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Select parasites of reptiles

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Parasitology

- General considerations:
  - Differences in parasite species and parasite loads between wild-caught animals and animals in managed care
  - Parasites with a direct life-cycles most important in clinical practice
  - Gastrointestinal parasites
    - Many are not shed continuously
    - Time between defecation and examination influences sensitivity

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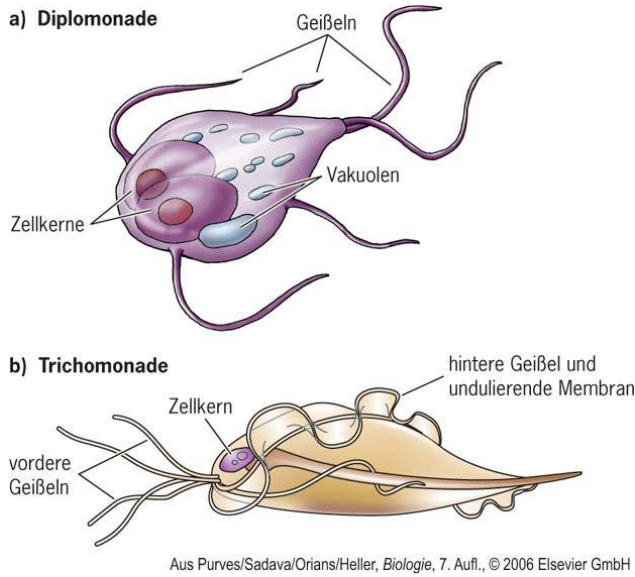
Parasitology

- Clinical disease often dependent on multiple factors, e.g.:
  - Parasite load
  - Host age
  - Co-infections
  - Hygiene

Single-celled parasites

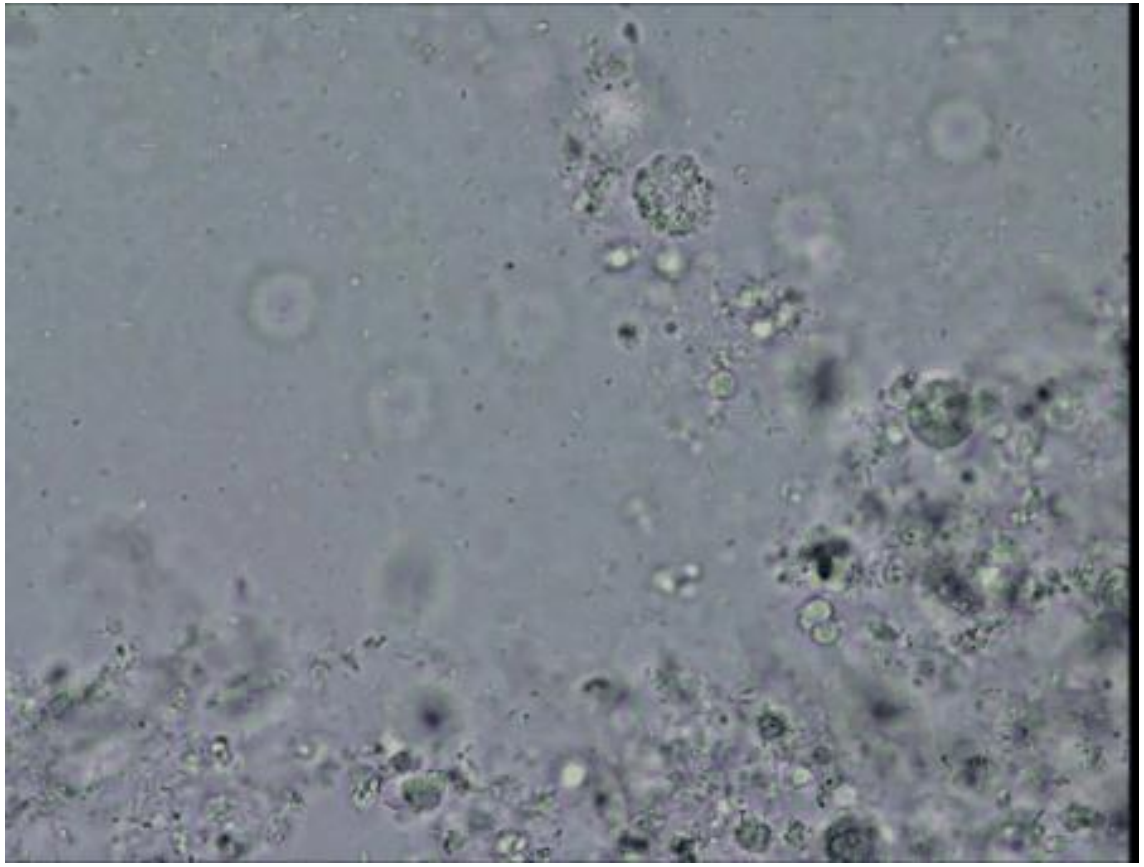
- Flagellates:
  - Genetically diverse, some common
- Amoeba:
  - Most important: *Entamoeba invadens*
- Coccidia



