



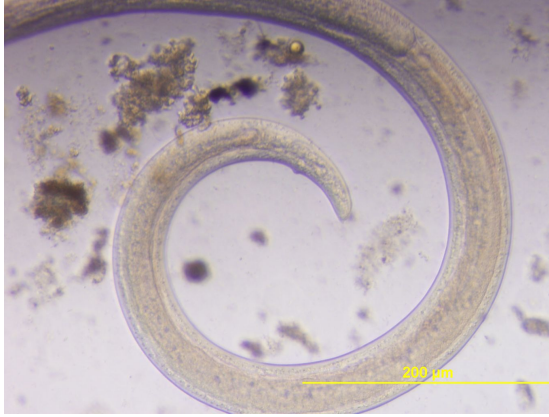
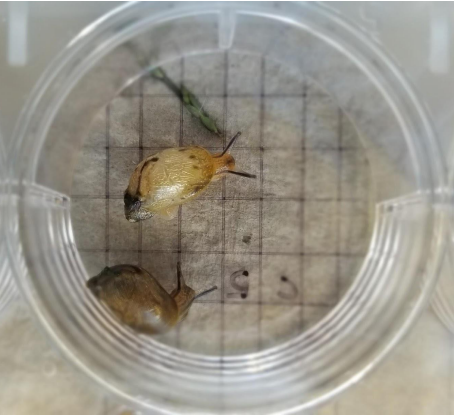
# Necro-suppurative meningo-myelitis and peri-neuritis in a lamb with presumptive in-utero *Parelaphostrongylus tenuis* infection

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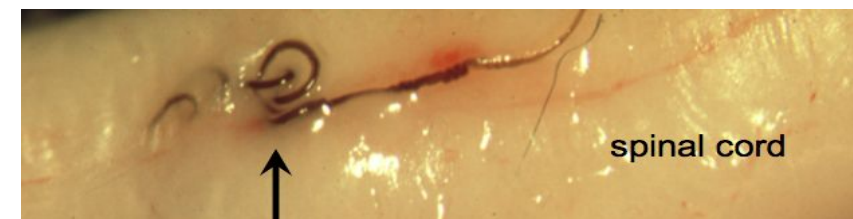
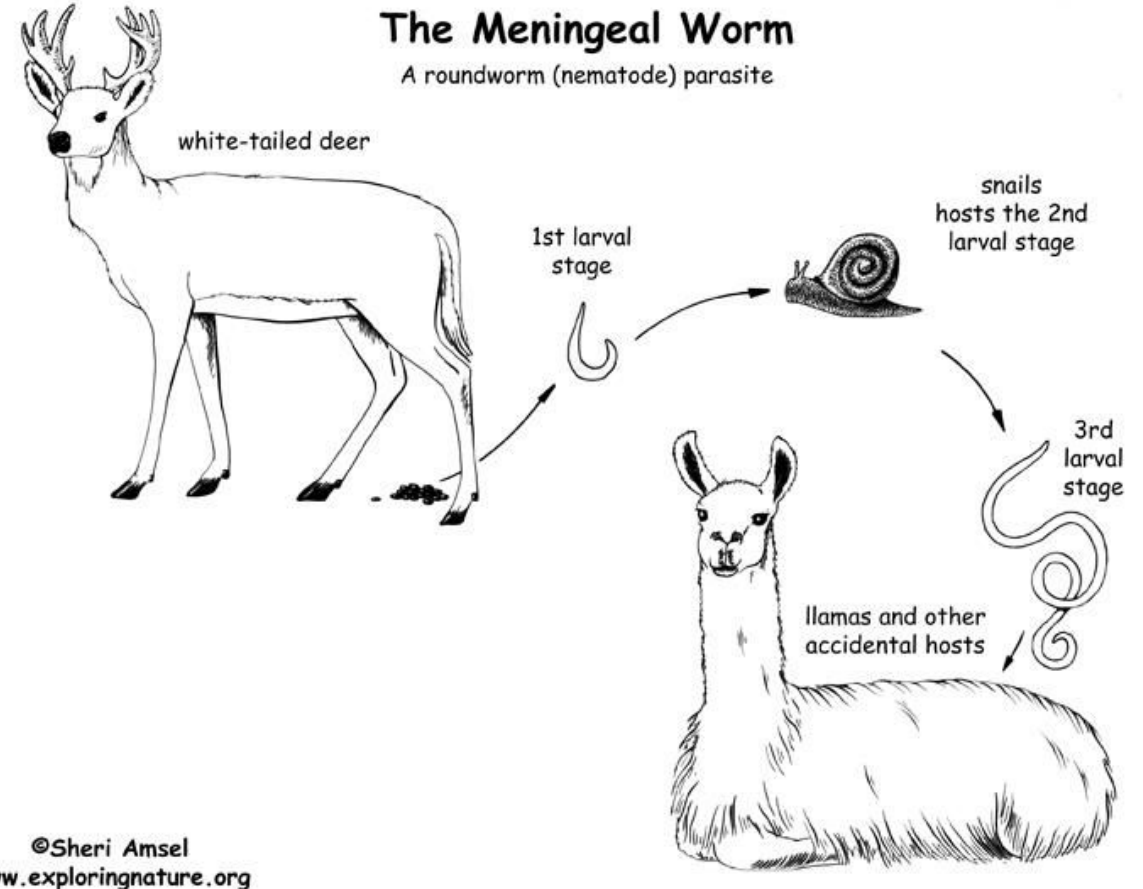
# Background



