliser),

Amoxycillin and Sucralfate (see handout or *Possumwood* website for doses).

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References

Vogelnest, L and Woods, R. (eds). 2008. *Medicine of Australian Mammals,* CSIRO Publishing.

Ladds, P. 2009. *Pathology of Australian Native Wildlife,* CSIRO Publishing.

Smith, J A, et al. 2008. *Identification and isolation of a novel Herpes virus in a captive mob of eastern grey kangaroos (Macropus Giganteus).* Veterinary Microbiology, vol 129, pp. 236-245.

Energy Systems. http://www.teachpe.com/physiology/energy_systems.php. Accessed 12 February 2016.

Thanks to Steve for preparing the slides