

Imaging in Crocodilians

Natural and Veterinary Sciences Applications

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Darwin April 2024

Documentation / Description / Diagnosis

Some species specific characteristics relevant to imaging

In this brief talk we will focus on 2 modalities that are more generally accessible and portable: ultrasounds and Xrays

CT scans are becoming readily accessible and we will touch on this as well

Species characteristics

Advantages

Size

Easy to keep
immobile

Anatomy eg
extra-thoracic
heart, compact,
easily identifiable
organs

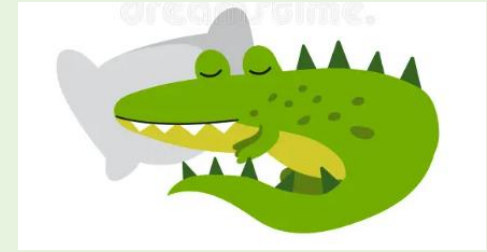


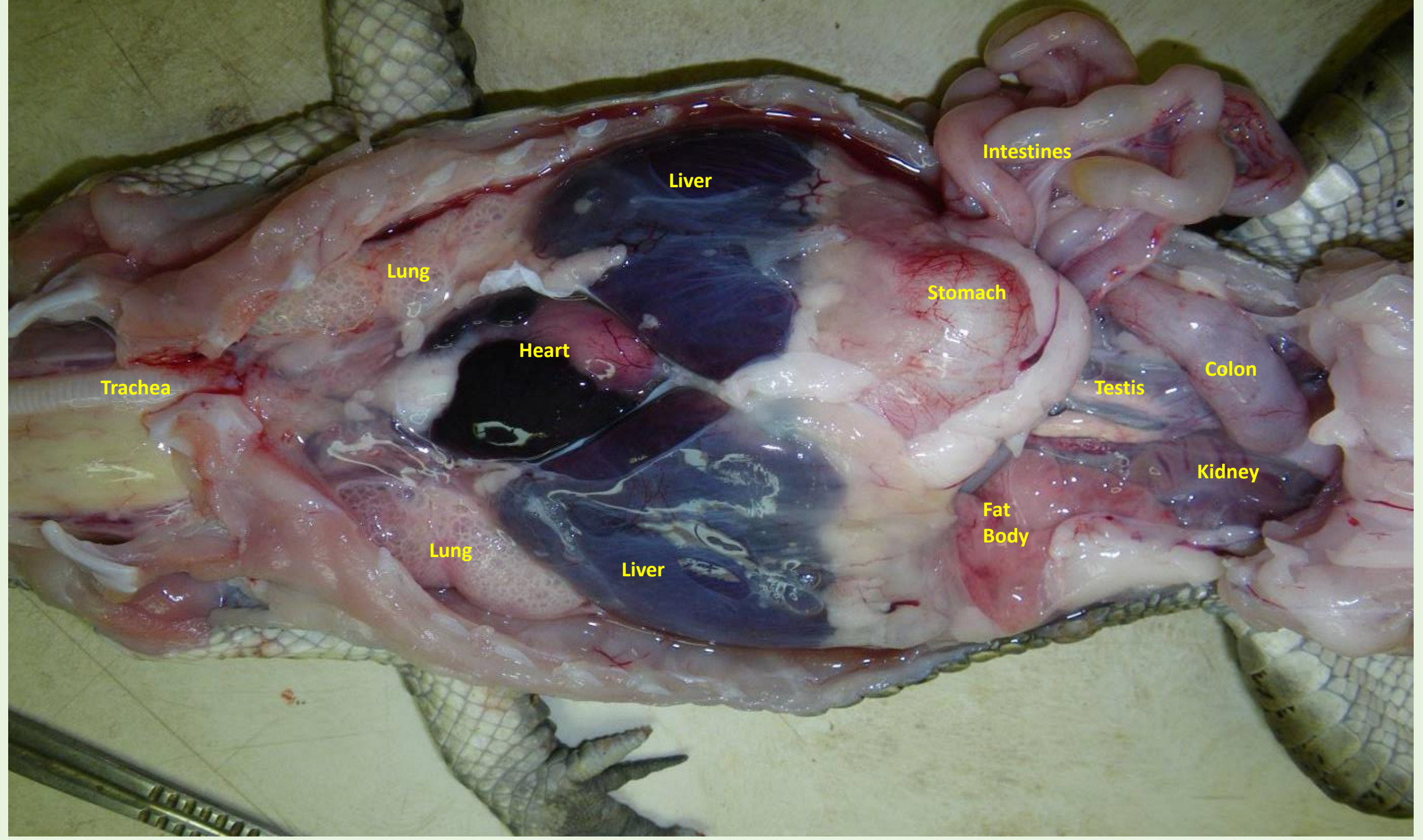
Difficulties

Size

Cannot lie lateral

Anatomy eg Armored skin, intrapelvic
kidneys





General examination is not trivial

Auscultation, percussion and palpation are of more limited value than in (most) mammals.

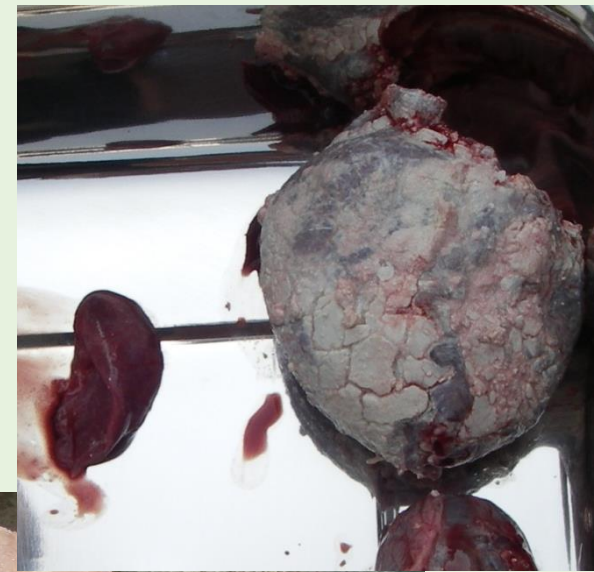
Metabolic state difficult to assess



C. niloticus Fat? Off food for many months

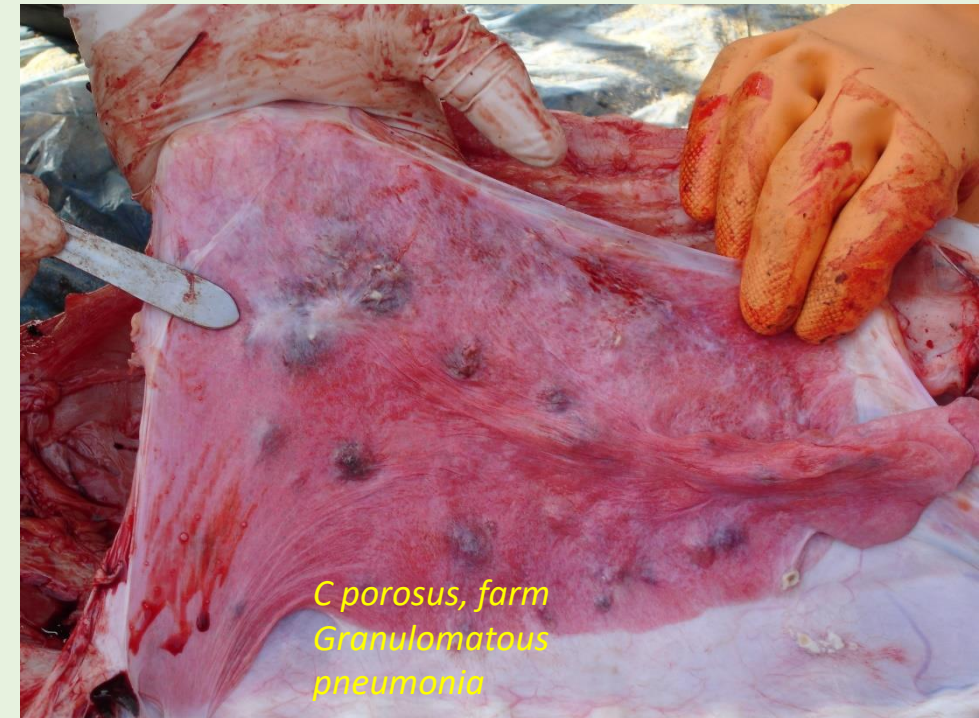


Gavialis gangeticus. Fat? Atrophied fat body



Septic status?

- No lymph nodes to assess
- Mucosae not easily accessible
- Blood picture is an imperfect reflection of the clinical picture



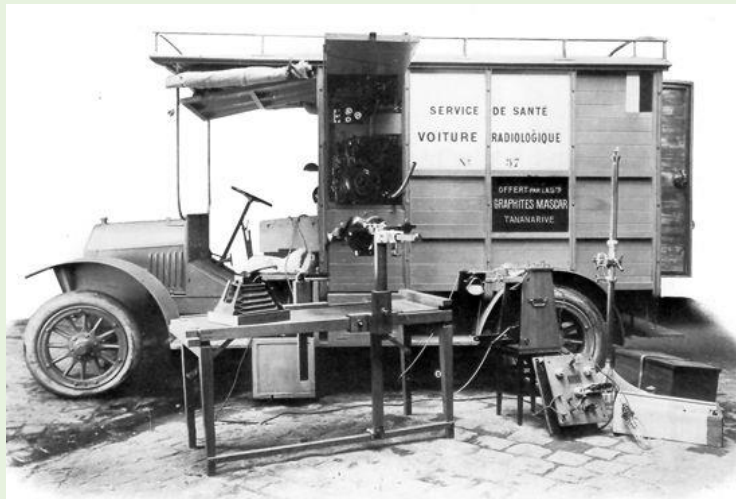
Blood values

- Lack of specific studies linking disease with blood picture
- Lack of specific studies linking blood picture to systems insult/integrity
- Poor reflection of sepsis on hematology and chemistry
- No automated hematology
- Lack of commercial serology/diagnostic kits

For these reasons, imaging is beneficial
(necessary?) to examine crocodiles in depth

Radiography can overcome some species-specific limitations

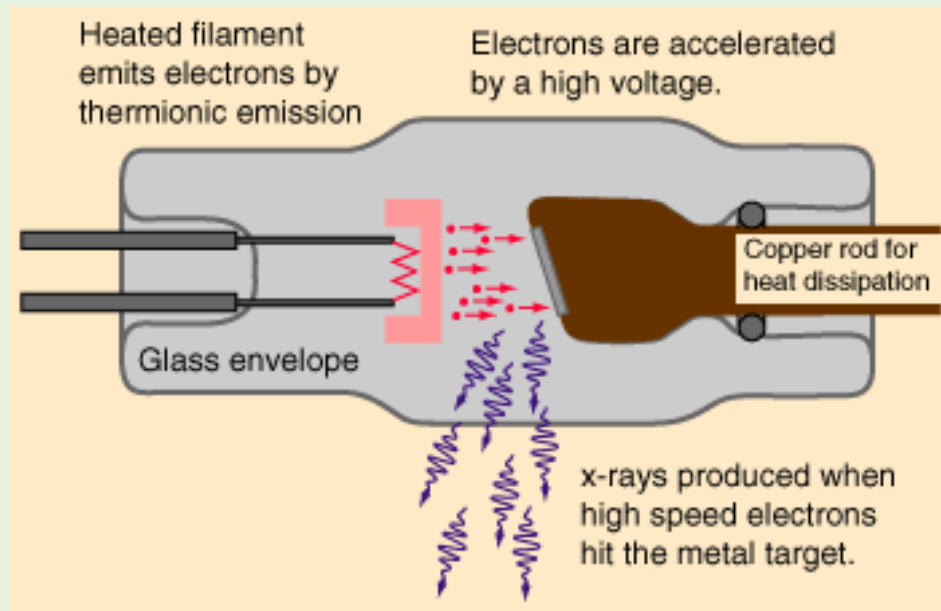
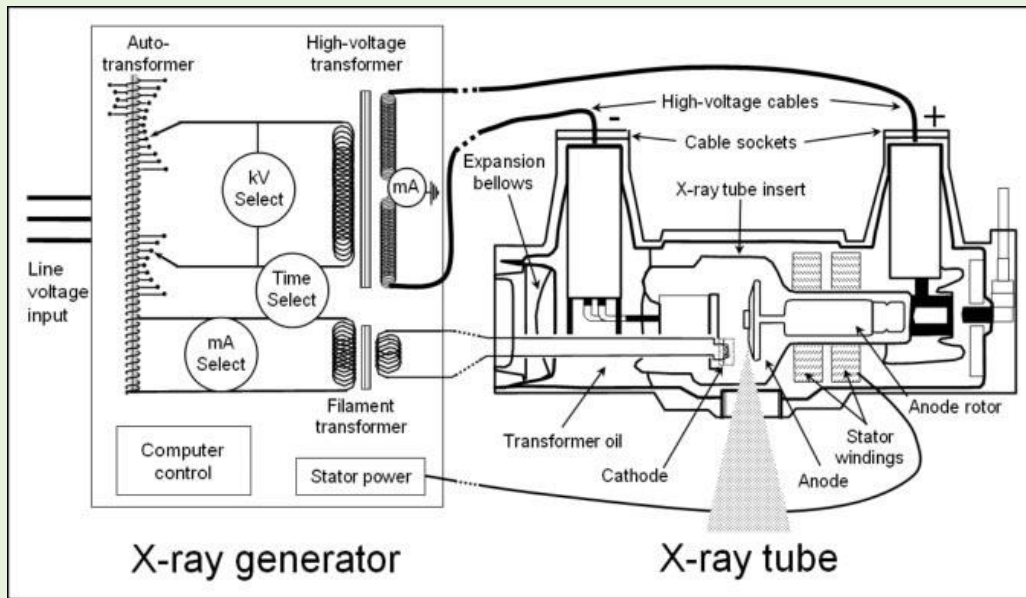
- Proven old technology. Project in 2 Dimensions
- high energy radiation (x rays), produced by an Xray generator, travel through the tissue and onto a substrate that is either a conventional film or a digital imaging plate.
- B&W only , the denser the tissue the whiter the image
- Conventional film: like photography: 1- good exposure 2- dark room 3- fresh developing bath 4- fresh fixation bath 5- viewing box
- CR-DR. 1- semi decent exposure 2-computer



WW1 Xrays in the field



1895, Bertha
Roentgen's hand

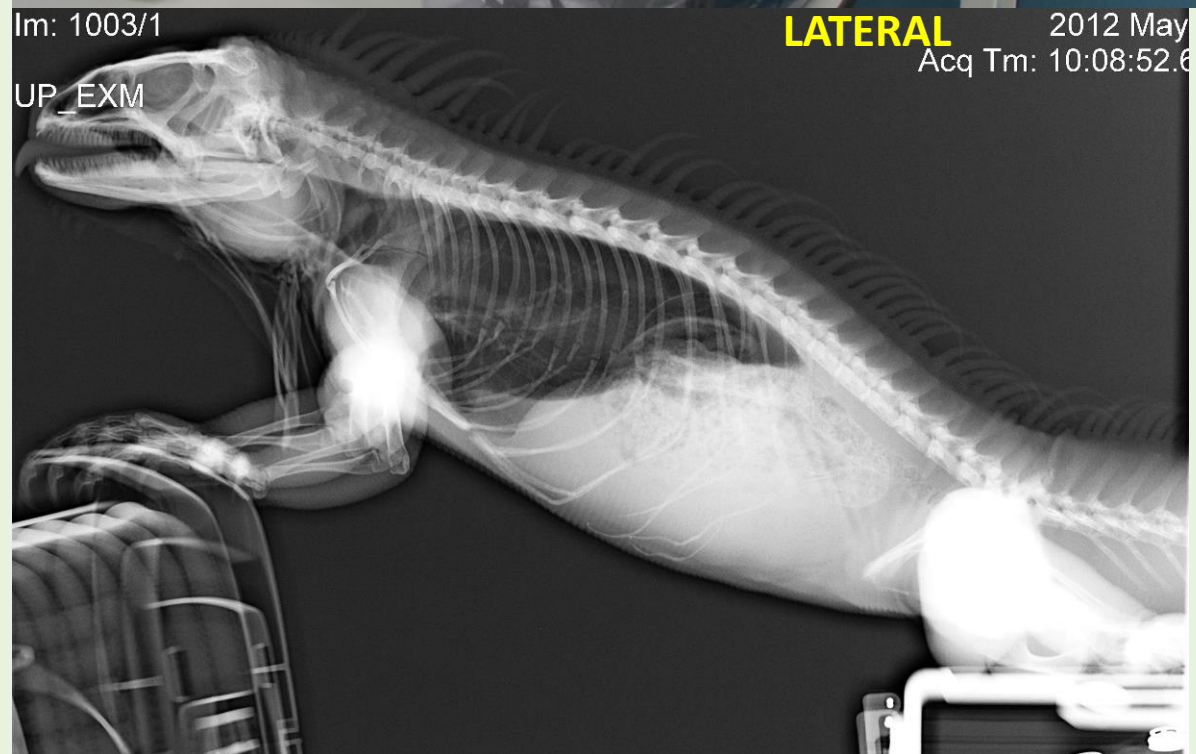


- species specific advantages and limitations
 - Easy to restraint immobile
 - Osteoderms
 - Joints difficult to interpret
 - Size
- Positions
 - Dorso Ventral (DV: beam from dorsum to ventrum)
 - Lateral: unnatural position so need a horizontal beam