Isospora and oyxurid egg, bearded dragon

Diplomonadida

- **Pear shaped trophoites**
- 2 nuclei and 4 pairs of flagellae
- **Fast, strait forward movement „torpedo-like“**
- In reptiles: ***Hexamita*** *spp.* most common (esp. turtles and tortoises)
    - Colonize the intestine and can infest the kidney, leading to inflammation



Source: F. L. Frye

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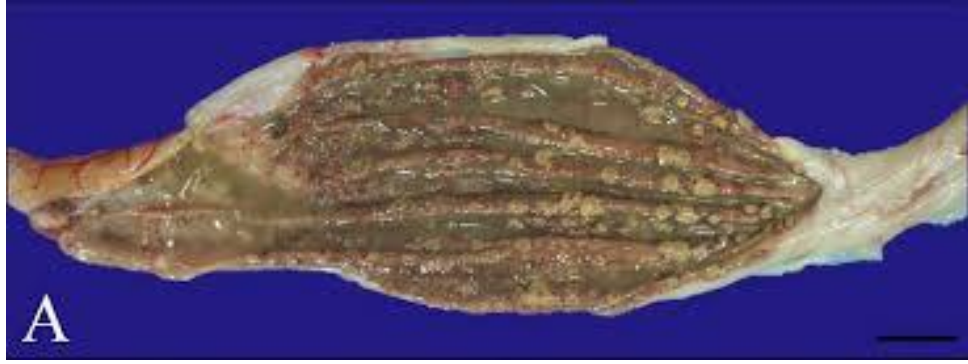
Amoeba



Stomach of an anaconda. Park et al. 2019. https://doi.org/10.17221/140/2018-VETMED

- *Entamoeba invadens*
  - Direct life cycle
  - Fecal-oral transmission
  - Motile trophozoite and more environmentally stable cyste
  - Most often found in squamates, but also pathogenic for chelonians
  - Cause enteritis and hepatitis
  - Multiple other *Entamoeba* species also found in reptiles
  - Diagnosis:
    - Microscopy, PCR
  - Treatment:
    - Adjustment of environmental temperature: >33°C in species that tolerate this
    - Metronidazole: 20 mg/kg PO daily

Testudine intranuclear coccidiosis (TINC)

- More than 70 coccidia have been described in chelonians
- First intranuclear coccidian in chelonians described in radiated tortoises (*Astrochelys radiata*) in the USA in 1994
- Considered an emerging disease in tortoises

Journal of Zoo and Wildlife Medicine 25(1): 95–102, 1994

INTRANUCLEAR COCCIDIOSIS IN RADIATED TORTOISES (*GEOCHELONE RADIATA*)