- *Paralaphostrongylus tenuis* (*P. tenuis*; meningeal worm; brain worm)
- Problematic for wild cervids (moose, elk, etc.) and livestock (camelids, sheep, goats, etc.).
- *P. tenuis* prevalence in white-tailed deer (WTD) is 82-86%.  
(Duffy, 2002; Slomke, et al., 1995; Gilbert, 1973; Behrend and Witter, 1968)
- 80% of WTD fawns become infected within their first eight months of life. (Slomke et al. 1995)
- ~4% of terrestrial gastropods in WTD habitat carry larval *P. tenuis*. (Lankester and Anderson. 1968)

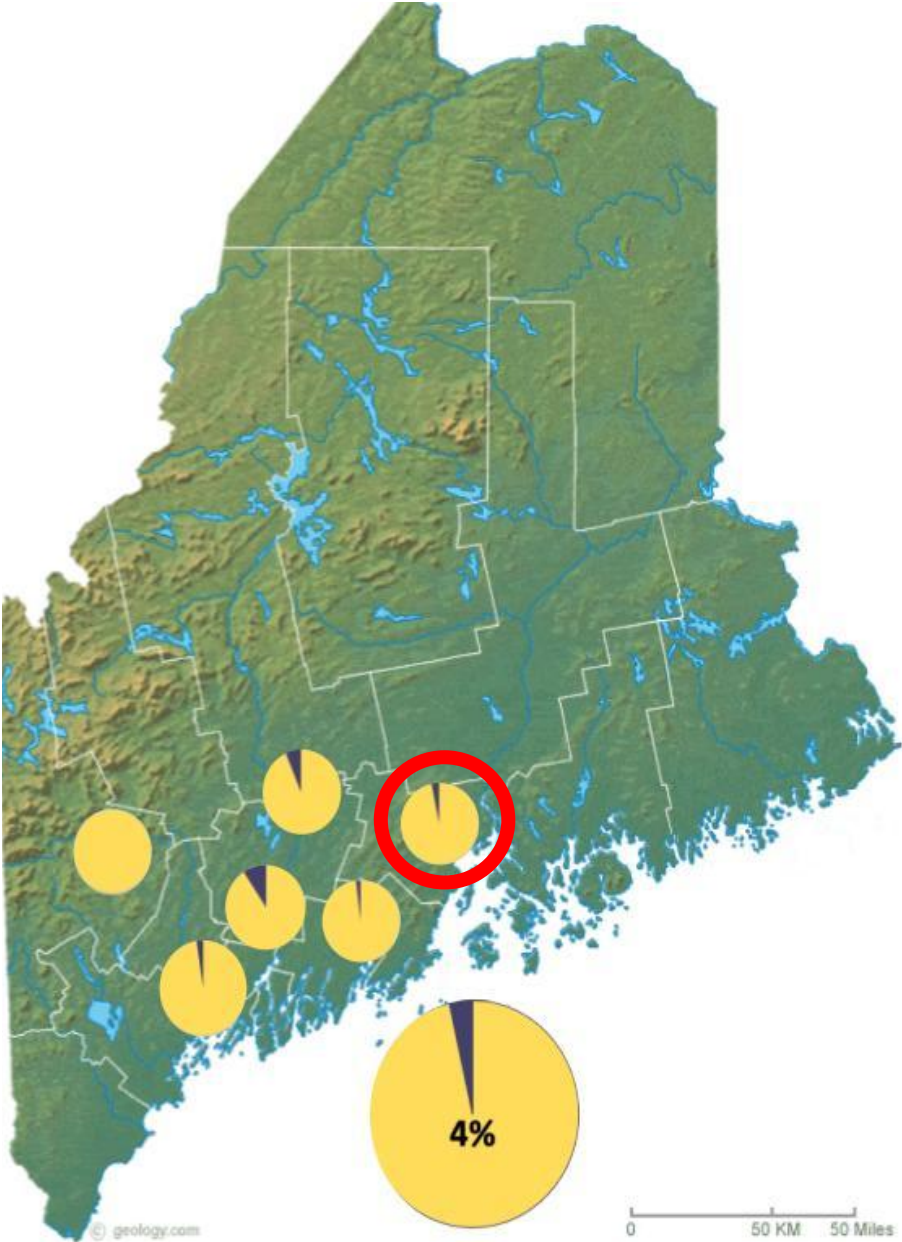
# Life Cycle of Meningeal Worm

- Adults in cranium of deer □ L1s migrate to lungs □ coughed up & swallowed □ expelled in feces.
- Gastropods pick up/ eat larvae □ L1s grow to L2 then L3s
- Deer ingests infected gastropod □ L3 move into the central nervous system (CNS) □ reaches the brain & matures into a reproductive adult.



[ Photo: Dr. Steve Purdy, *P. tenuis* on alpaca spinal cord]

- Incubation period of *P. tenuis* in small ruminants ranges from 28 to 60 days (Brooks, 2016; Rickard et al. 1996)
  - experimentally infected (larval numbers  $\geq 200$ ) from 4 to 71 days