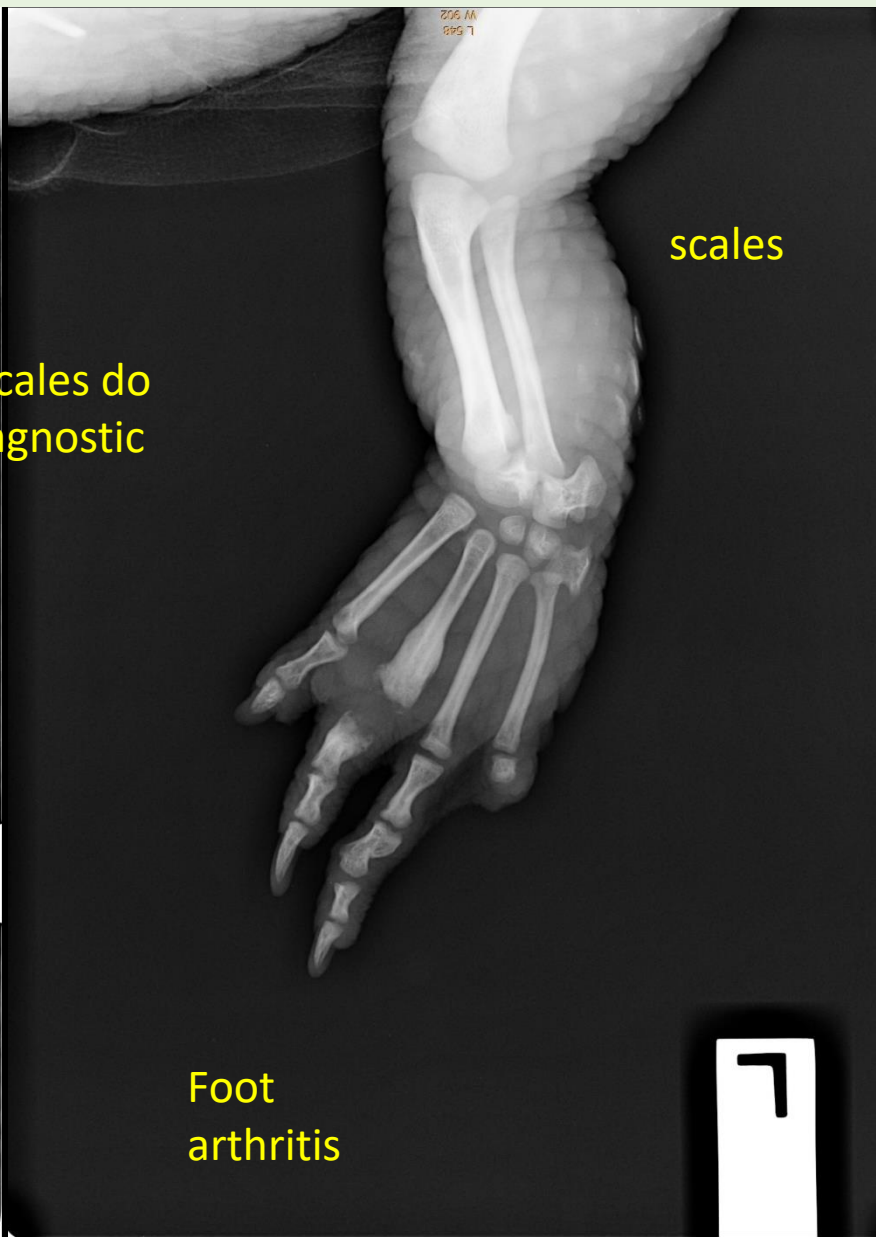


DV



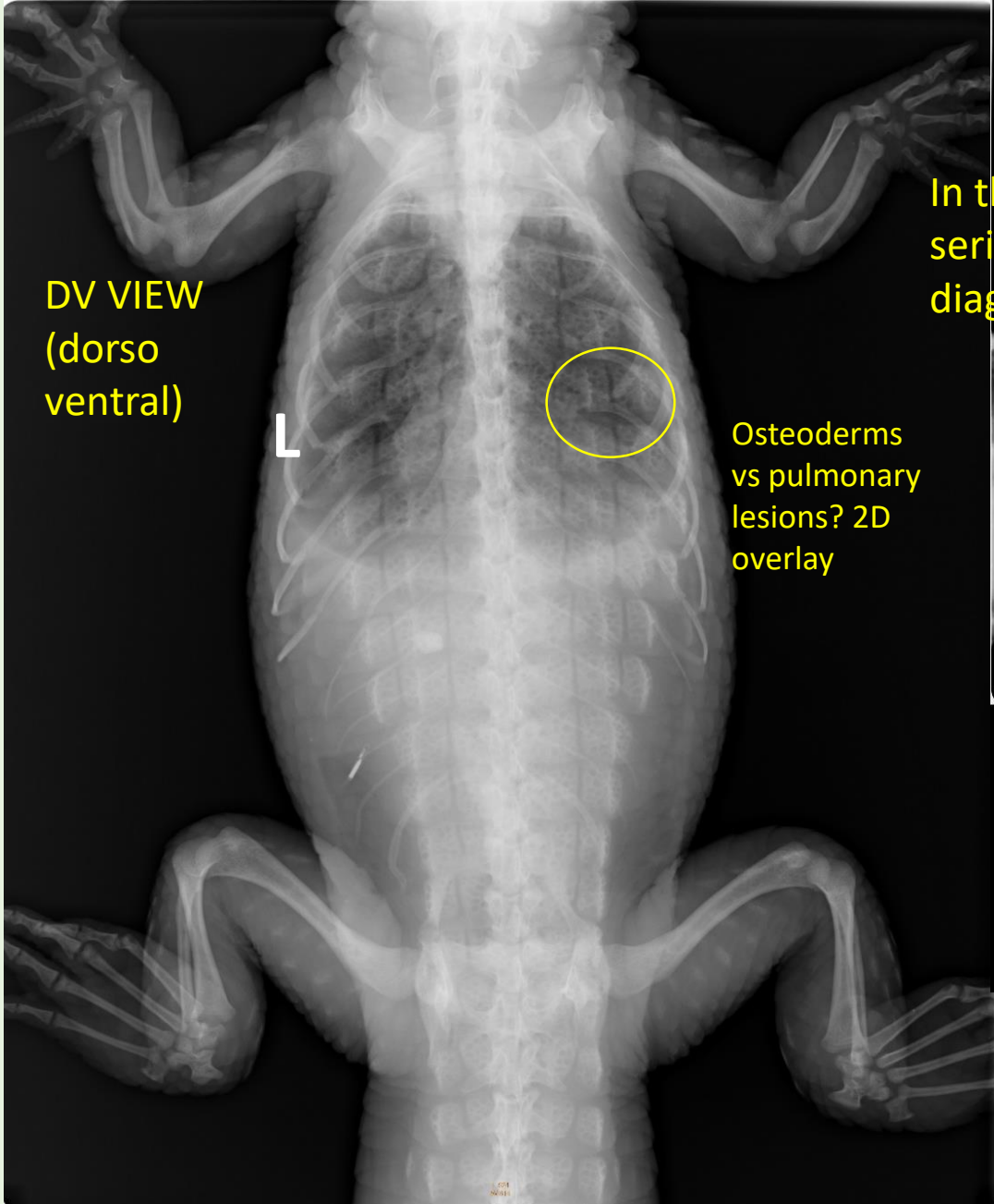


In this case scales do
not affect diagnostic
quality much



scales



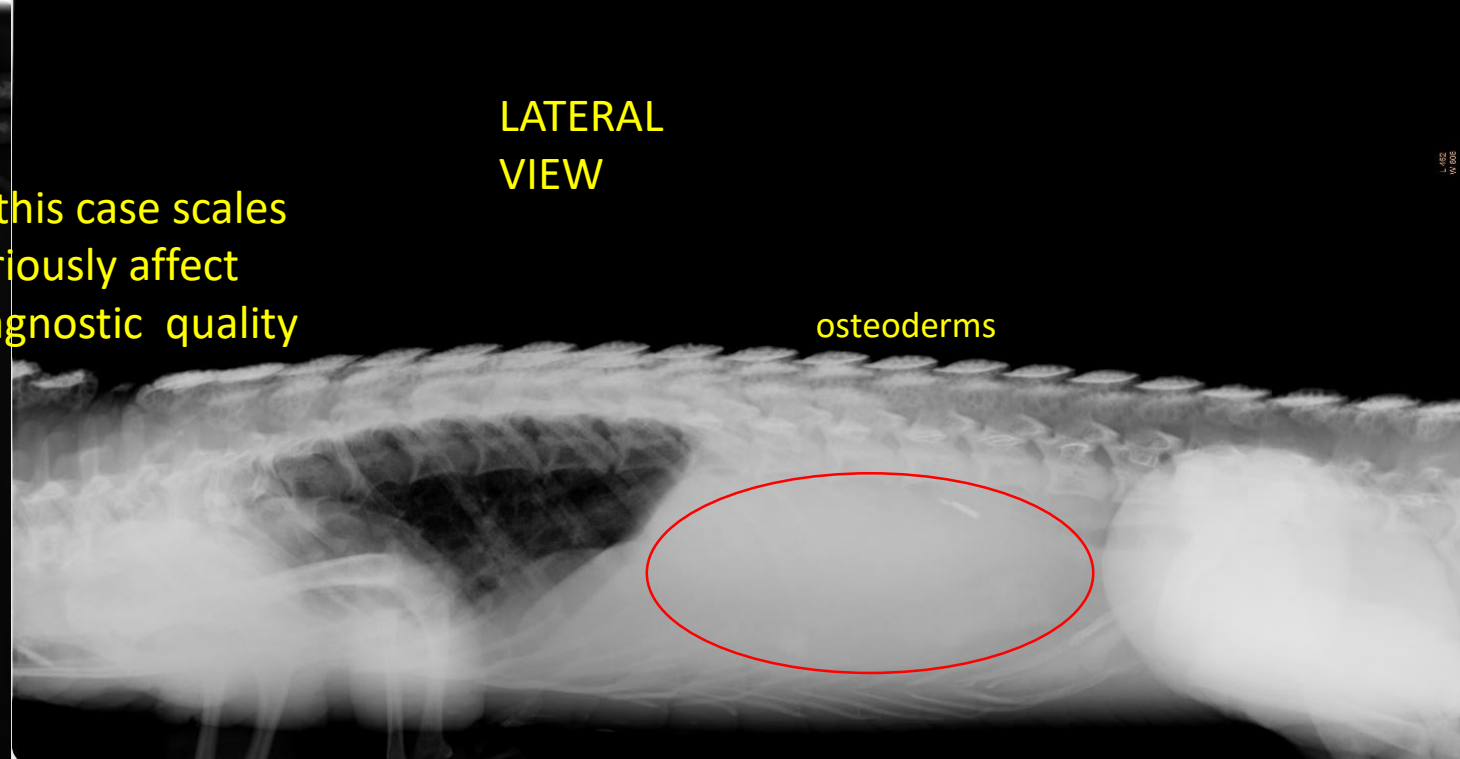


DV VIEW
(dorso ventral)

L

Osteoderms
vs pulmonary
lesions? 2D
overlay

In this case scales
seriously affect
diagnostic quality



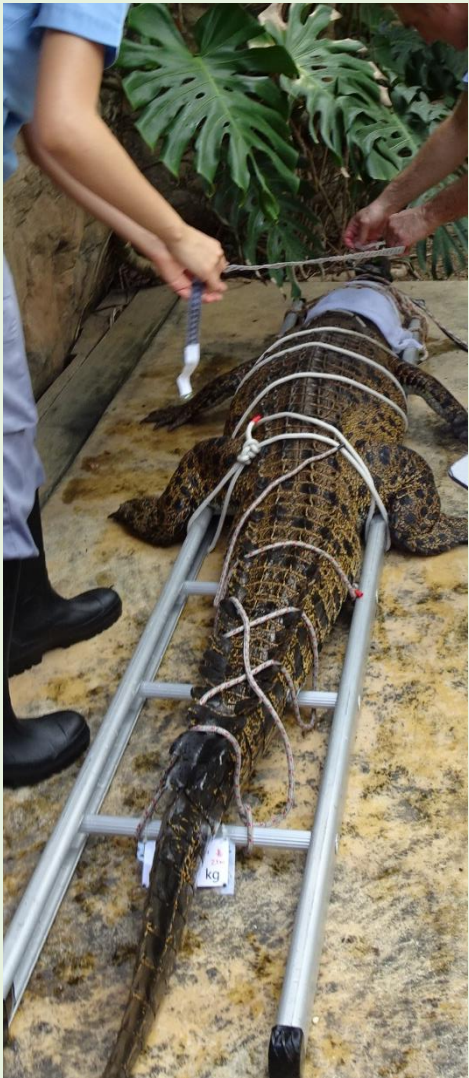
LATERAL
VIEW

osteoderms

Very poor
differentiation of
coelomic organs

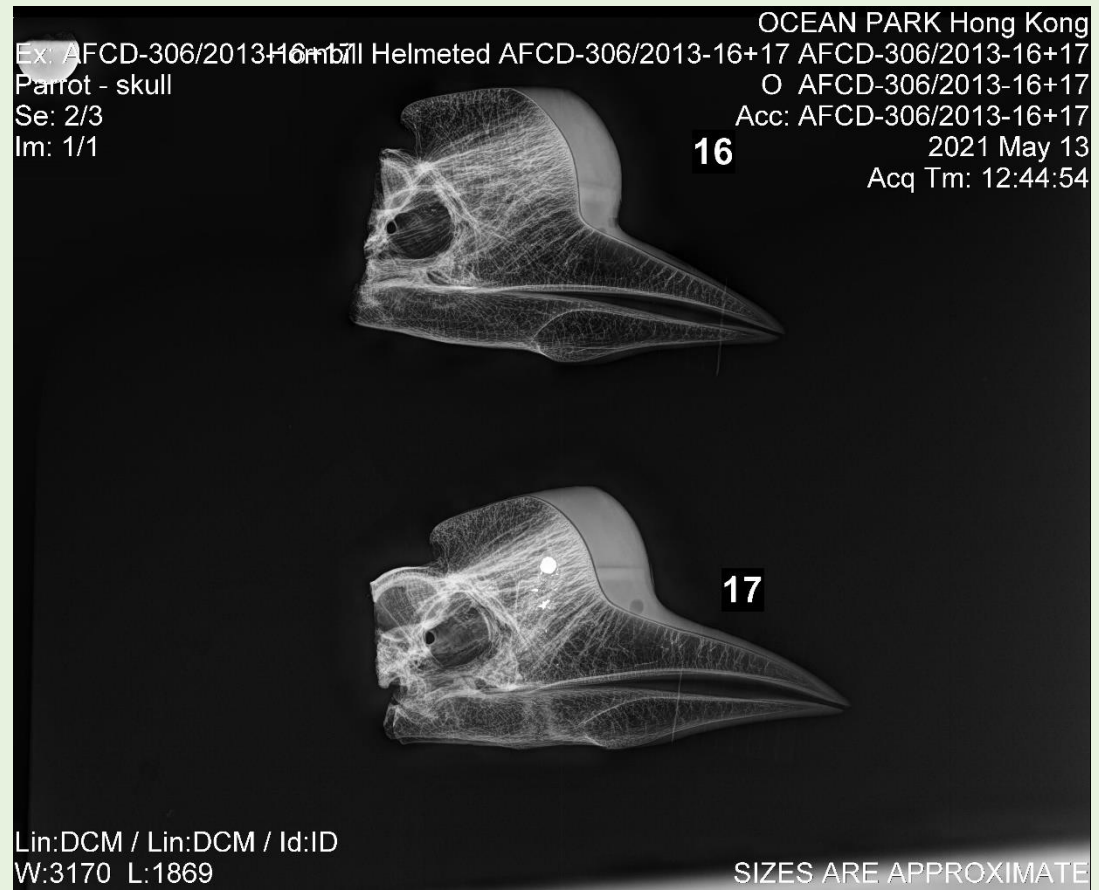


From the real world

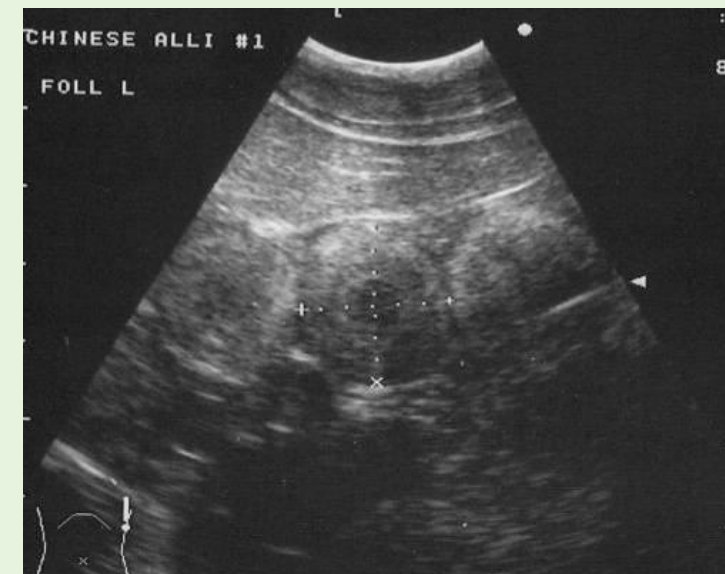
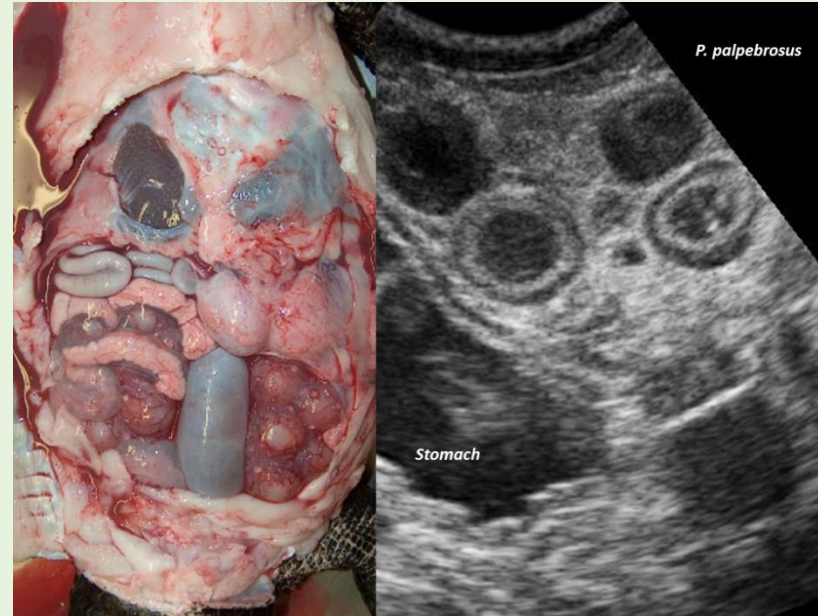
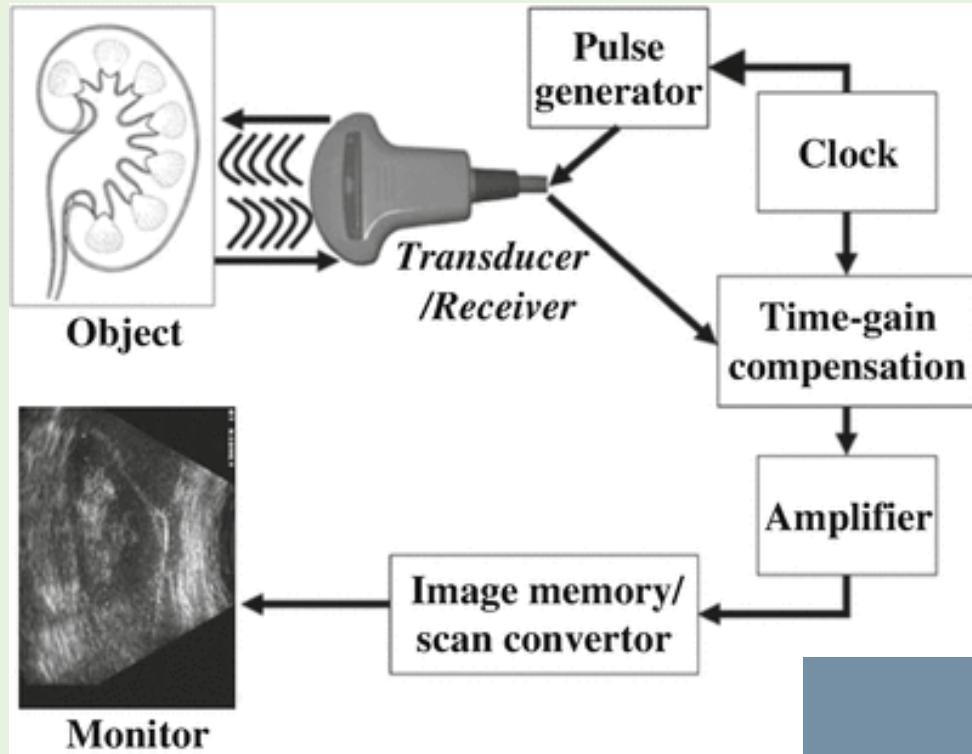