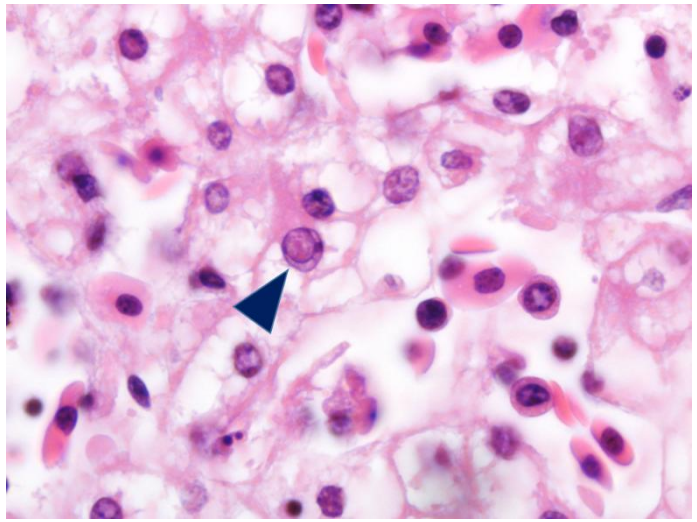
Elliott R. Jacobson, D.V.M., Ph.D., Juergen Schumacher, D.V.M., Sam R. Telford, Jr., Ph.D., Ellis C. Greiner, Ph.D., Claus D. Buergelt, D.V.M, Ph.D., and Chris H. Gardiner, Ph.D.

TINC

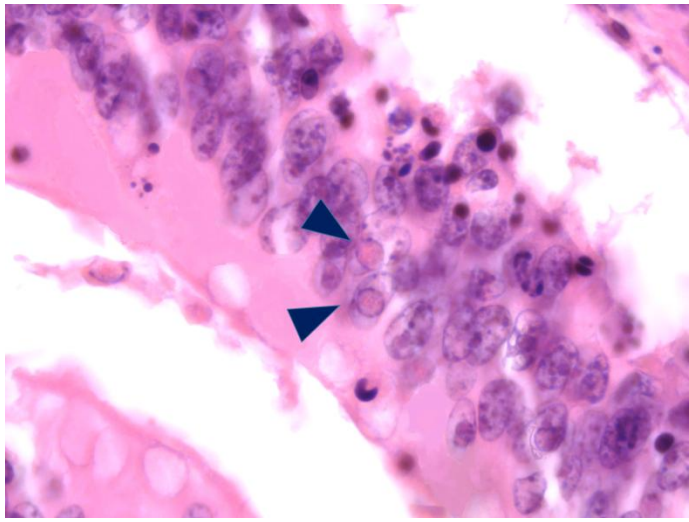
- Described in various species
  - Mostly tropical tortoises, e.g.
    - Leopard tortoises (*Stigmochelys pardalis*)
    - Indian star tortoises (*Geochelone elegans*)
    - Spider tortoises (*Pyxis arachnoides*)
    - Red-footed tortoises (*Chelonoidis carbonarius*)
  - Also described in Emydidae
    - E.g. box turtles (*Terrapene carolina carolina*)
  - Also in Geoemydidae
    - E.g. Arakan forest turtles (*Heoseyms depressa*)

TINC

- Clinical signs:
  - Non-specific
  - Anorexia, lethargy, weight loss, respiratory disease, cloacal swelling, ascites
  - Systemic disease:
    - Found in e.g., gastro-intestinal tract, liver, respiratory tract, urinary tract, pancreas, eye, ear, etc.



Liver of a radiated tortoise with TINC



Small intestine of a radiated tortoise with TINC

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TINC

- Transmission study: 2 animals of each species infected orally with oocystes:
  - Leopard tortoise (*Stigmochelys pardalis*)
  - African spurred tortoise (*Centrochelys sulcata*)
  - Spur-thighed tortoise (*Testudo graeca*)
  - Hermann‘s tortoise (*Testudo hermanni*)
  - Horsfield‘s tortoise (*Testudo horsfieldii*)
- All were successfully infected and shed oocysts
- Spur-thighed and leopard tortoises developed disease


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European Journal of Protistology 67 (2019) 71–76

European Journal of PROTISTOLOGY

www.elsevier.com/locate/ejop

Intranuclear coccidiosis in tortoises — discovery of its causative agent and transmission

Lada Hofmannová[a,*], Jana Kvičerová[b], Kristýna Bízková[a], David Modrý[a,c,d]