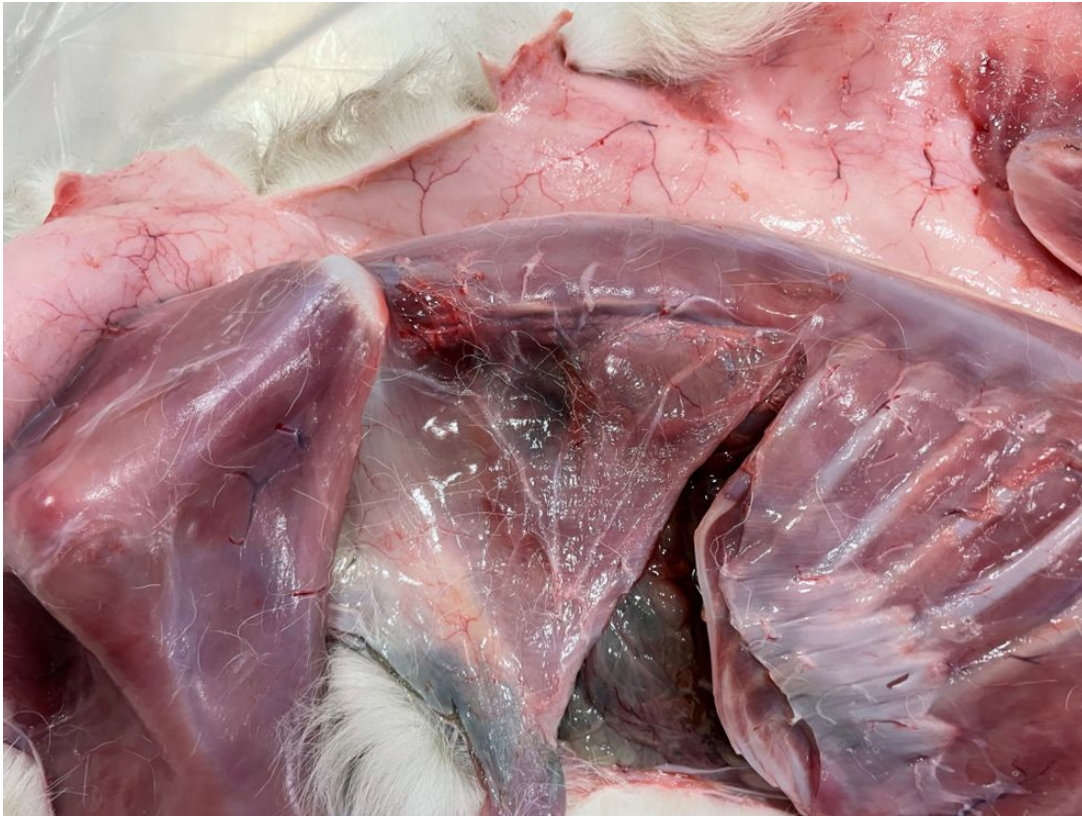
- 2- year study on 6 Maine small ruminant farms
- Risk assessment
  - Population dynamics (gastropods & larvae) on wildlife overlap areas
  - Environmental variables that influence transmission
  - Farmer management (rotational grazing, deworming, wildlife control)
- Risk reduction
  - Mowing & pastured poultry for reducing gastropod population

- Necropsy of a dead lamb from a cooperating farm in the study
- History: 2.5 week old lamb with bilateral ascending neurologic impairment
  - Ewe had not been on pasture nor had snails been noted yet on the farm (farmer observation).
- Presumptive trauma, but treated for brainworm as well
- No response to steroids, ivermectin treatment
  - 3 days from normal to complete paralysis to death
- Acceptable body condition, with small amounts of subcutaneous, epicardial and perirenal brown fat