Forensics

- Death, rotting or freezing do not affect Xray imaging



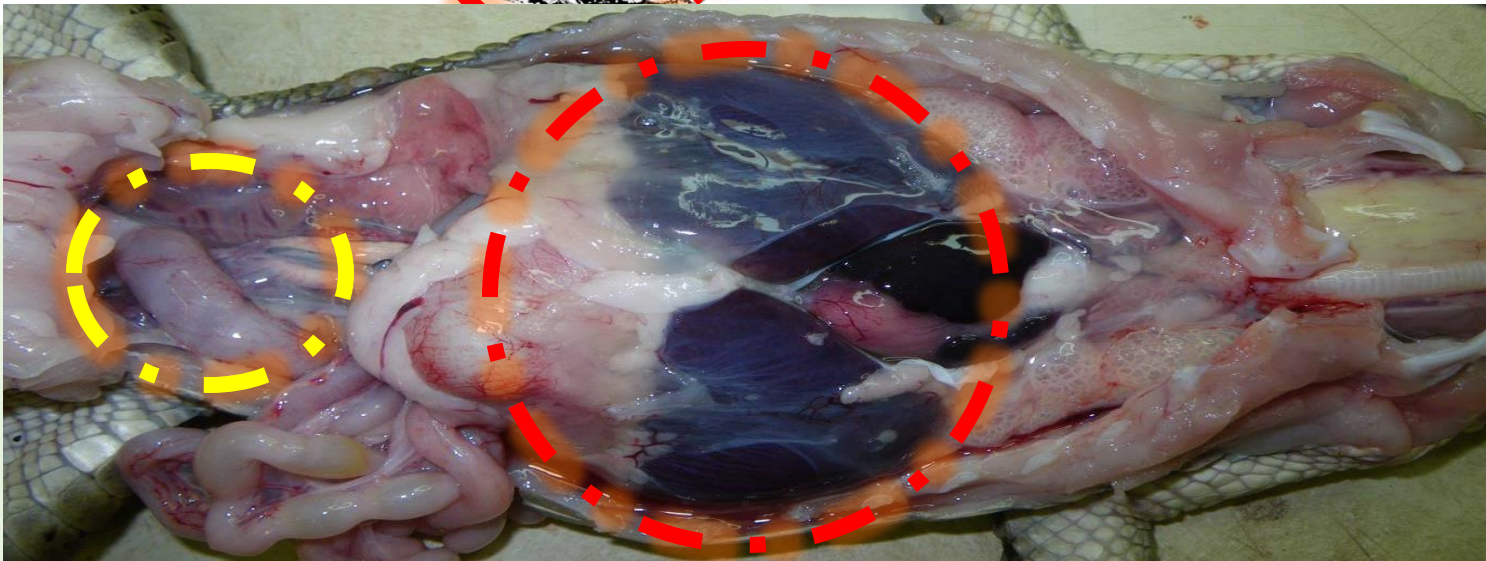
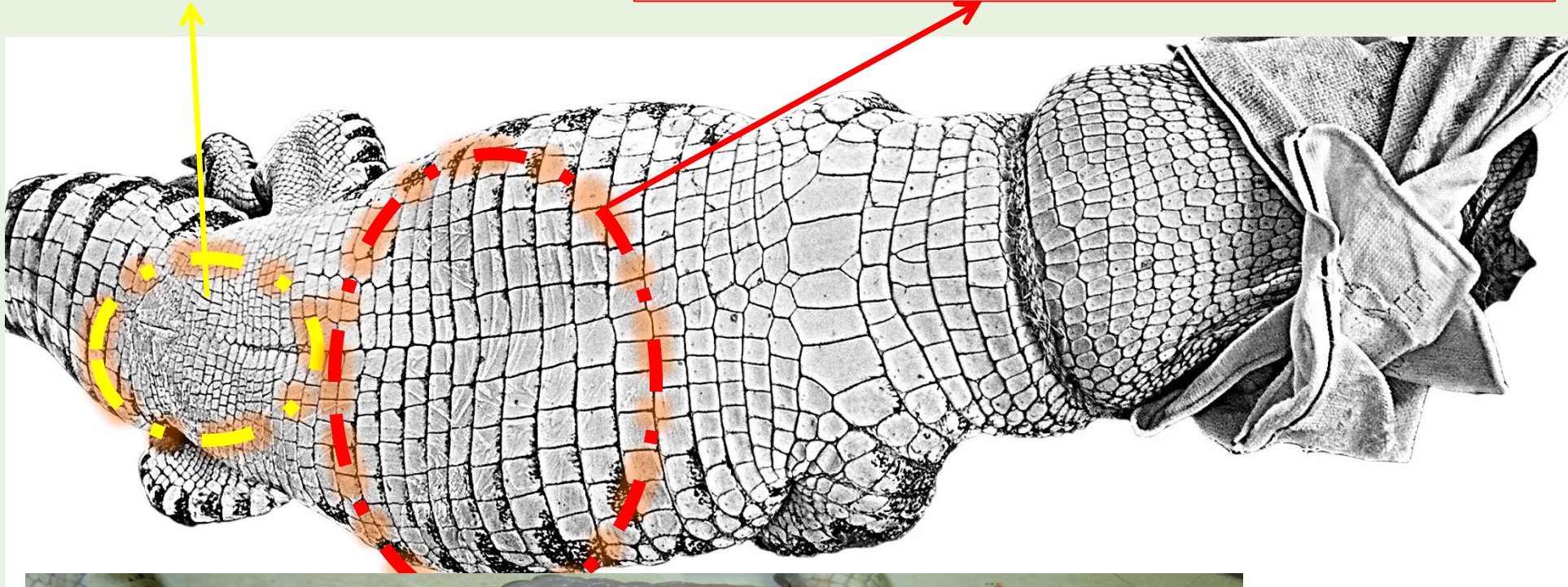
Ultrasonography can overcome some species-specific limitations



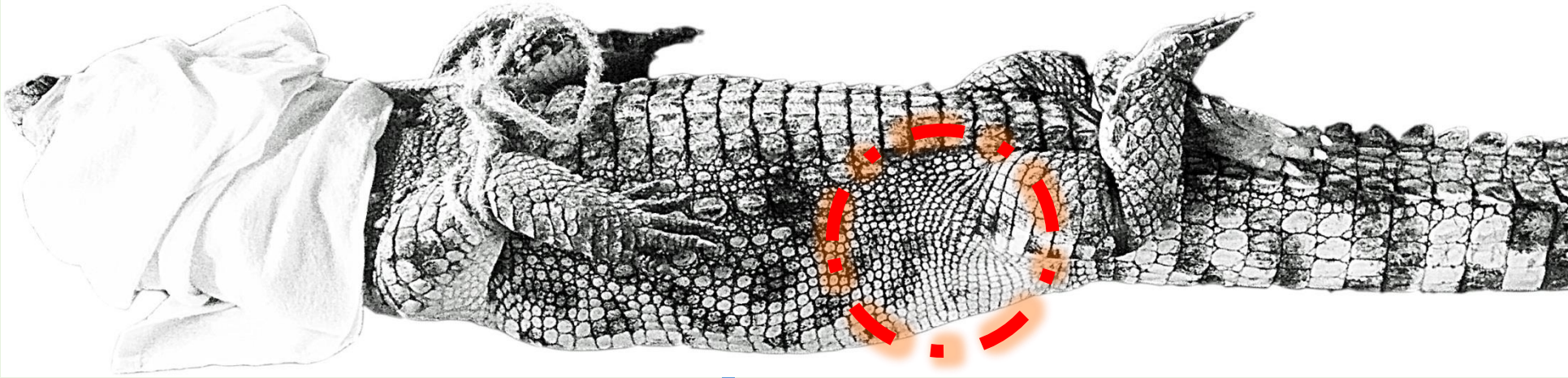


Kidneys, bladder,
rectum,

Heart, Liver, spleen, Gall bladder, gonads, eggs,
duodenal loop, guts, pancreas, fat body, ..

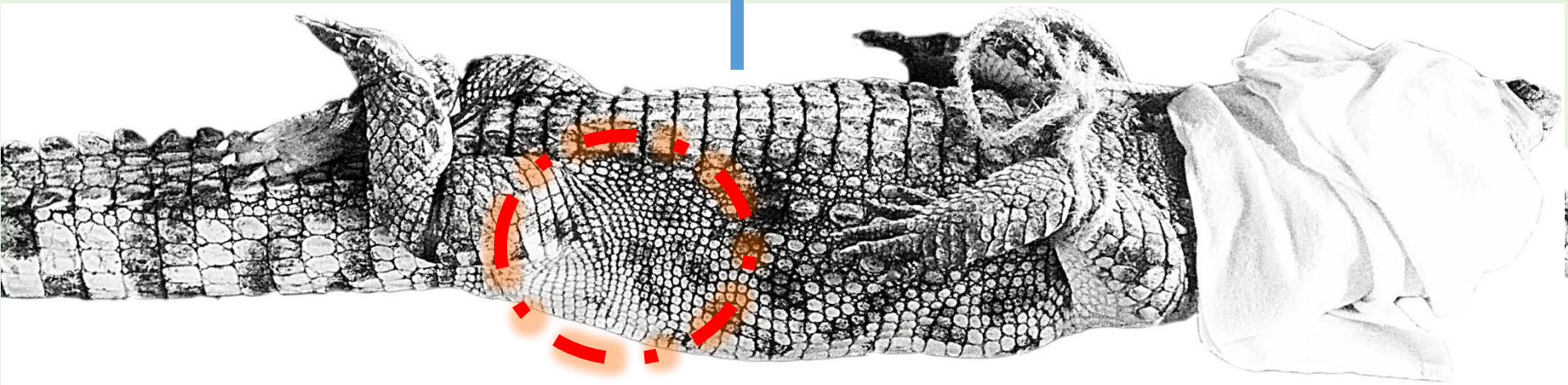


Topography
Appearance
Findings

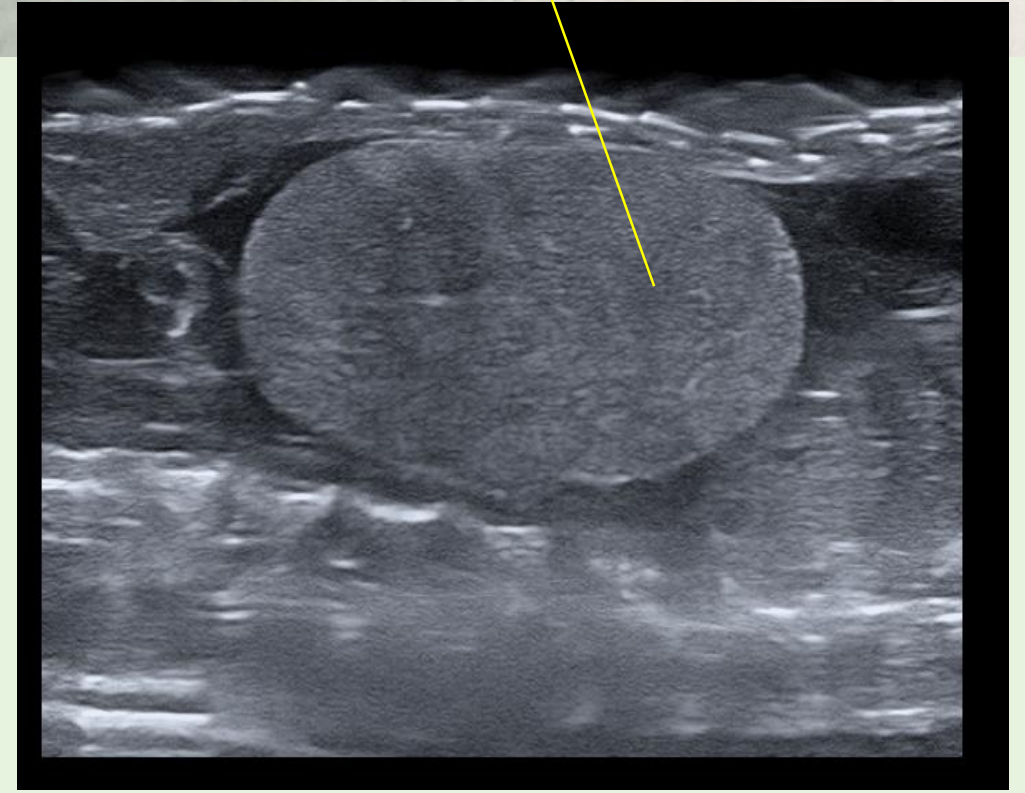
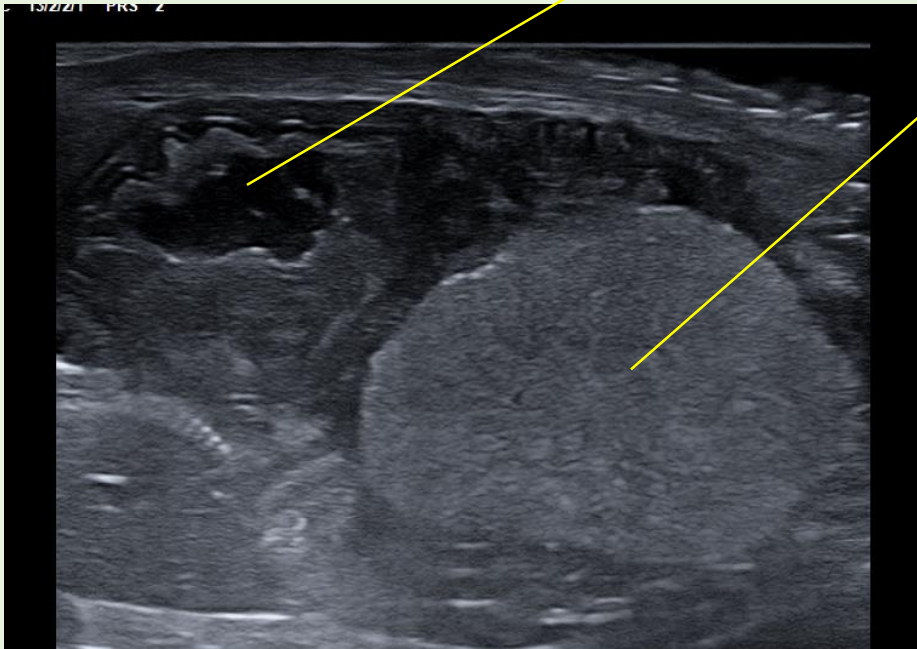
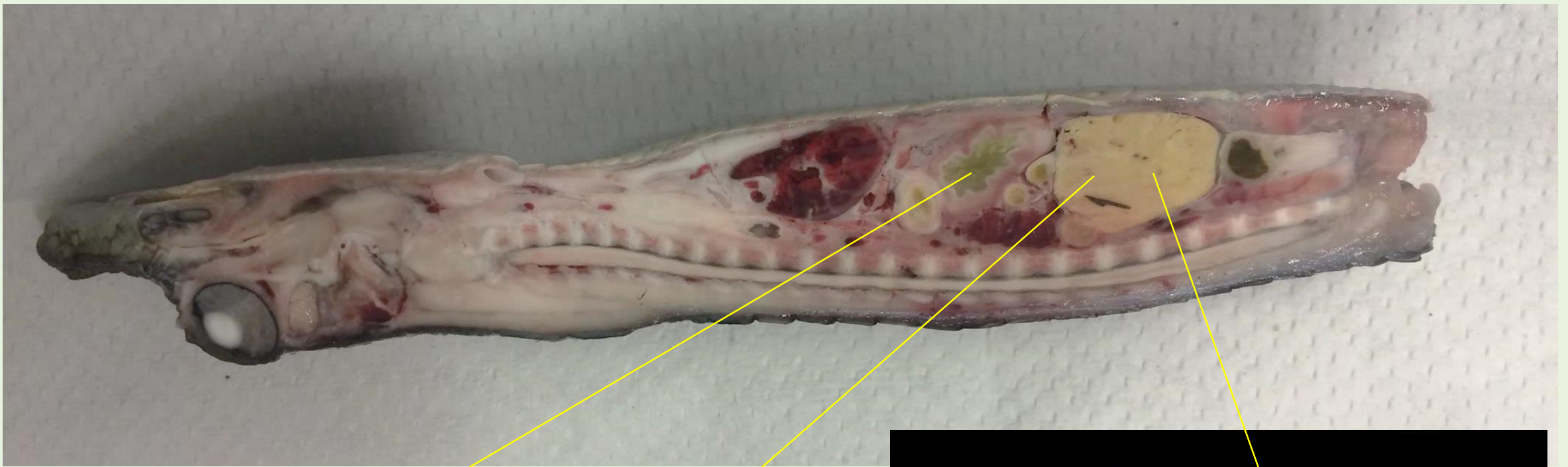


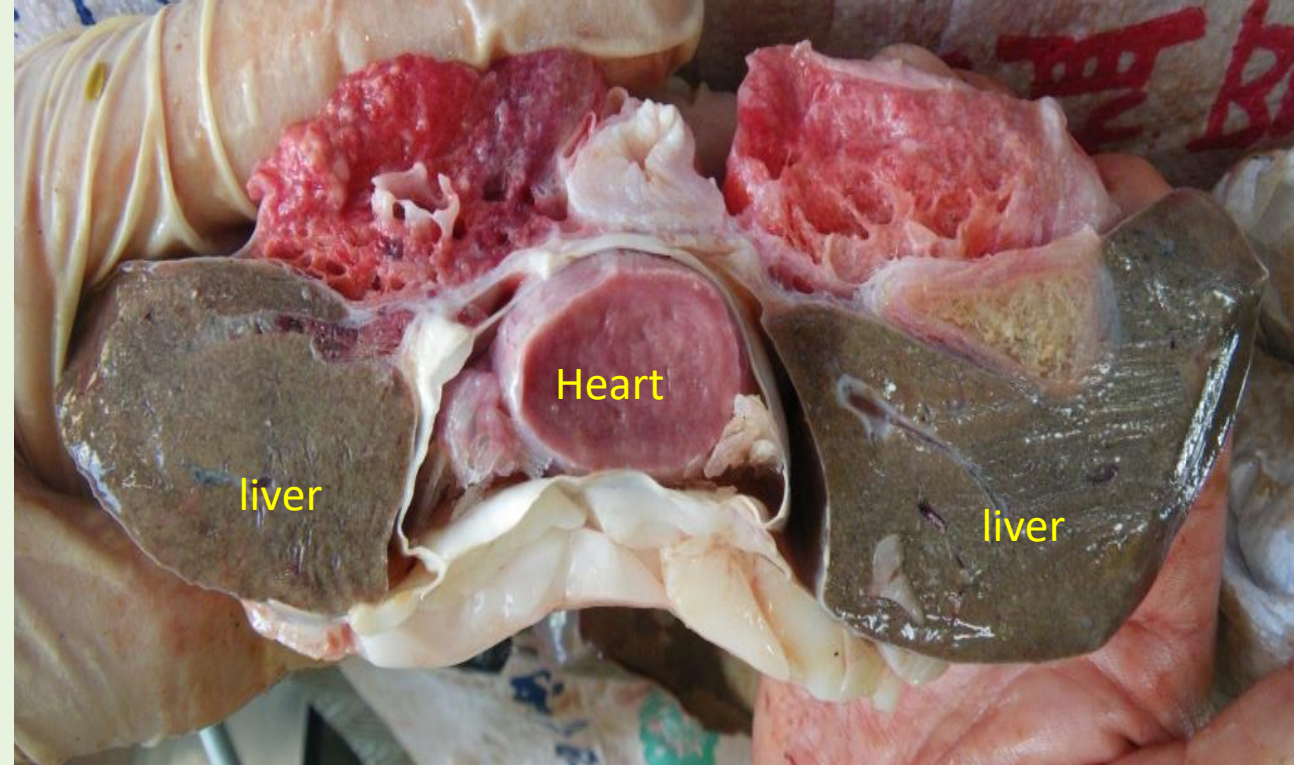
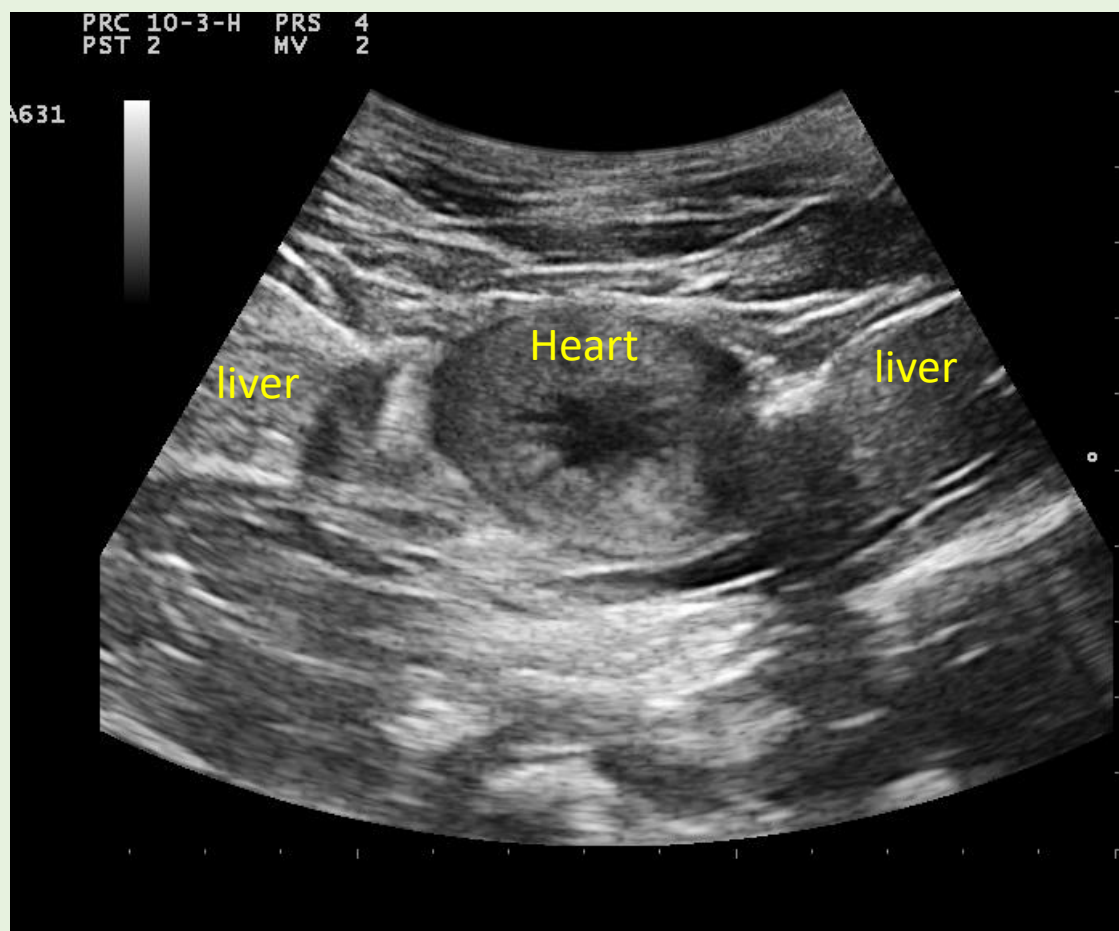
Right Flank: Right liver +, ovaries+, eggs +, spleen +/-, fat body, duodenal loop +, guts, kidneys and testis +/-,