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TINC

- Detection usually via PCR
- Usually shed through the cloaca
  - Also found in oral swabs, nasal discharge, and in the blood
- Diagnostic samples:
  - Combined oral and cloacal swabs
  - Nasal discharge, if present

TINC

- Treatment:
  - Ponazuril 30 mg/kg PO every 24 h
  - Toltrazuril 15-30 mg/kg PO every 48 h
  - Higher doses may be necessary, long treatment period

Journal of Zoo and Wildlife Medicine 48(4): 1165–1171, 2017

EXTENSION OF THE KNOWN HOST RANGE OF INTRANUCLEAR COCCIDIOSIS: INFECTION IN THREE CAPTIVE RED-FOOTED TORTOISES (*CHELONOIDIS CARBONARIA*)

Justin M. Stilwell, D.V.M., Natalie K. Stilwell, D.V.M., Ph.D., Nicole I. Stacy, D.V.M., Dr. med. vet, Dipl. A.C.V.P. (Clinical), James F.X. Wellehan, D.V.M., Ph.D., Dipl. A.C.Z.M., Dipl. A.C.V.M., and Lisa L. Farina, D.V.M., Dipl. A.C.V.P.

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THE OFFICIAL PUBLICATION OF THE ASSOCIATION OF REPTILE AND AMPHIBIAN VETERINARIANS

ROUNDTABLE

The Journal of Herpetological Medicine and Surgery, Volume 32, No. 2, 2022 pp. 144–154
DOI: 10.5818/JHMS-D-20-00024

Testudine Intranuclear Coccidiosis (TINC)

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Journal of Zoo and Wildlife Medicine 49(3): 802–805, 2018

A PRELIMINARY ANALYSIS OF PROLONGED ABSORPTION RATE OF PONAZURIL IN RED-FOOTED TORTOISES, *CHELONOIDIS CARBONARIA*

Shemi L. Benge, B.S., M. Tobias Heinrichs, Pharm.D., Sarah E. Crevasse, A.A., Behrang Mahjoub, M.Sc., Charles A. Peloquin, Pharm.D., F.C.C.P., and James F.X. Wellehan Jr., D.V.M., Ph.D., Dipl. A.C.Z.M., Dipl. A.C.V.M.

TINC

- Animals can be treated and clinical improvement is possible
  - Treated animals likely remain carriers

- Recommendation for quarantine in order to determine freedom from infection:
  - Test 3x in 4-6 week intervals

Cryptosporidia

- Apicomplexa, closely related to coccidia
- Globally distributed
- Direct lifecycle
- Gastro-intestinal infections in vertebrates
  - Over 45 species recognized
  - Some very host specific, others broader host ranges
- Several species found in reptiles
  - Other species found in prey animals

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Cryptosporidia

- Two most common species in reptiles: *C. serpentis* and *C. varanii* (previously referred to as *C. saurophilum*)
- In chelonians: *C. testudinis* and *C. ducismarci*
- *C. avium* found in multiple cases in lizards

→ Gastric: *C. serpentis, C. testudinis*

→ Intestinal: *C. varanii, C. ducismarci*

- Not self limiting, can cause chronic, fatal disease

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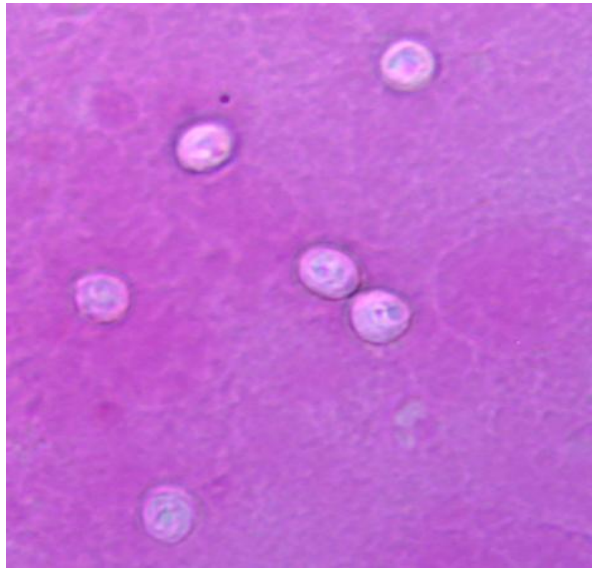
Cryptosporidia: Diagnosis