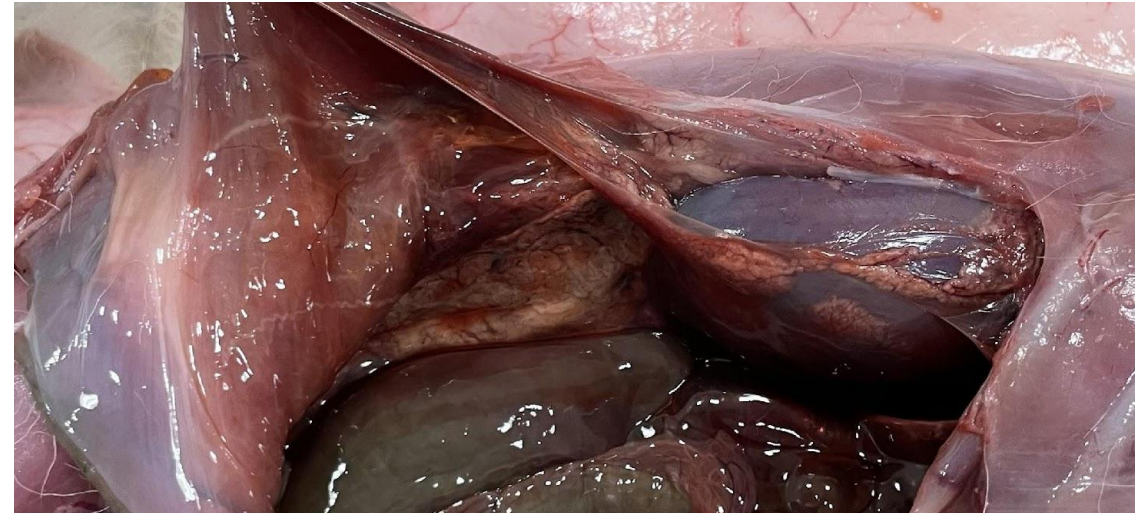


Photo: Anne Lichtenwalner

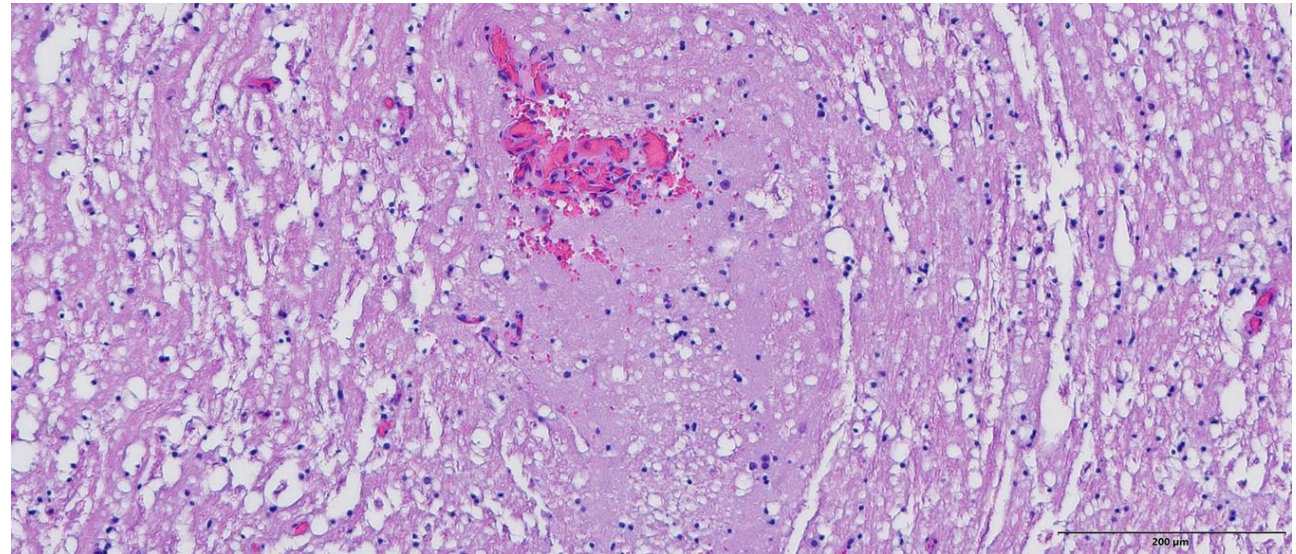
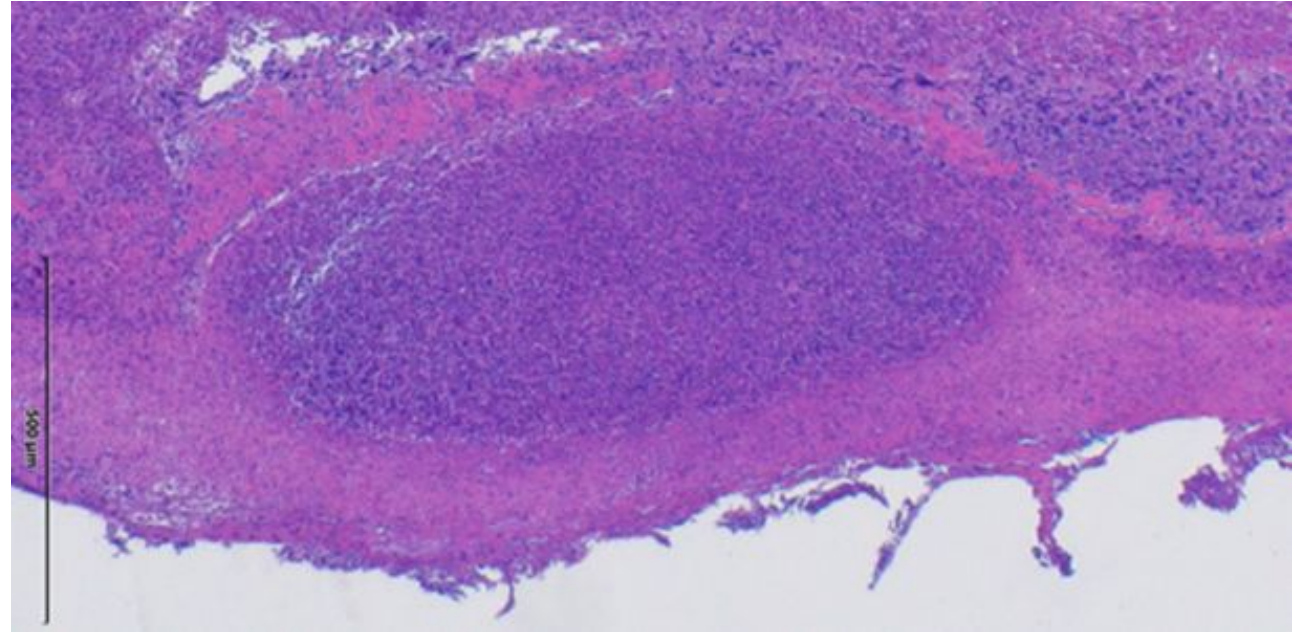
- Flaccid hindlimbs & subcutaneous erythema & fascial damage: right lumbar region over the epiaxial muscles, at approximately the level of the 5th lumbar vertebra