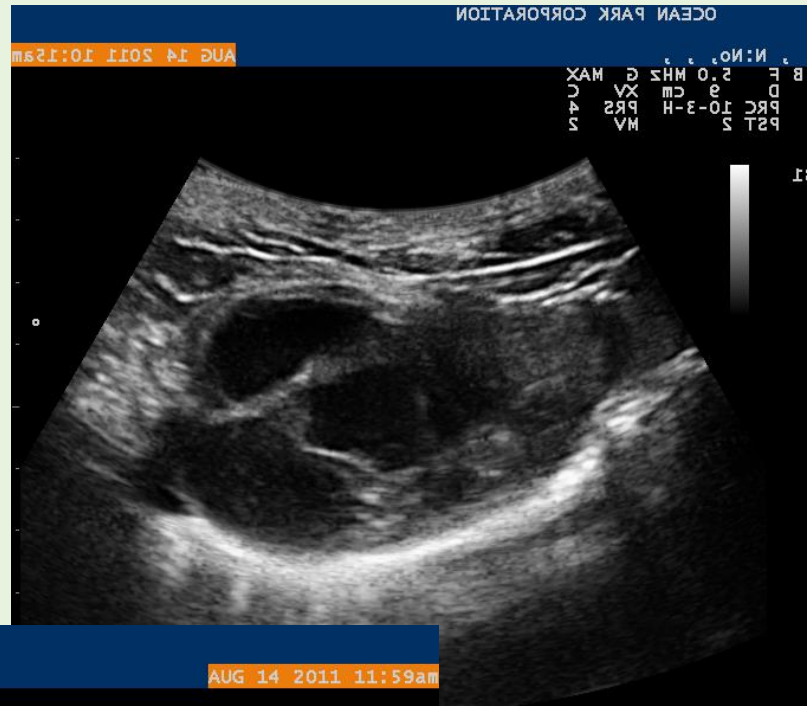
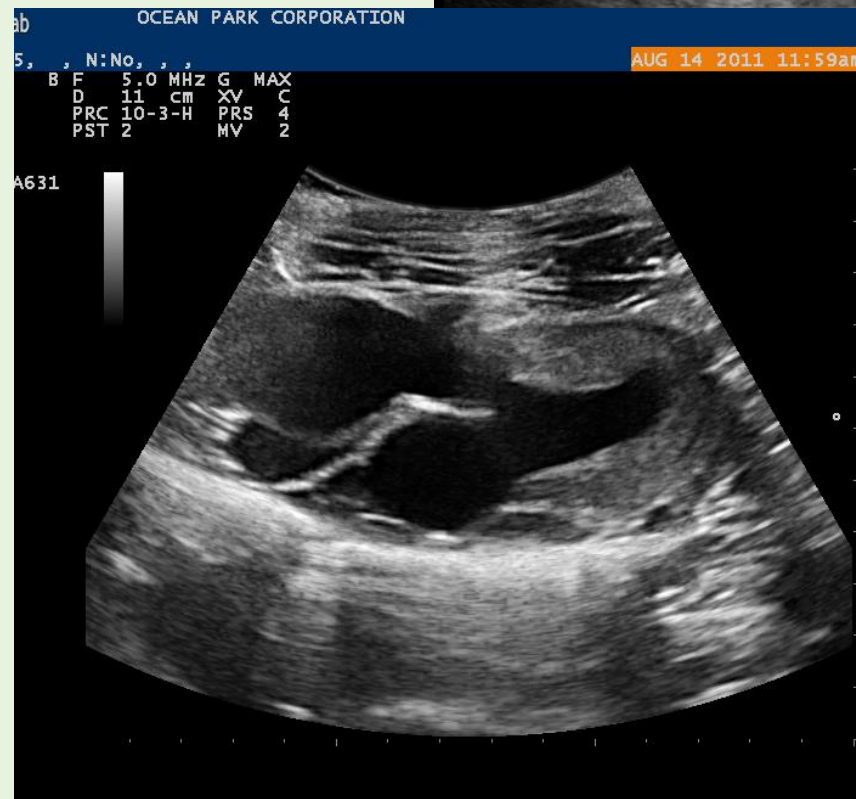
Left Flank: Stomach+, ovaries+, eggs+, L. liver +/-, Kidney and testis +/-, guts, duodenal loop +/-





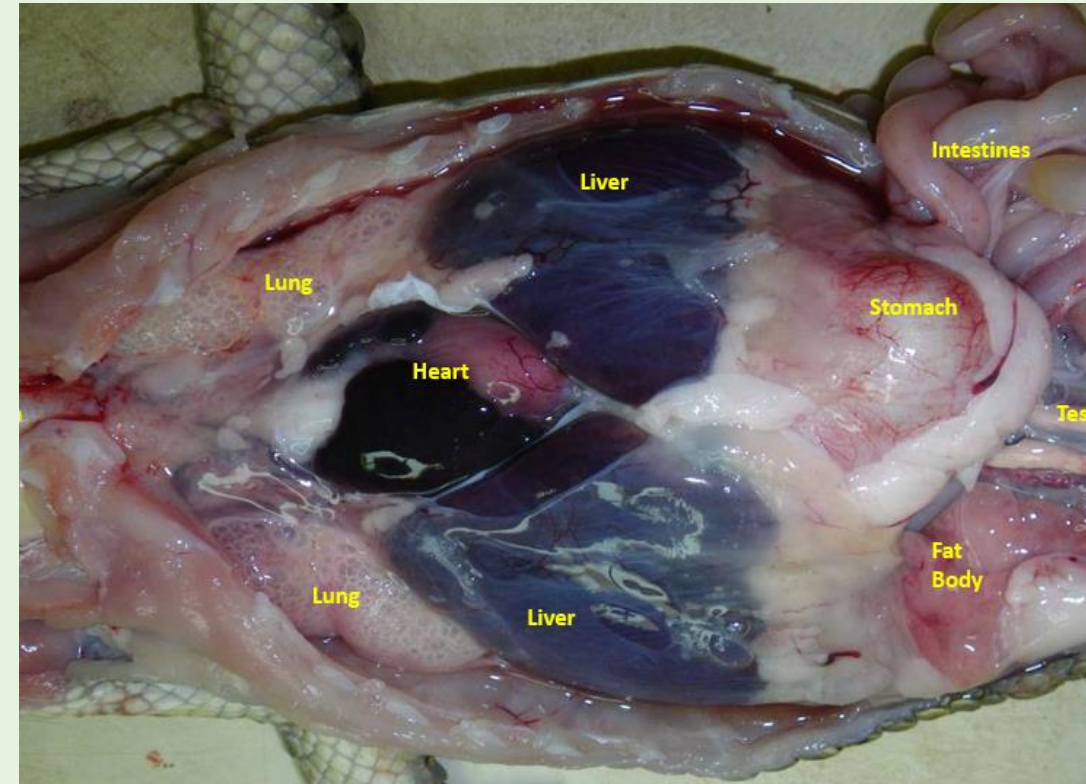


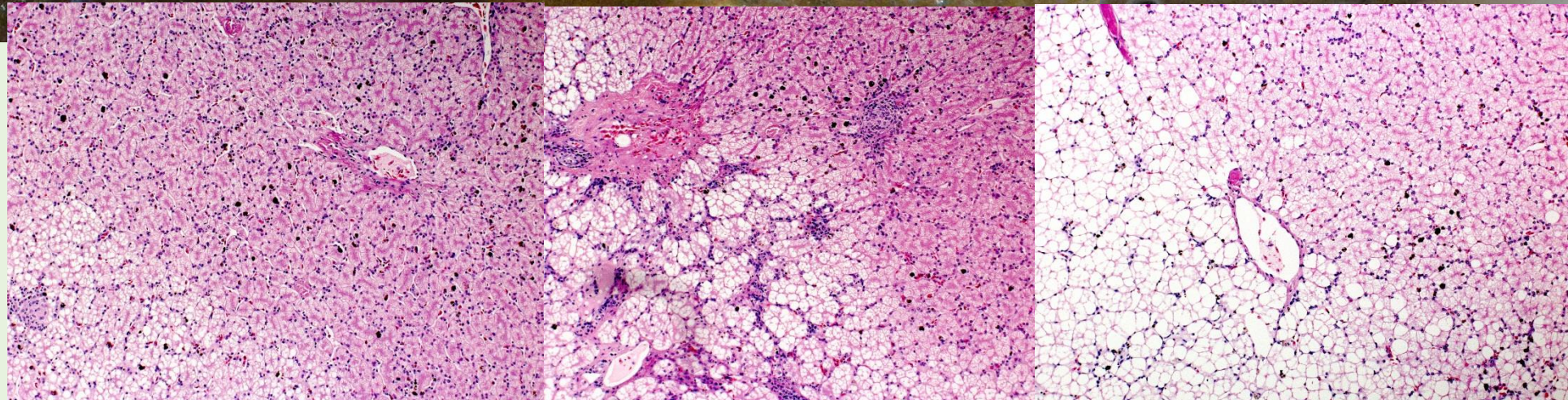
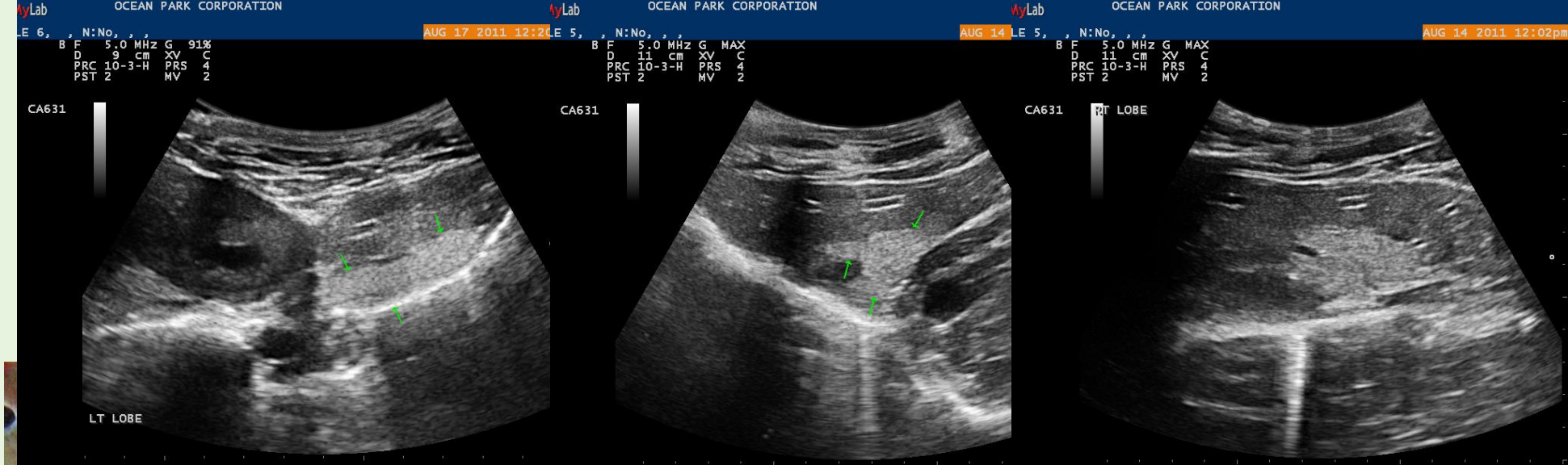




Liver

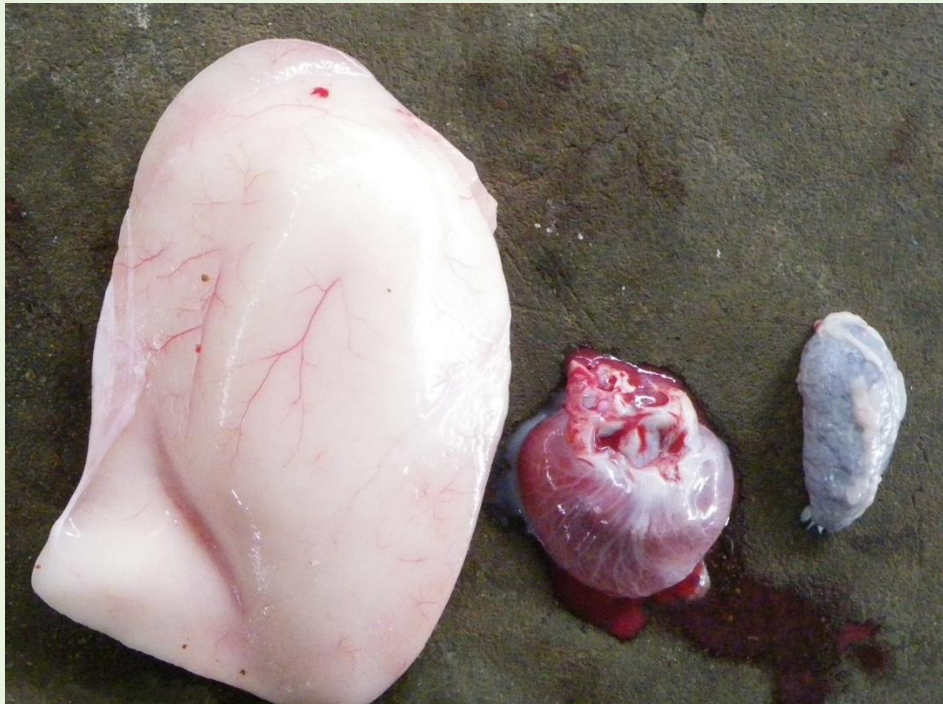
- Liver can be assessed thoroughly, lesions can be seen and matched gross and microscopic findings in location and approximate size
- Hepatic lesions (fatty degeneration and necrotizing hepatitis). Common in septic states, nutritional disorders.