- Sample materia: Feces, regurgitated material, gastric bioptate
- Methods:
  - PCR (with sequencing for species differentiation)
  - Microscopy with various staining methods (modified Ziehl-Neelsen)
  - Immunofluorescent antibody test (IFAT)
- Are not shed continuously – it may be necessary to test multiple samples



Cryptosporidia: Treatment

- Animals remain chronically infected
  - Paromomycin has been used to reduce shedding and clinical signs
- Strict biosecurity
  - Quarantine
  - Separation
  - Disinfection – difficult
    - Cresols
    - Heat

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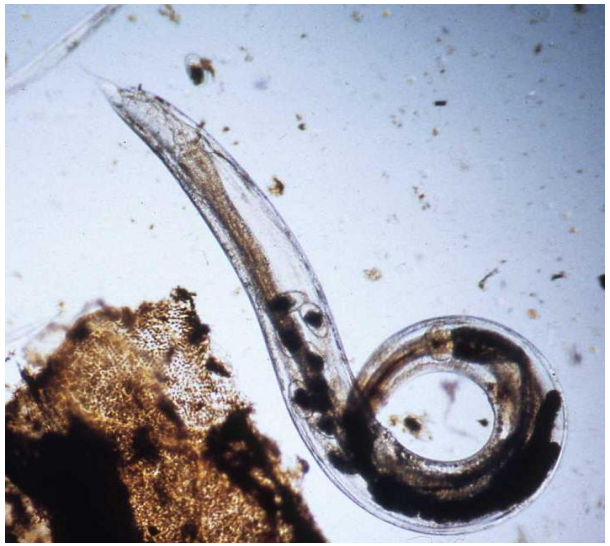
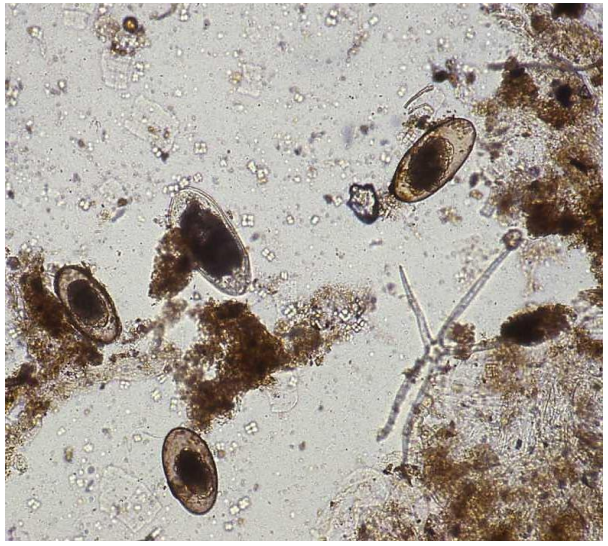
Nematodes

- Most common: Oxyurids
  - High burden possible due to direct life cycle
  - Discussions on if and when to treat
    - Fenbendazole 25-100 mg/kg
    - Ivermectine:
      - Toxic for chelonians, crocodilians, indigo snakes, skinks



Adult oxyurid



Oxyurid eggs

Pentastomids

- Arthropods, subphylum Crustacea
  - Many different species
- Indirect life cycles
  - Mostly vertebrate intermediate hosts
  - Many use reptiles as definitive hosts
  - Most often found in the lung
- Emerging in e.g. North America (*Raillietiella orientalis*)
- Several species zoonotic – humans as aberrant intermediate hosts
  - *Armillifer* spp. considered emerging zoonotic threat in parts of Africa
  - Found in African pythons used as bushmeat (Hardi et al., 2017)
    - *Armillifer armillatus*, *A. grandis*