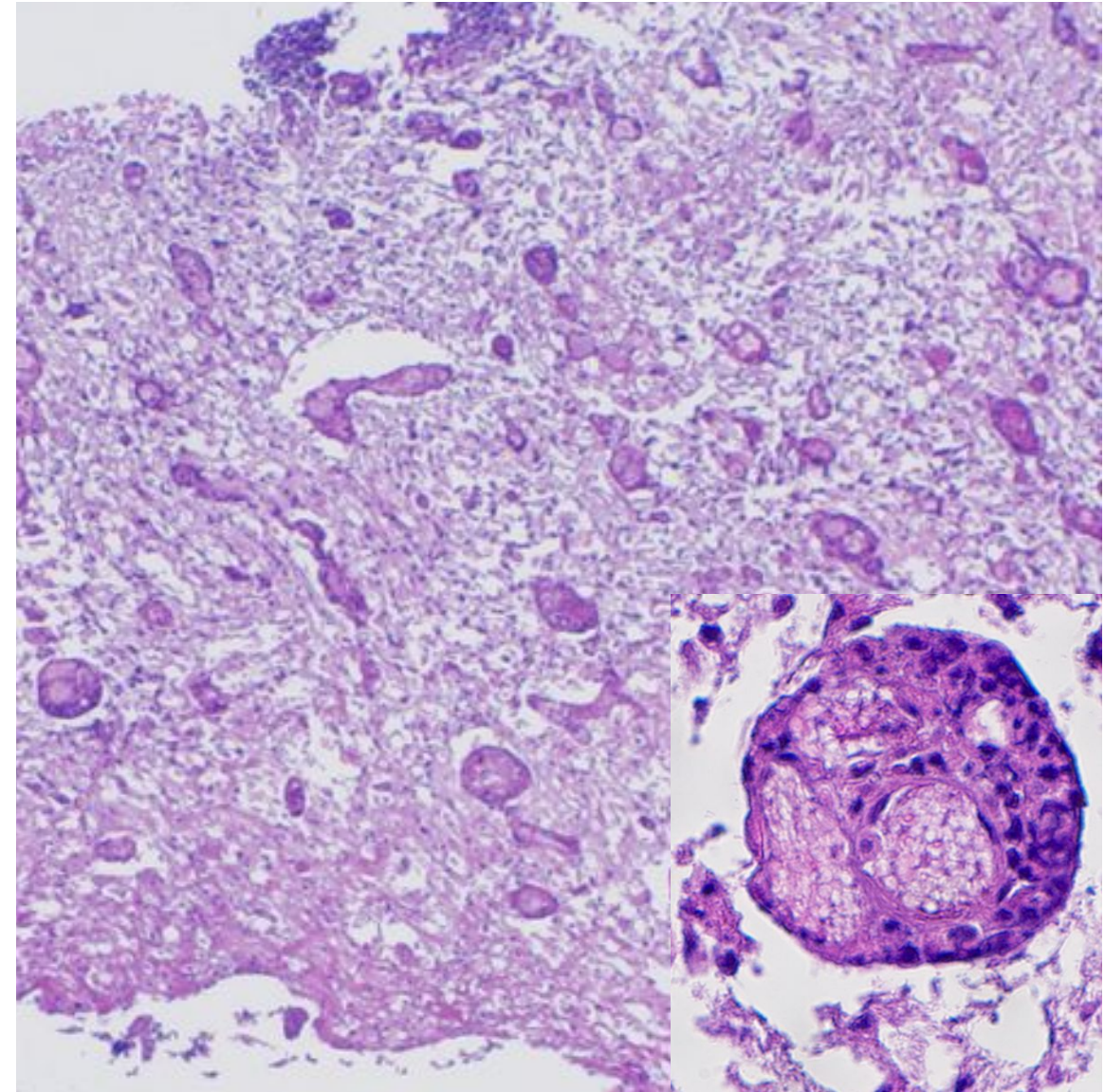
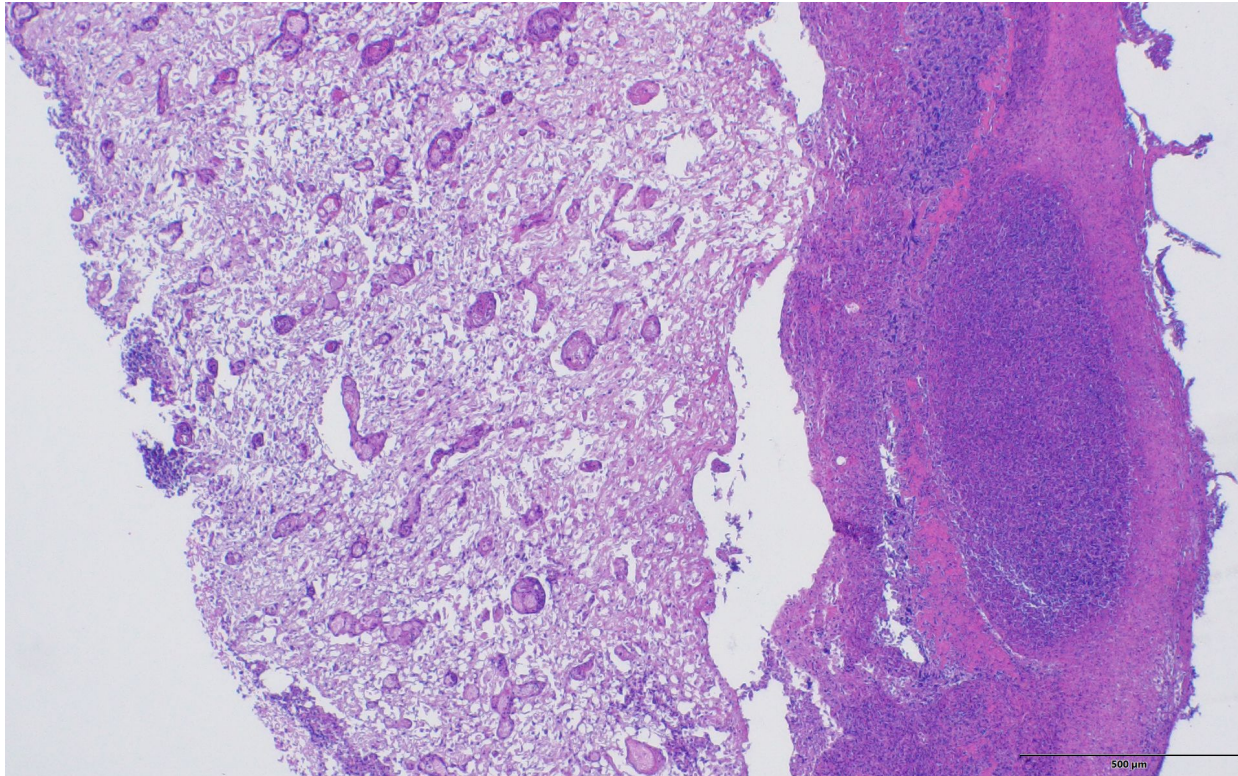
- Bilateral sublumbar abscesses, perispinal fibrinous debris