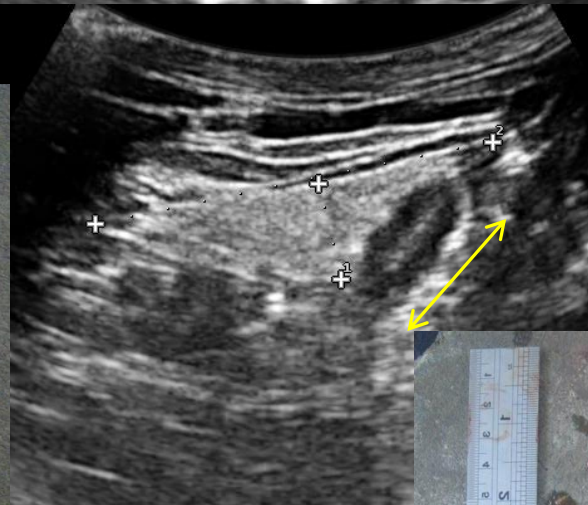
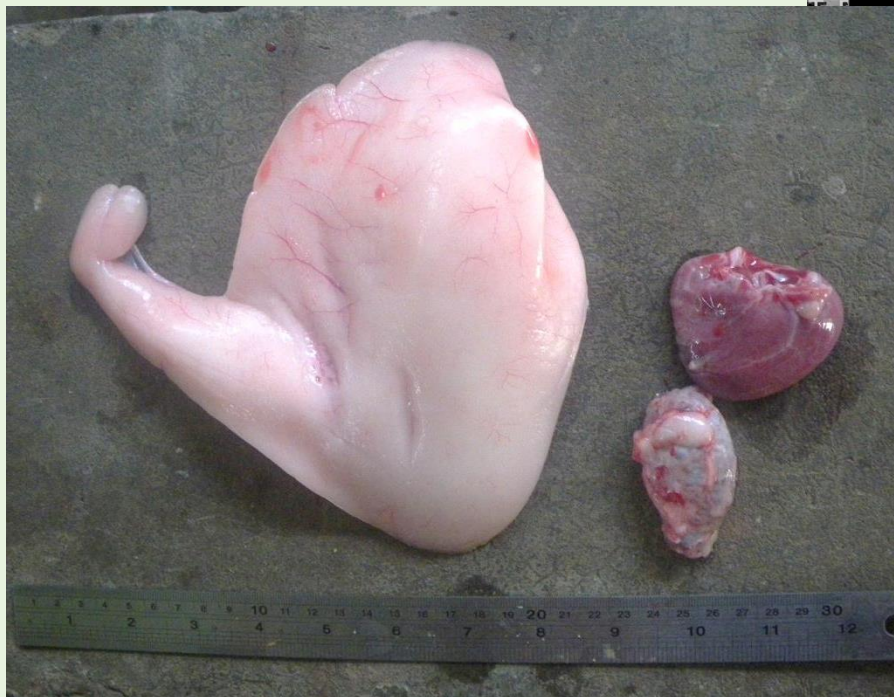




Fat body by ultrasound

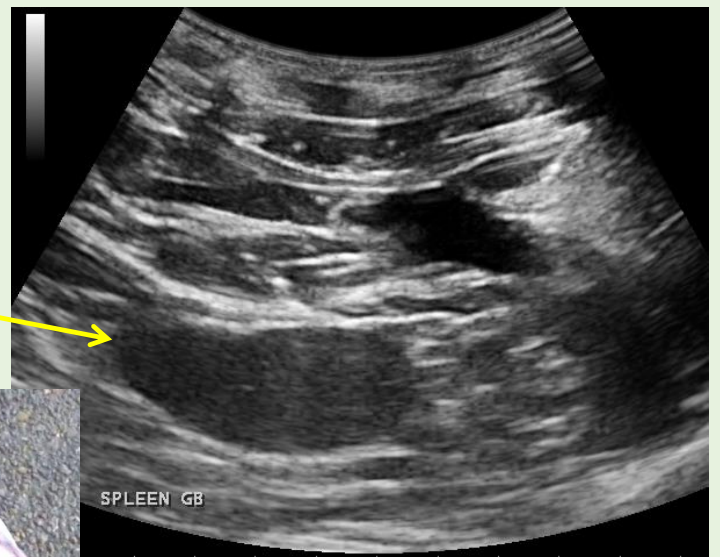
- Size of the Fat Body is impossible to determine without imaging.
- Organ volume is not accurate as a result of shape of the organ but maximum dimensions are to qualify as 'depleted', 'OK', 'Large'





Spleen

- Spleen shape and budding can be seen, size can be measured, also not accurate.
- Texture can be appreciated
- Budding sign of activation/stimulation of immune system
- Requires some patience to find and examine: find the GB, look below it



Findings, gonads

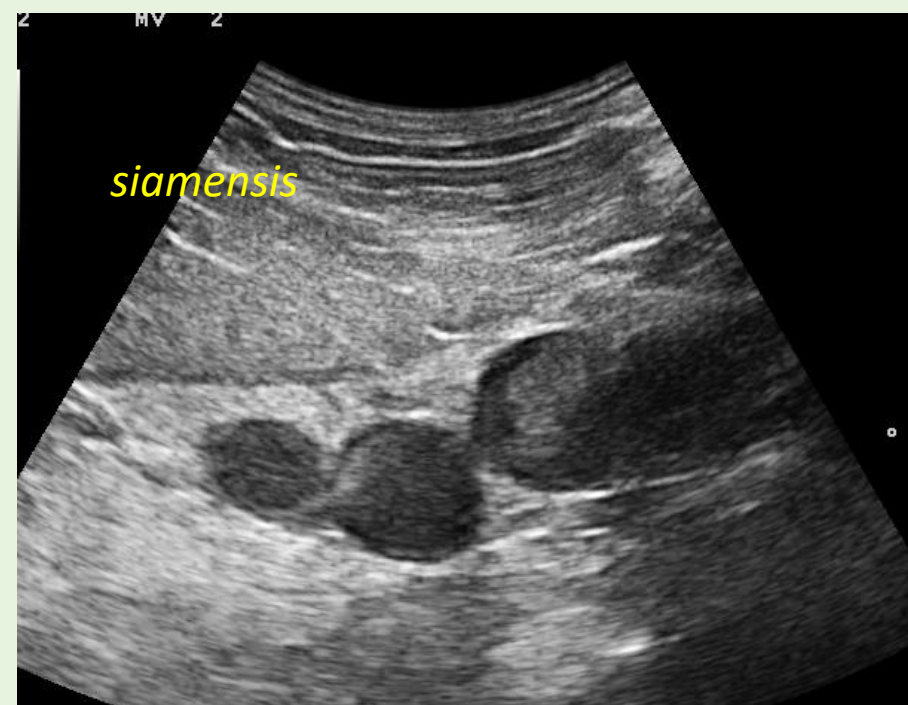
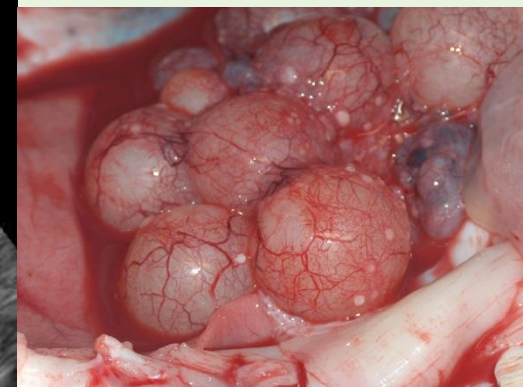
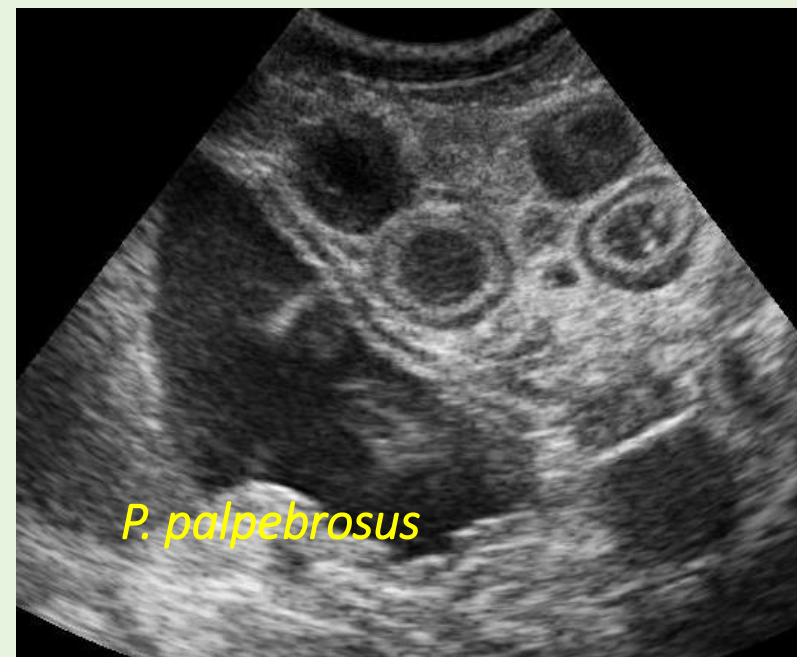
- Gonads can be visualized and measured
- Reproductive status of females is easily assessed
- Males reproductive status : data is lacking but testicles are observable, though sometimes hard to find



A. sinensis

Siamensis



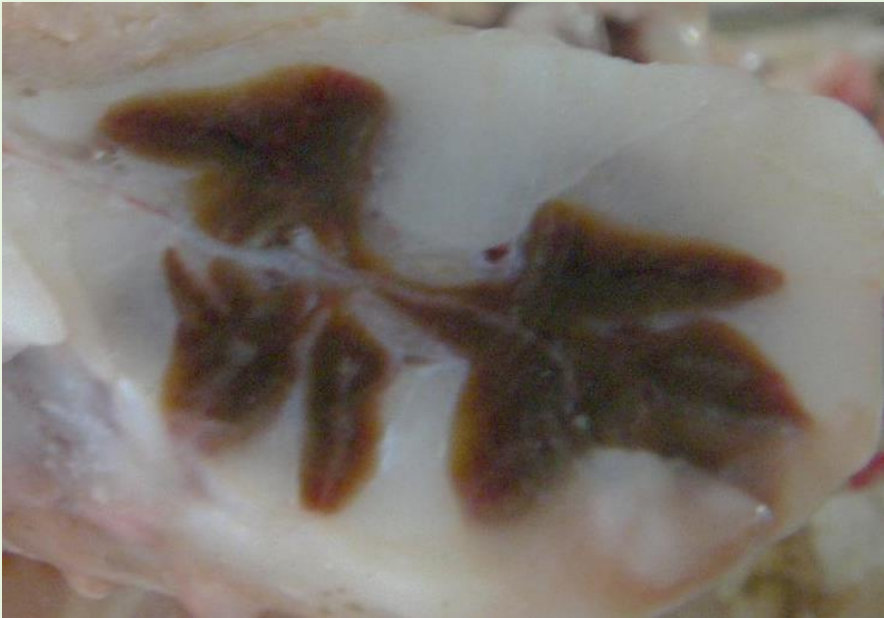


Other organs that can be found and assessed

- Gall bladder
- Pancreas : between duodenal loops
- Intestines and duodenal loop
- Stomach
- Kidneys: most difficult organ to recognise, species differences

Kidneys

C siamenis



C niloticus



No. , ,

MAR 04 2011 10:30am

3.5 MHz G 52%
13 cm XV C
RC 12-3-H PRS 4
ST 2 MV 2



: CHINESE ALLIGATOR

DUOD LOOP

Pancreas

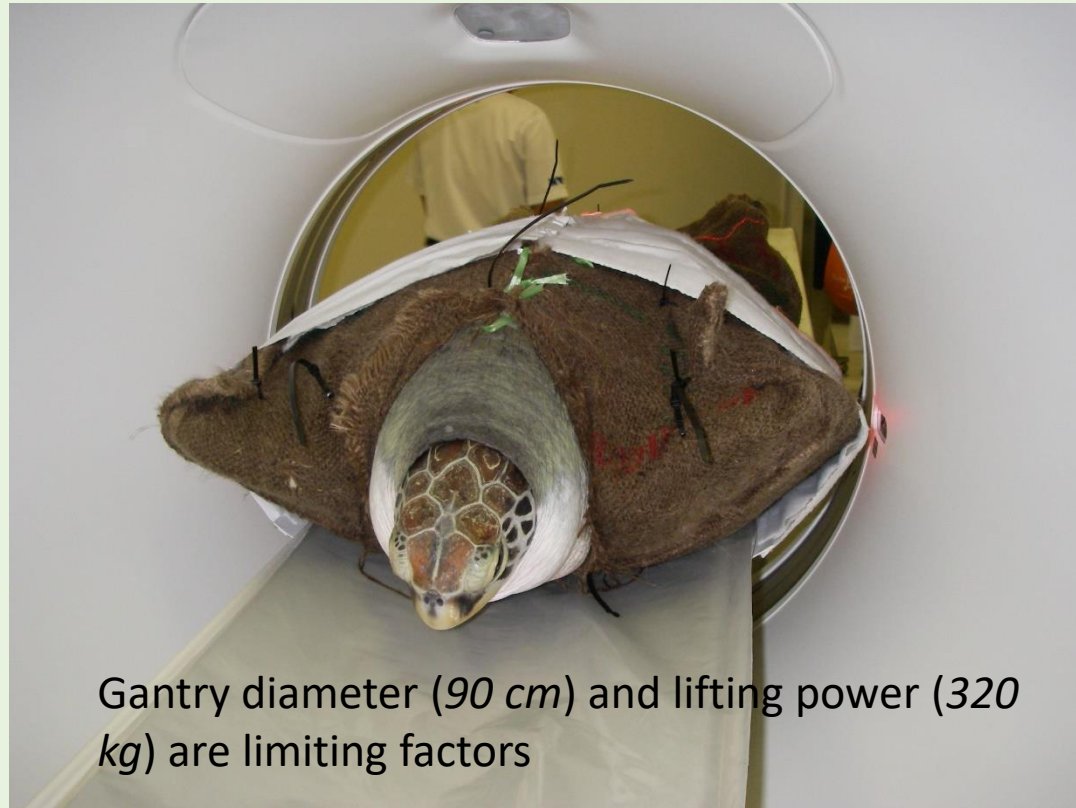


Forensics?

- Death , rotting or freezing affect ultrasound imaging

Computed Tomography CT scan. Serial rotating X-rays and big computers

More costly , not portable (yet?)



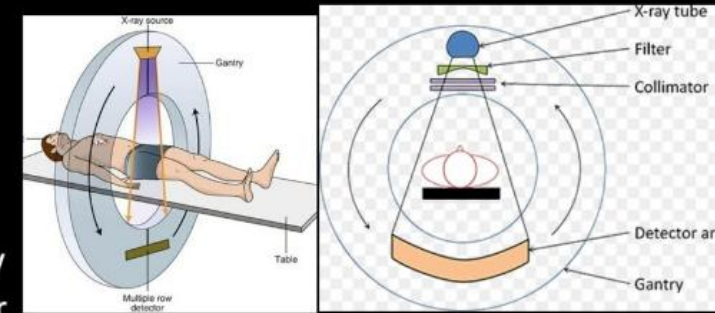
Gantry diameter (90 cm) and lifting power (320 kg) are limiting factors

Components of CT scanner

Part - 1

CT Gantry

1. CT Tube
2. CT Collimator
3. Detectors
4. Filters
5. High frequency generator
6. Patient couch



Radiology Technical

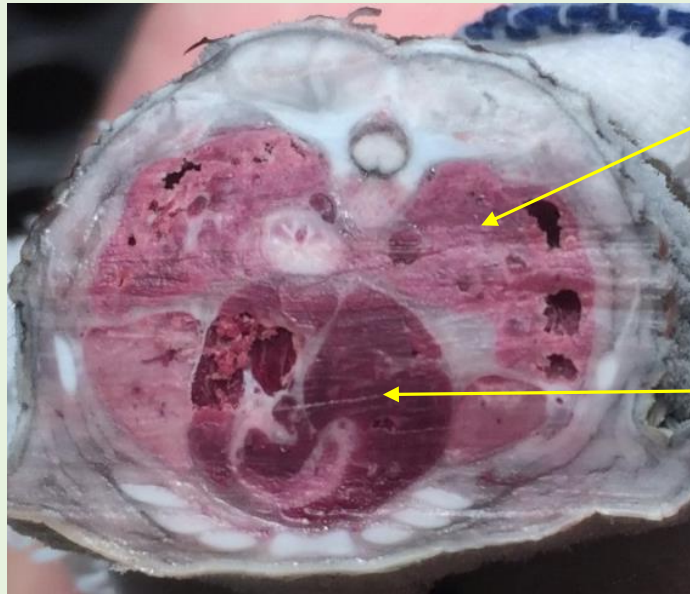


Chinese alligator IV contrast

Advantages

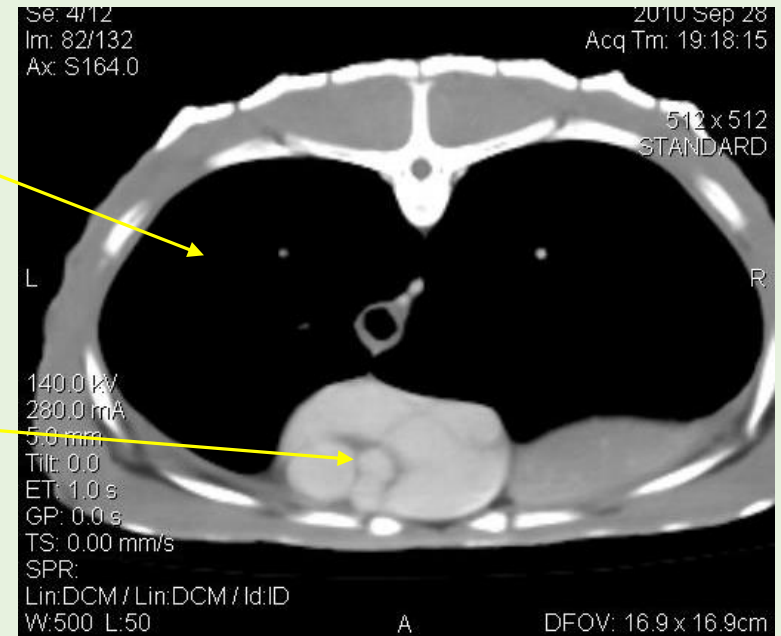
- Fast
- All organs are more easily viewed
- Allows 3D studies
- Allows anatomical studies without sacrificing the subjects (live to fossil!)

Frozen section



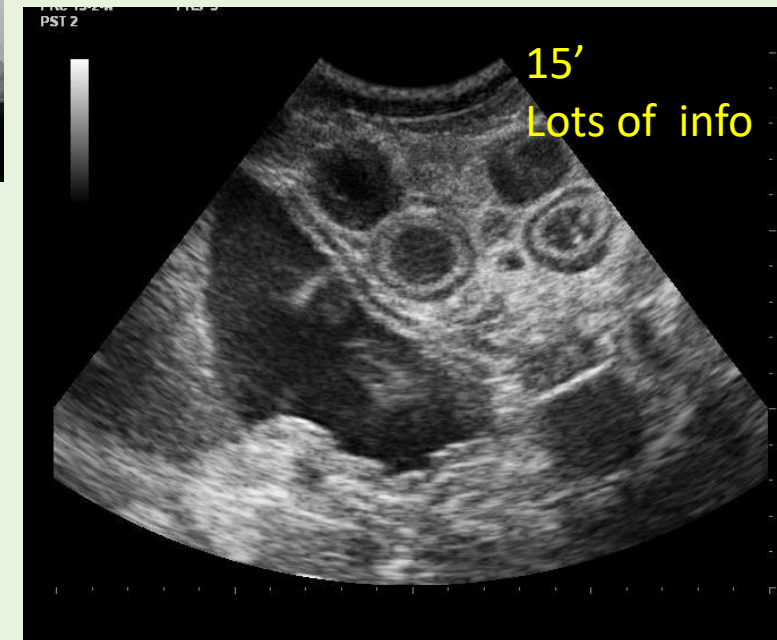
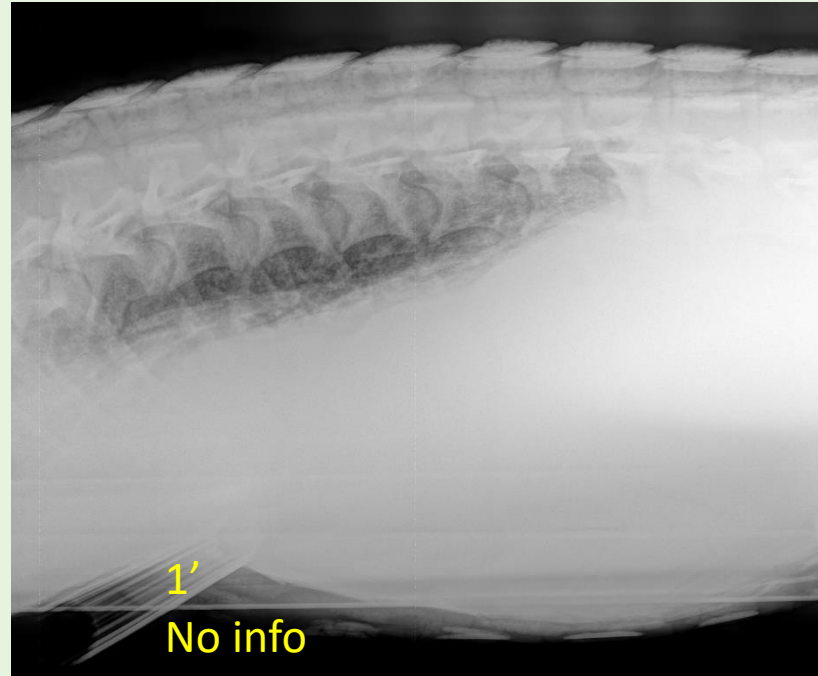
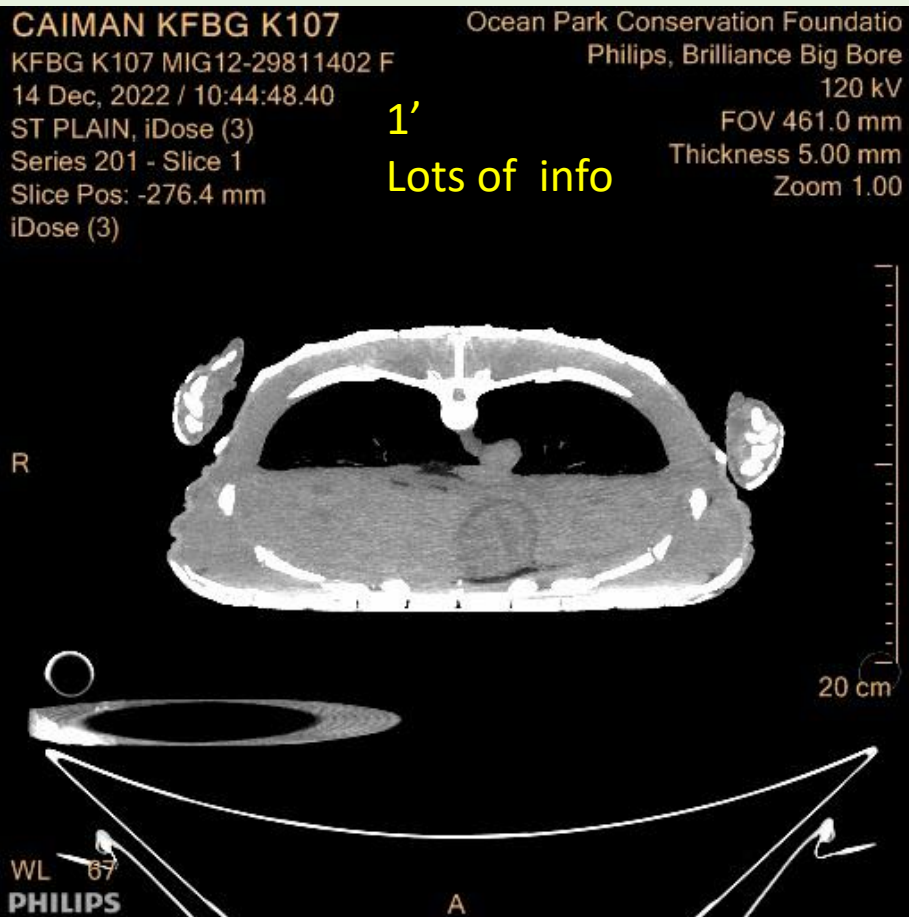
Lung