Hardi et al. 2017. EcoHealth. DOI: 10.1007/s10393-017-1274-5

Thank you for your attention

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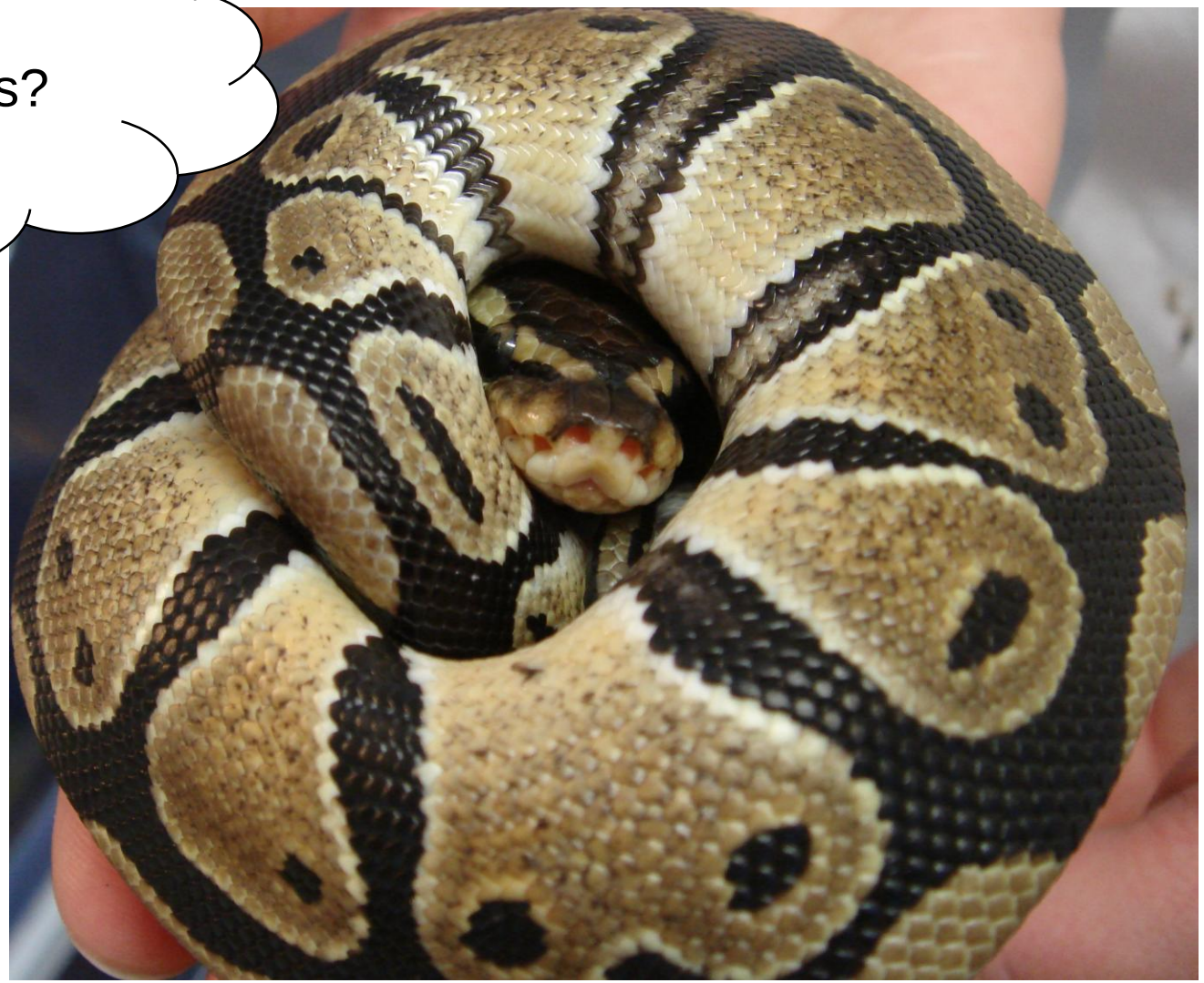
Questions?



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