Heart



CT

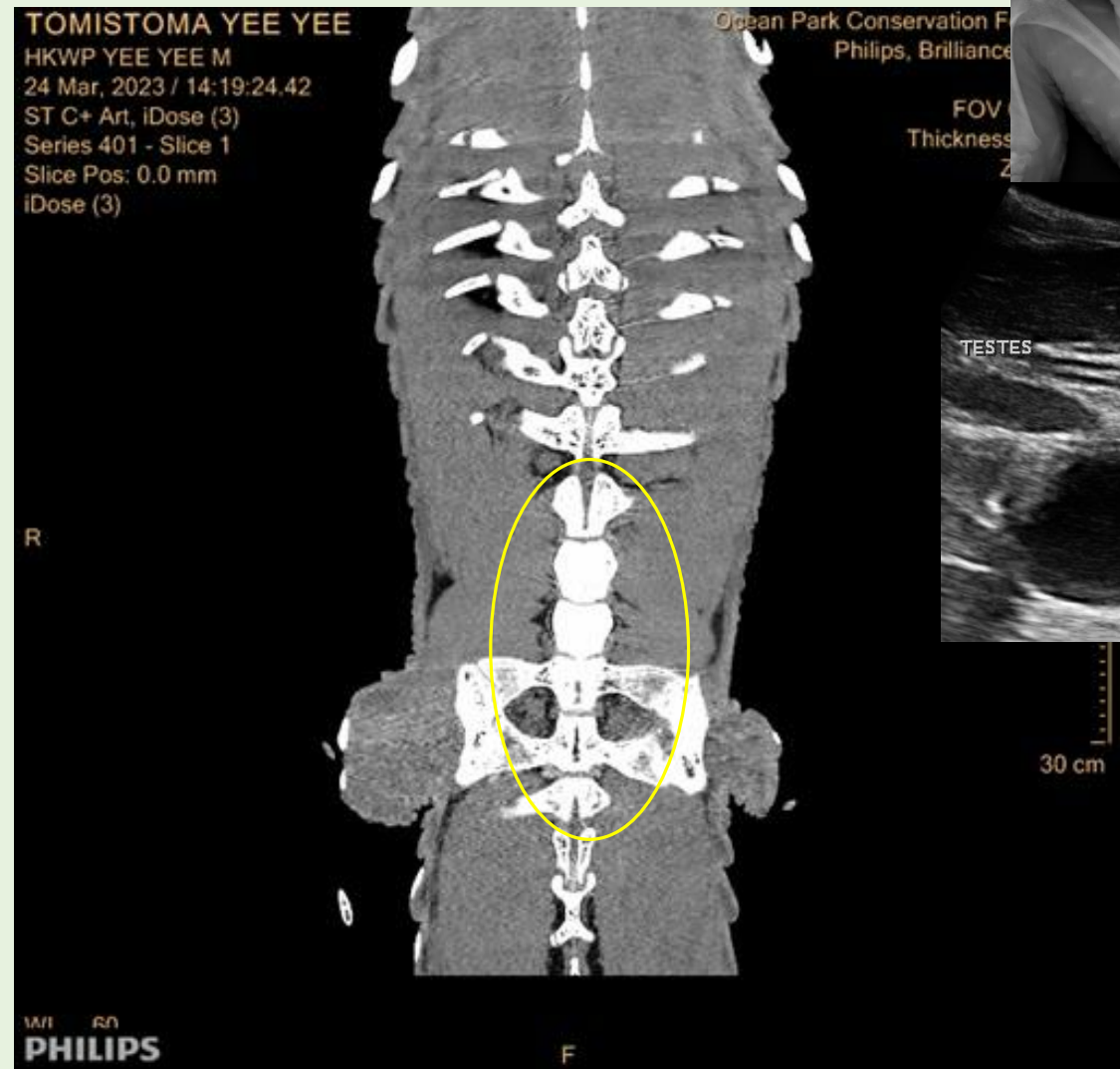
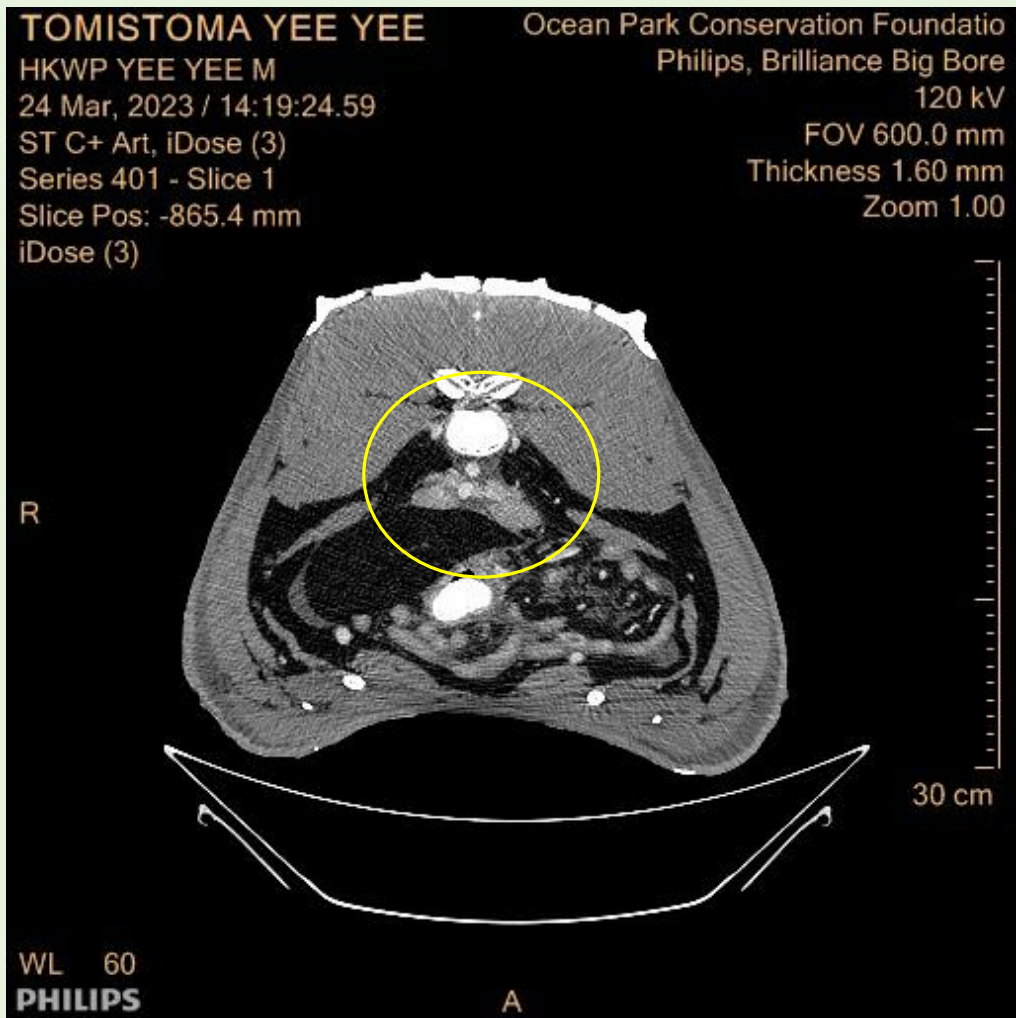
Abdominal Xrays vs CT vs US

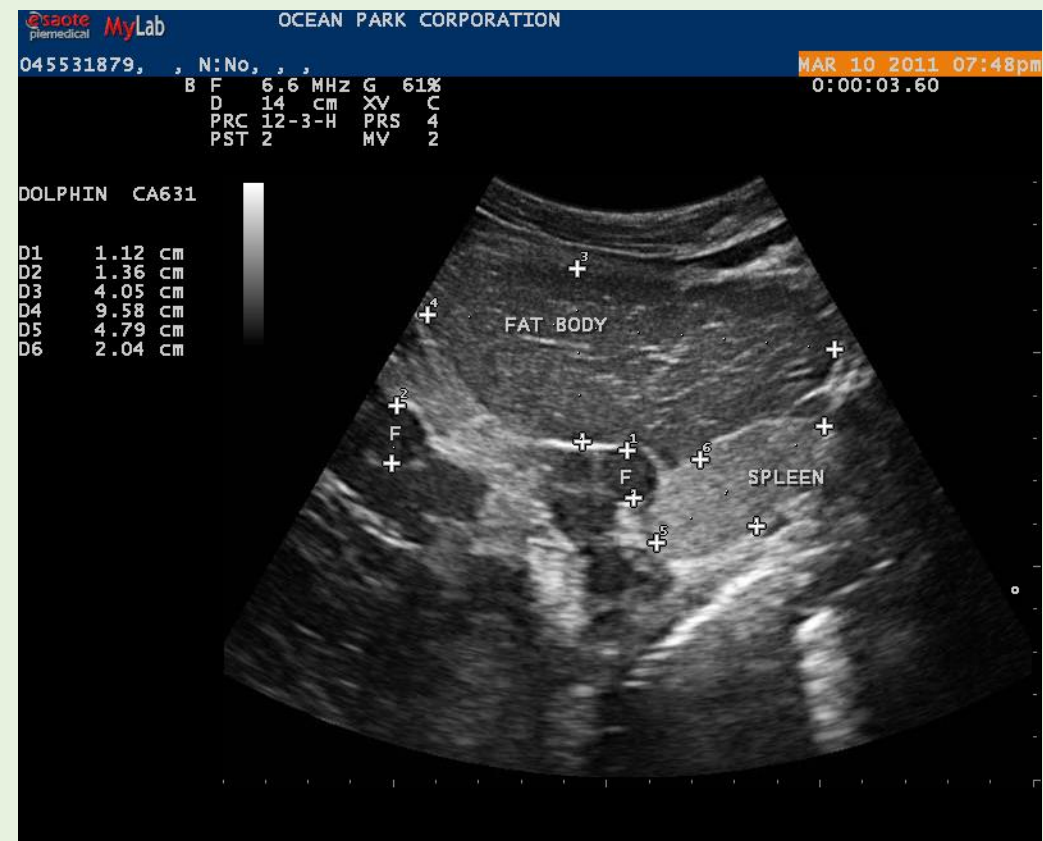
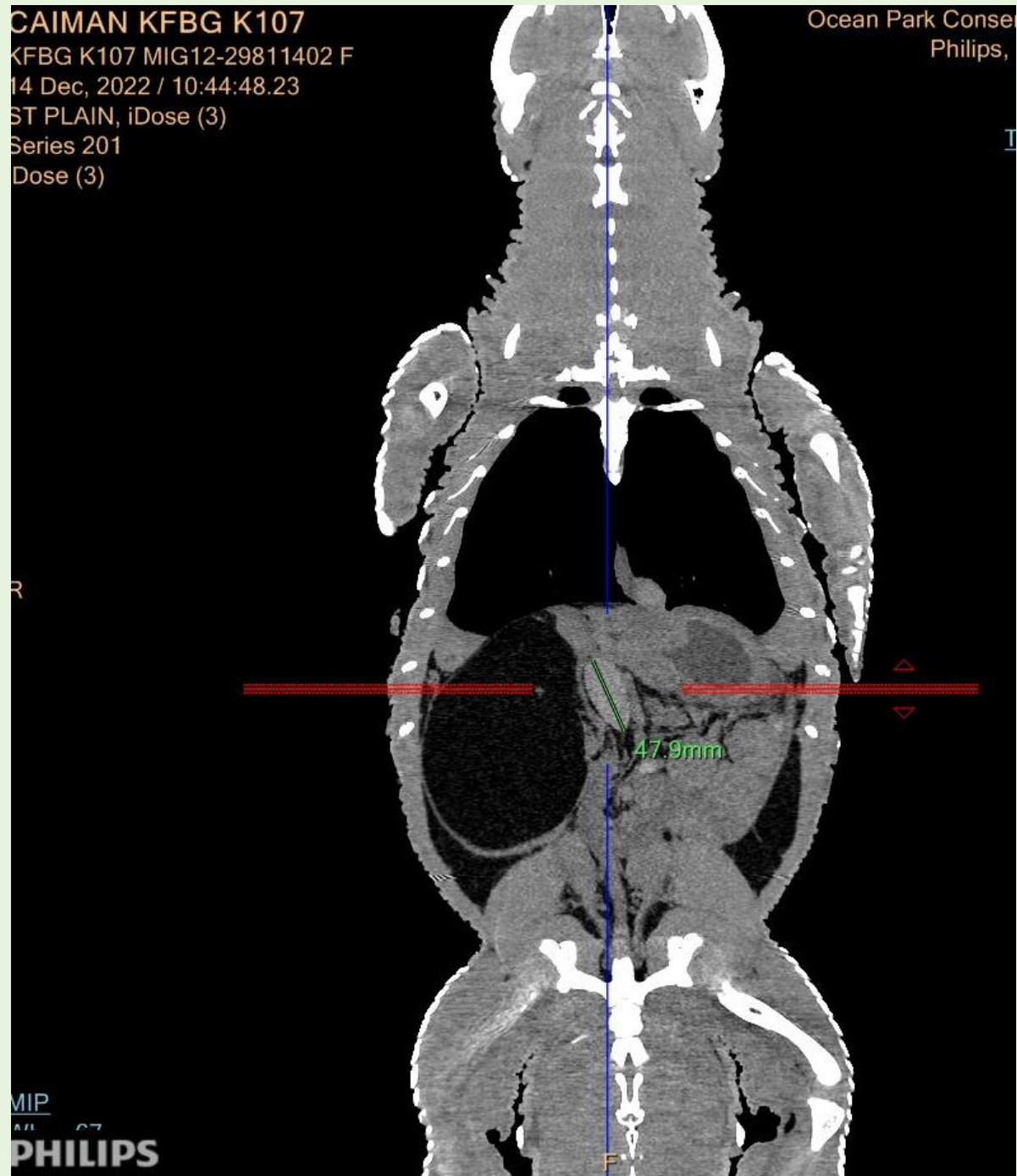


Organ appearance Lungs



Organ appearance Kidneys contrast





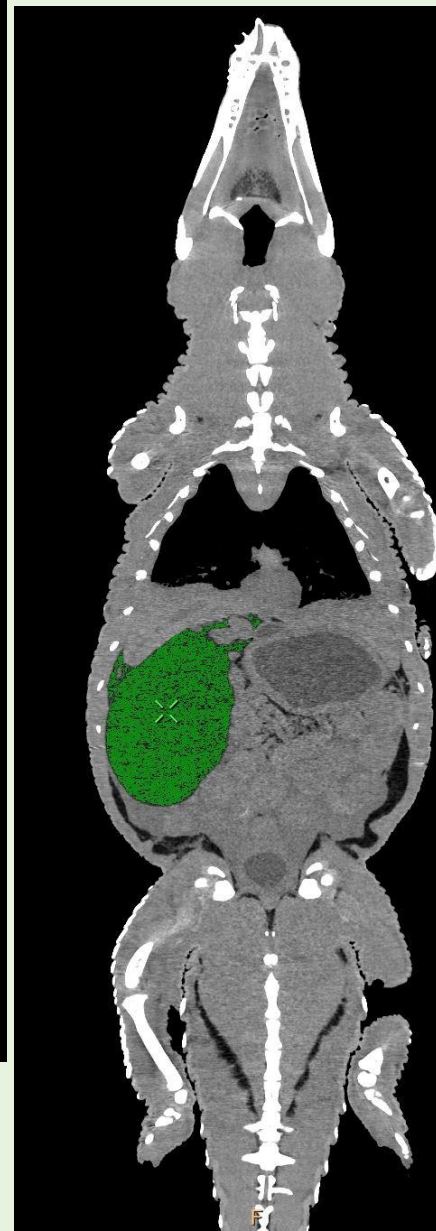
spleen



FB volume

Technical data on the right side of the image includes:

- PG K107
- G12-29811402 F
- 10:44:20.53
- ce 1
- Phillips, IntelliSpace Portal
- Zoom 1.00
- 50 cm
- R
- P
- F





HR

[Vol. Rend.](#)

PHILIPS

ARF

TOMISTOMA YEE YEE
HKWP YEE YEE M
24 Mar, 2023 / 14:19:08.05
ST C+ Art, iDose (3)
Series 401 - Slice 1



Cranial sinuses

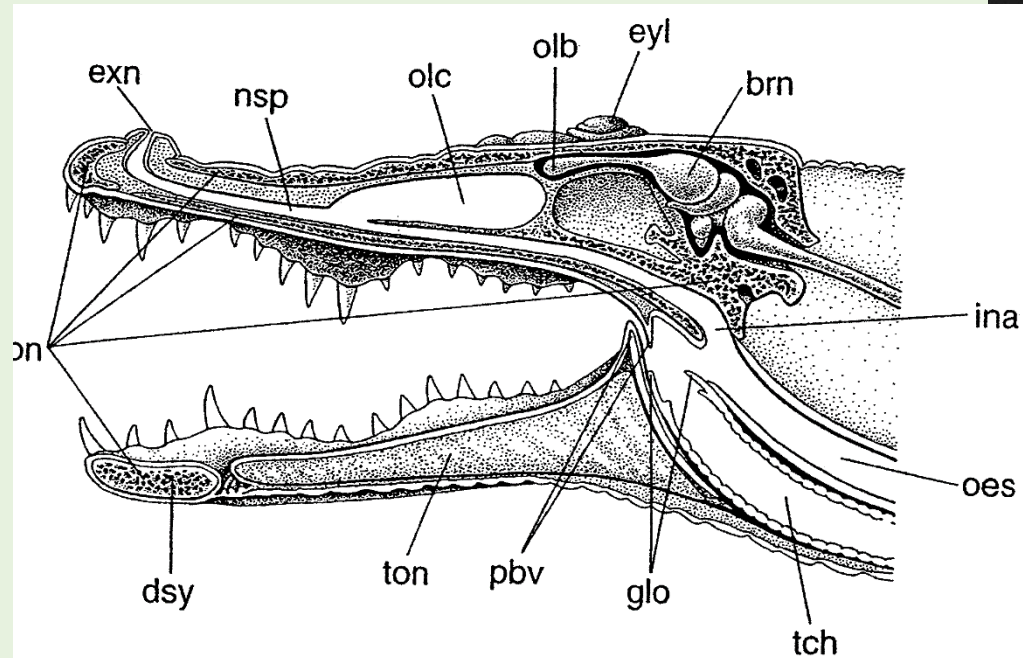
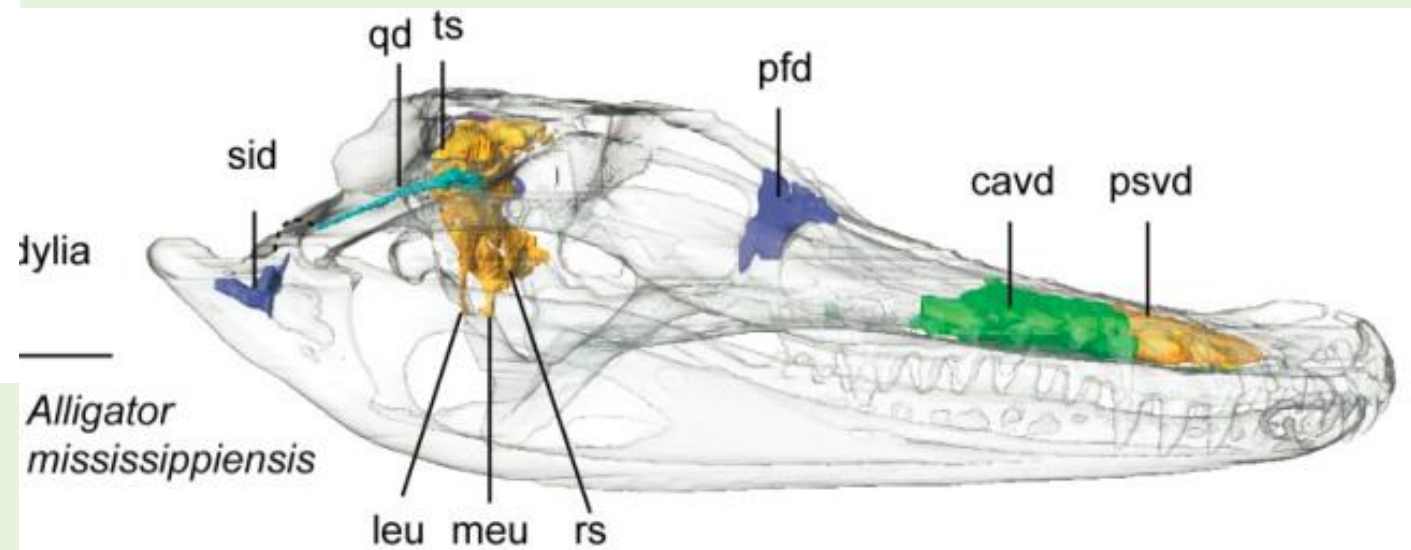
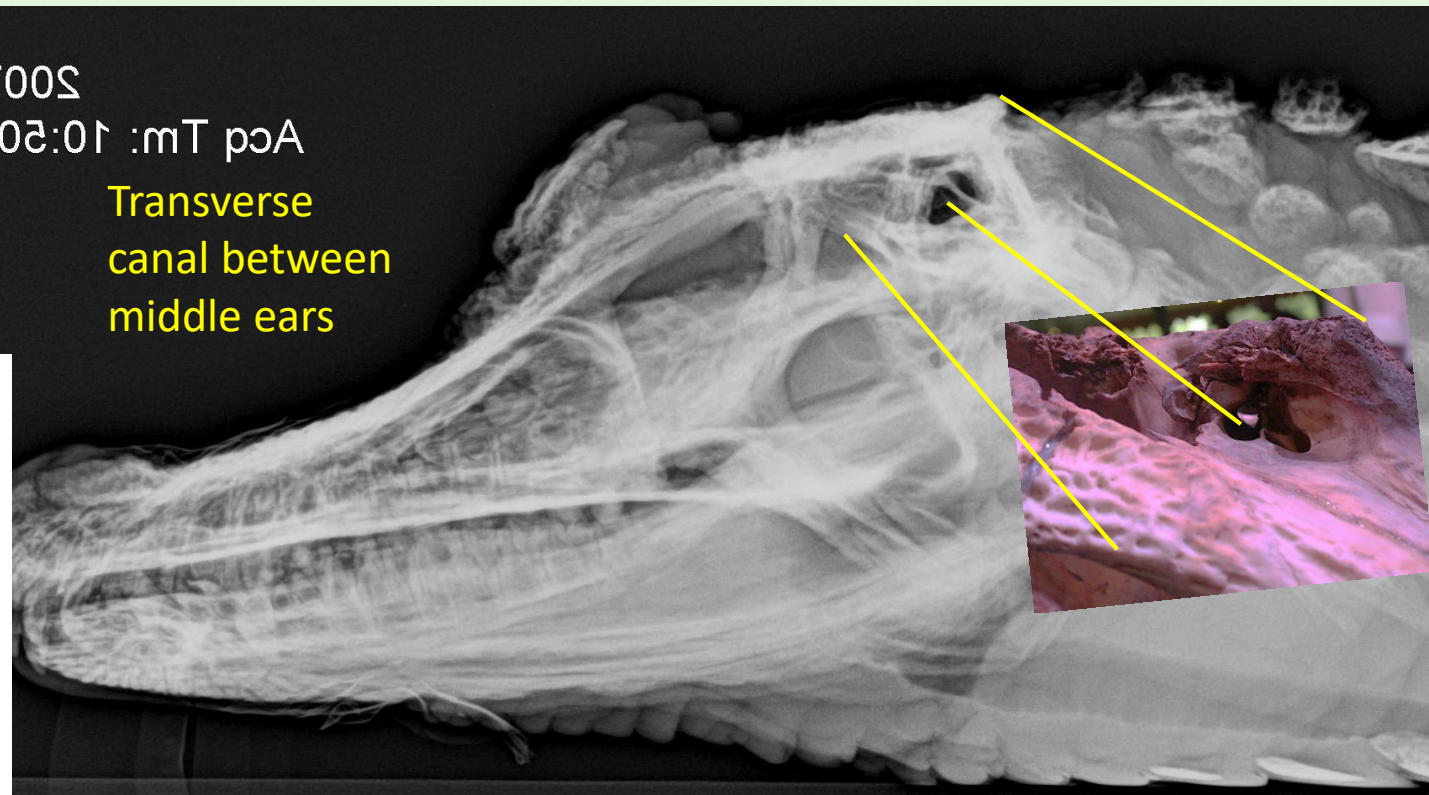
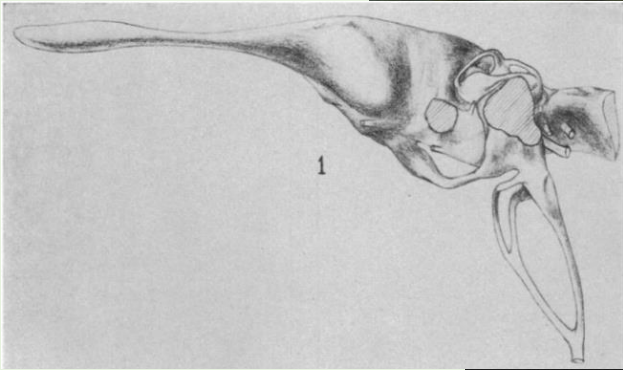


Figure 40.2 Sagittal section of the head of *Crocodylus porosus*. **bon**, bones of the skull; **brn**, brain; **dsy**, dentary symphysis; **exn**, external nares; **eyl**, eyelid; **glo**, glottis; **ina**, internal nares; **nsp**, nasal passages; **oes**, oesophagus; **olb**, olfactory bulb; **olc**, olfactory chamber (location of conchae); **pbv**, palato-buccal valve; **tch**, trachea; **ton**, tongue. [D. Kirshner]

7005
S:05:01 :mT poA

Transverse
canal between
middle ears

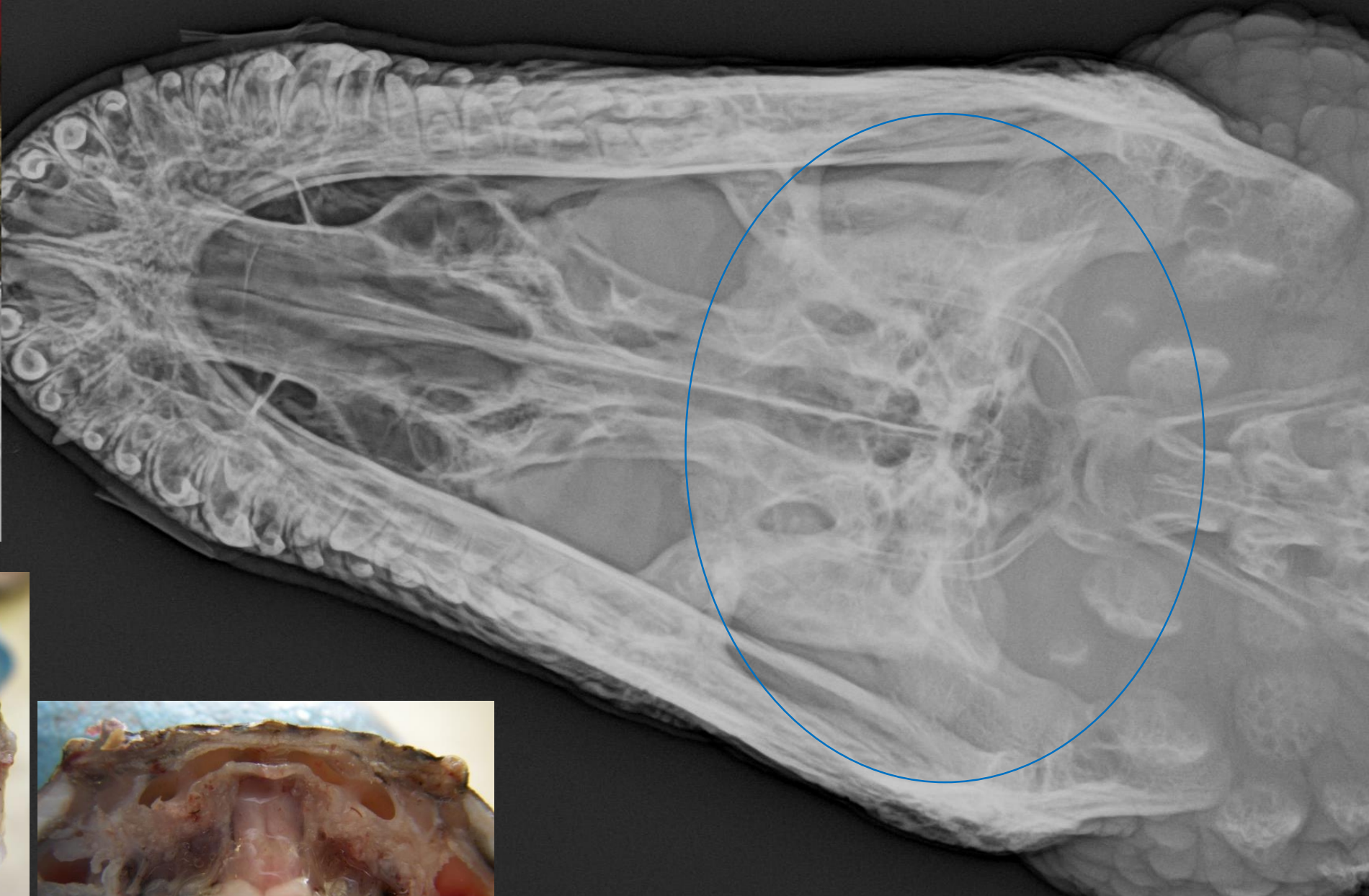


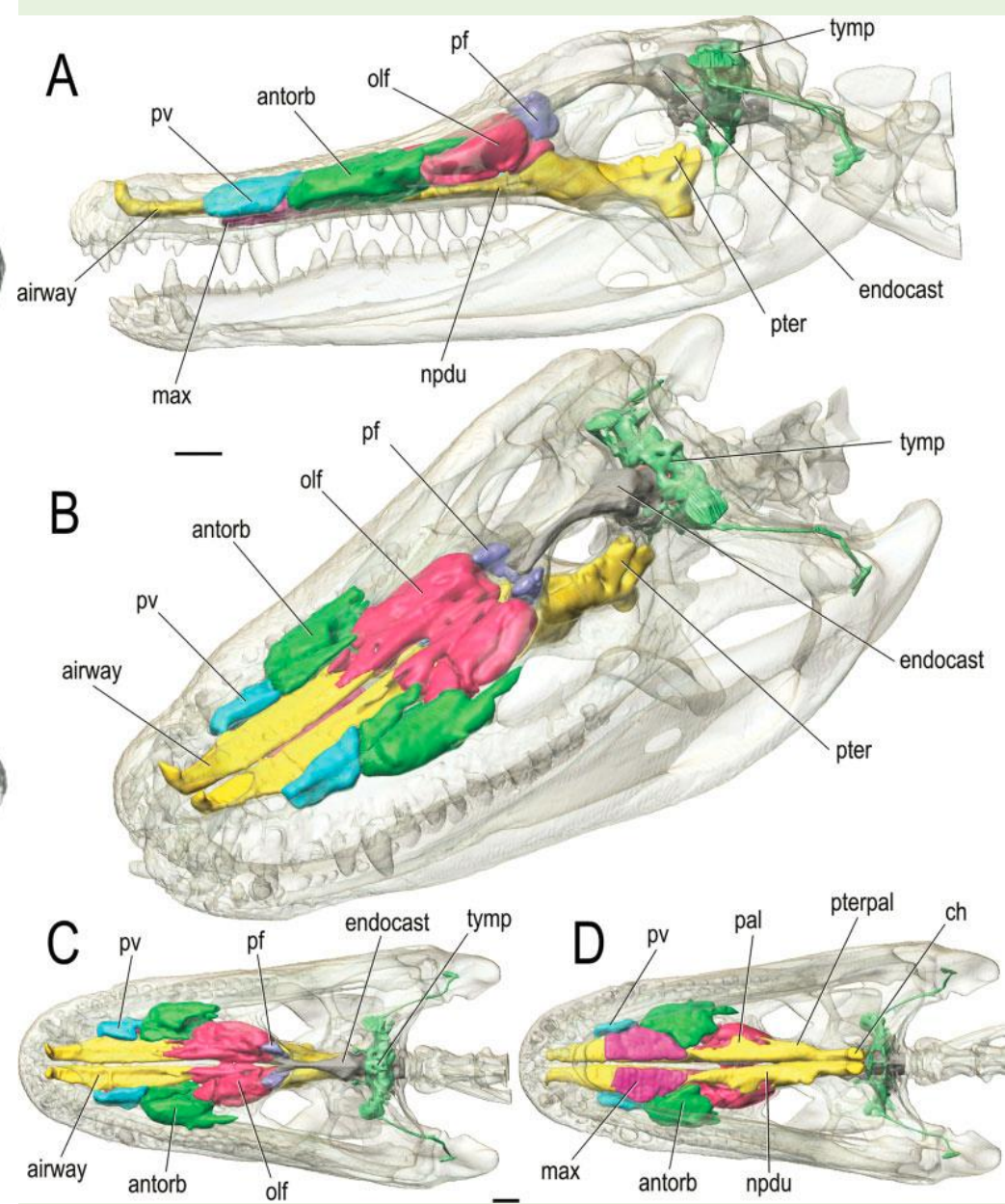
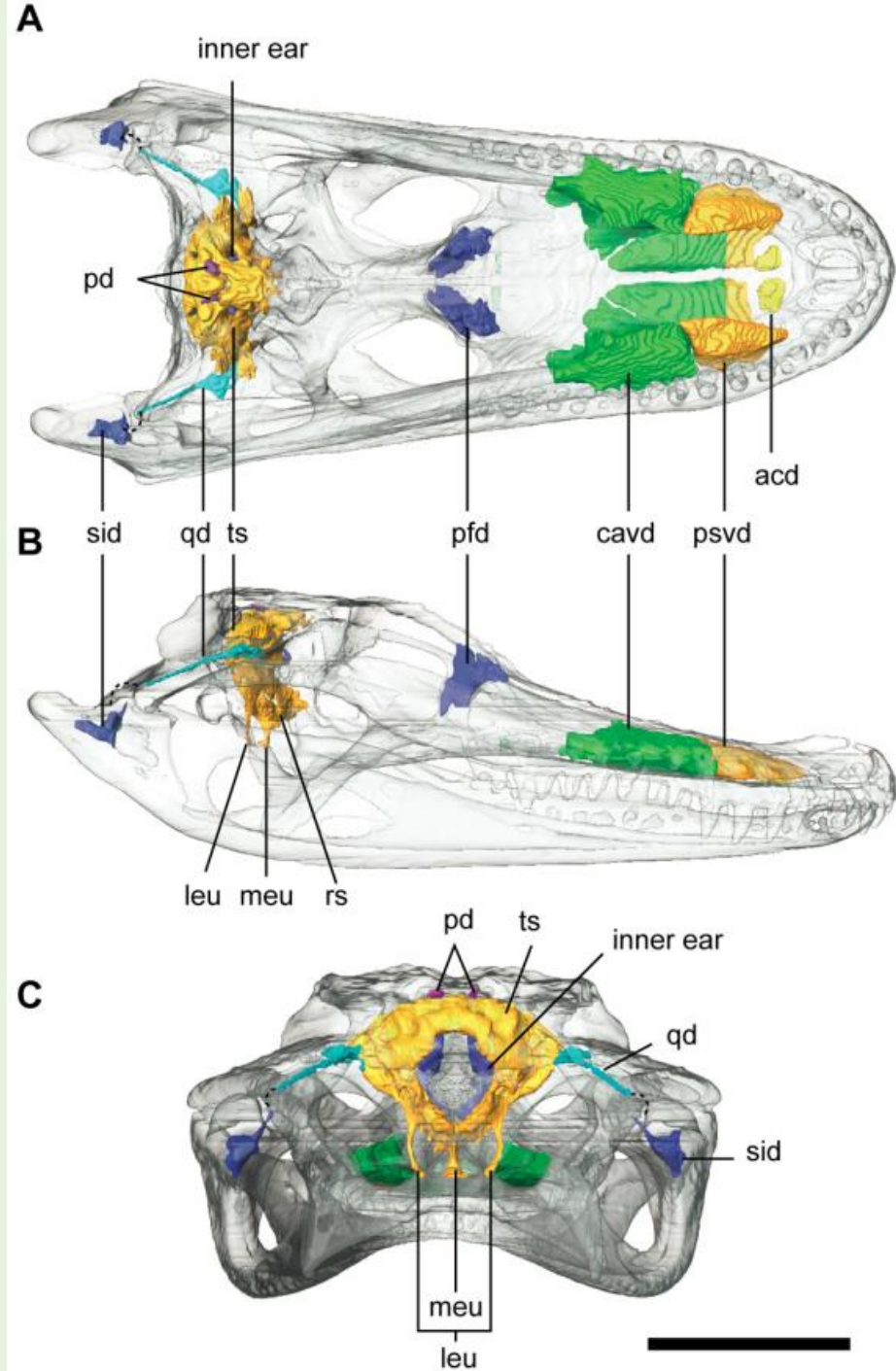


:mT poA

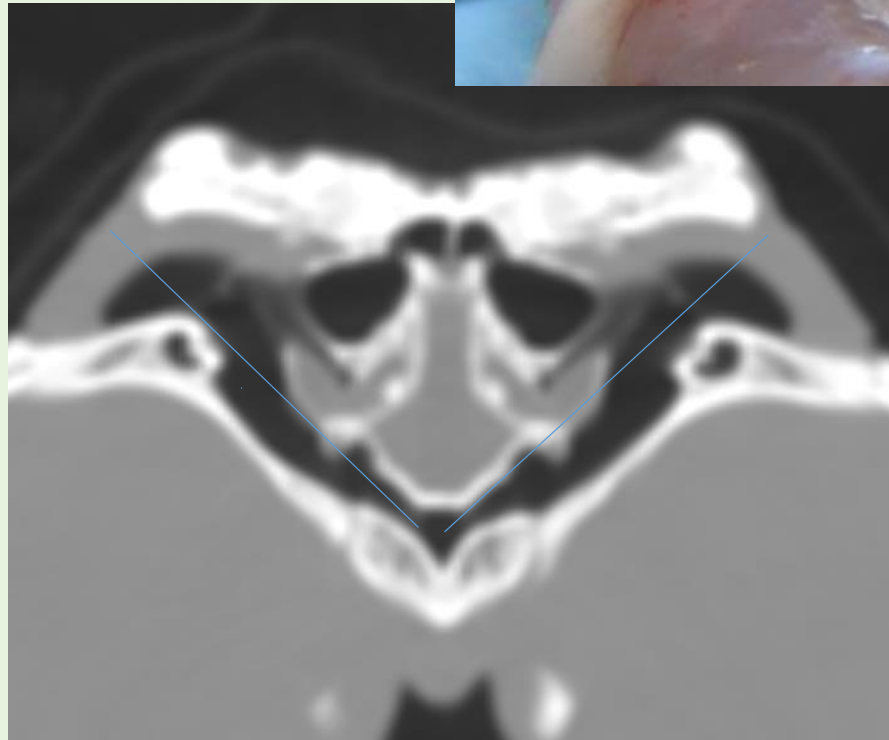
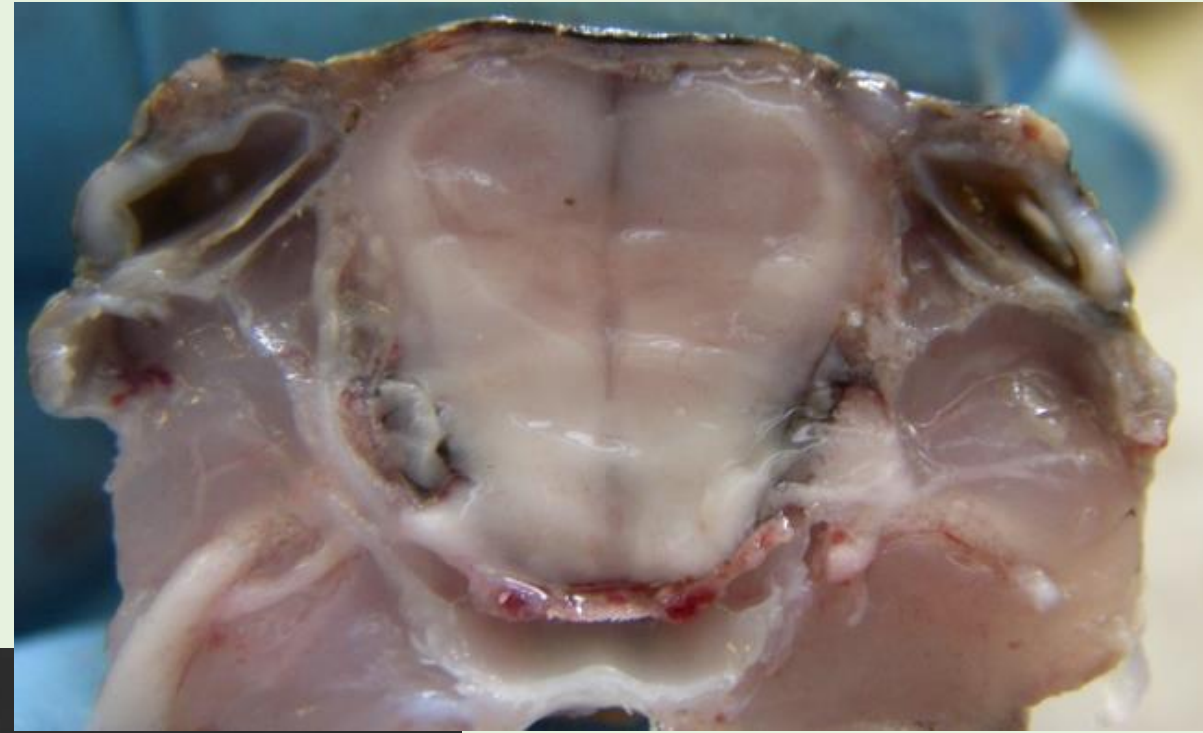
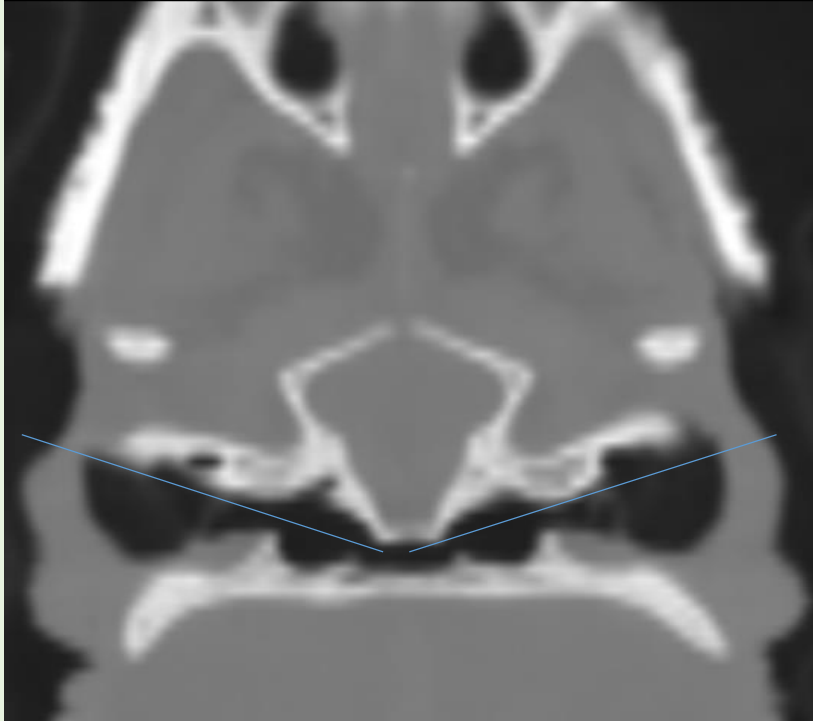
Colbert 1946





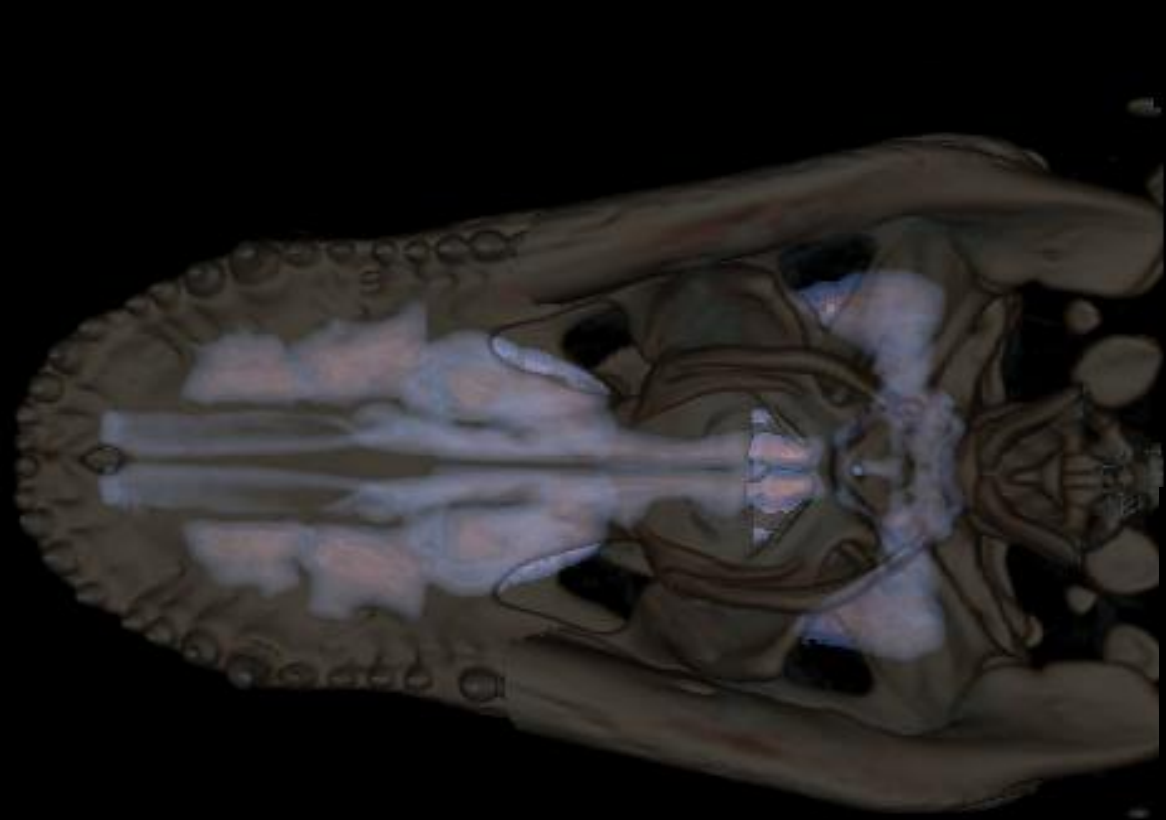


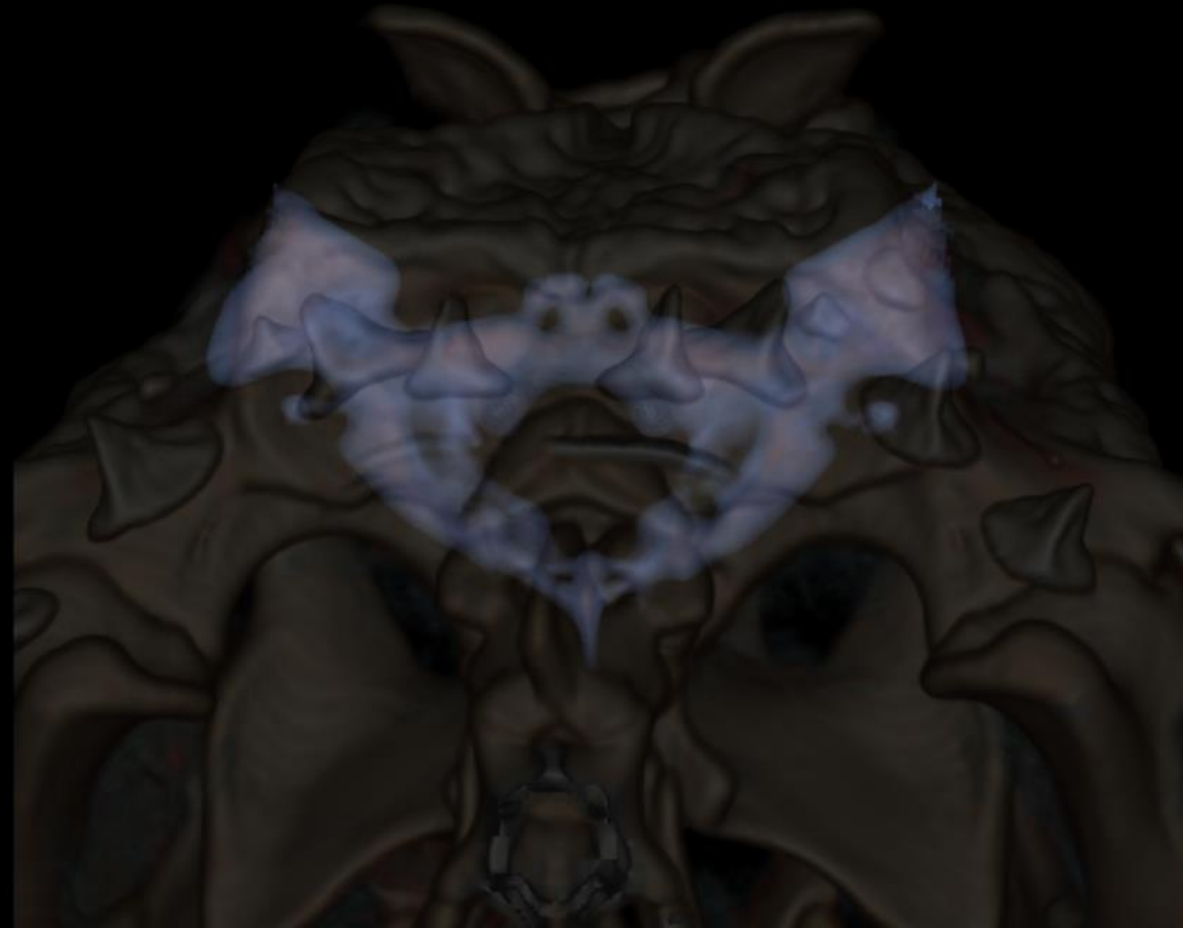
transverse

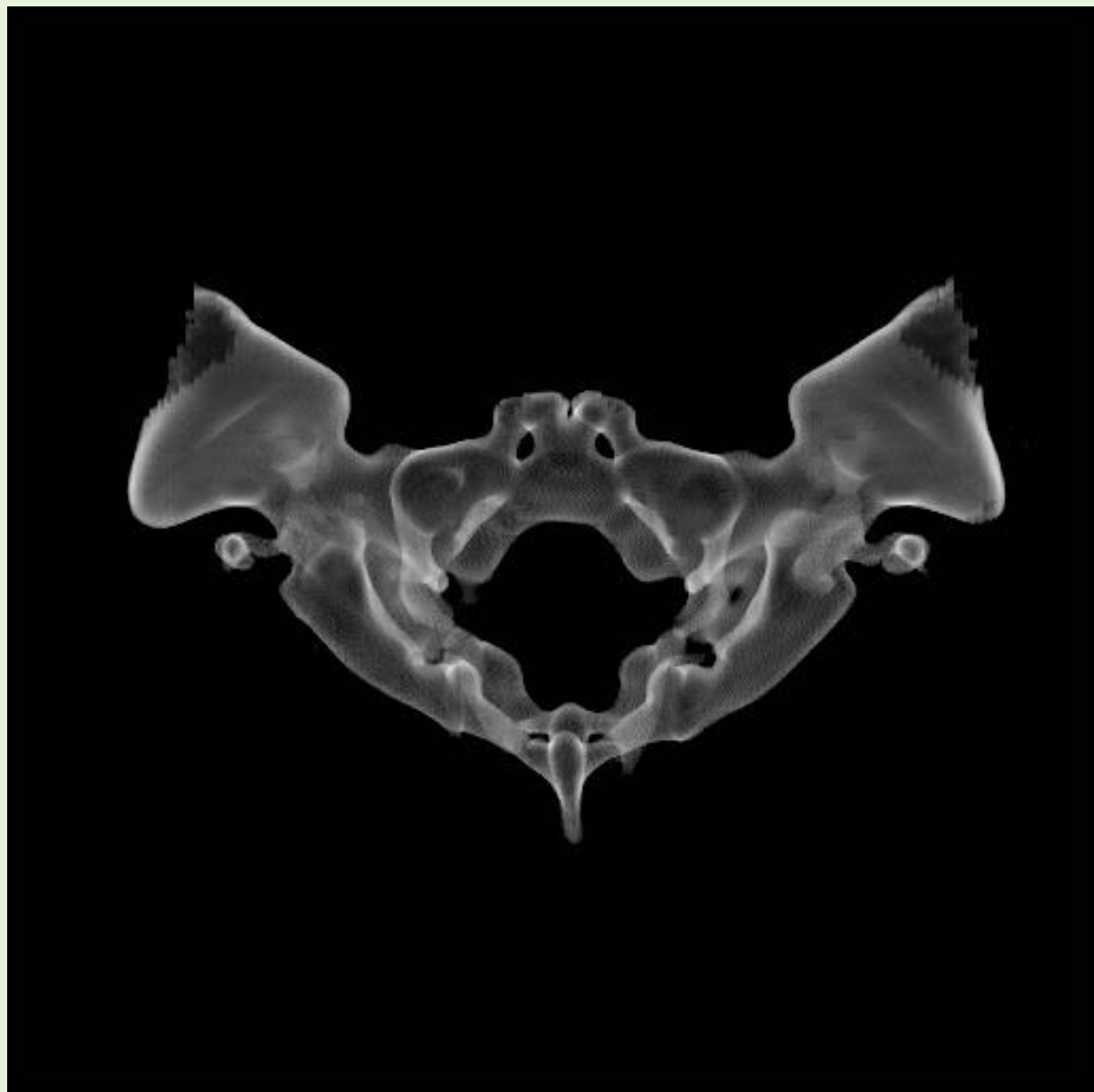
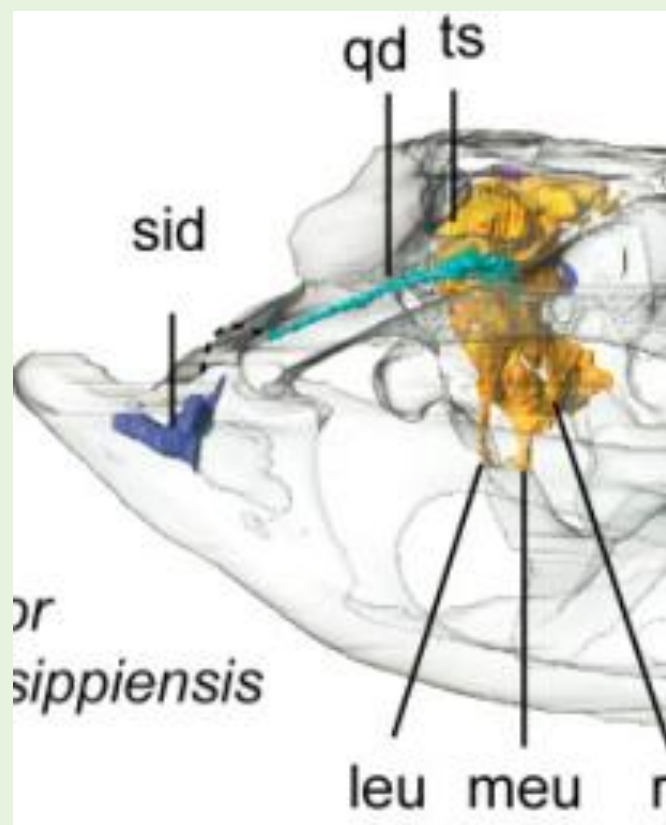




Acid Tm: 10:20:25
5005







Combining CT and Ultrasounds sounds ideal



Thank you