- Abscess culture: *Staph aureus* and *E. coli*
- Neural tissues:
  - Moderate to severe autolysis
  - Multifocal hemorrhage



- Histologic findings: spinal cord and sublumbar tissues
  - Lumbar spinal cord: severe extensive necro-suppurative meningo-myelitis
  - Lumbar spinal nerves: severe extensive necro-suppurative peri-neuritis

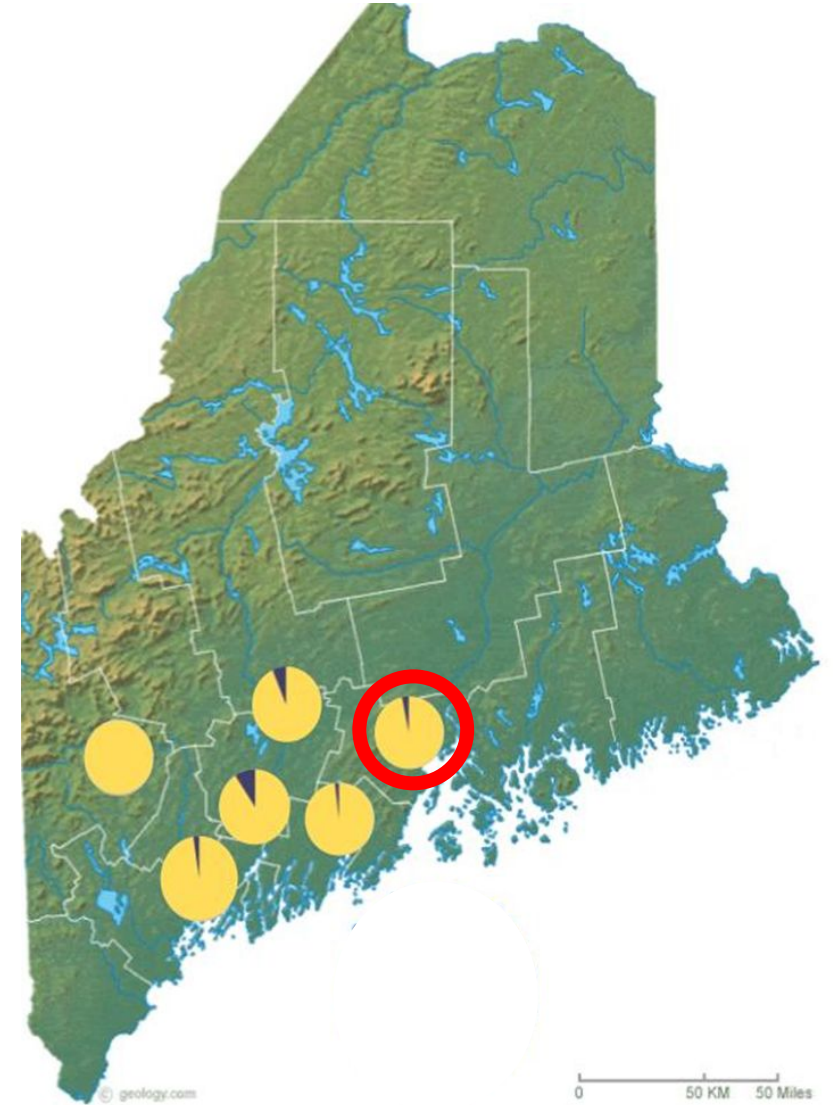




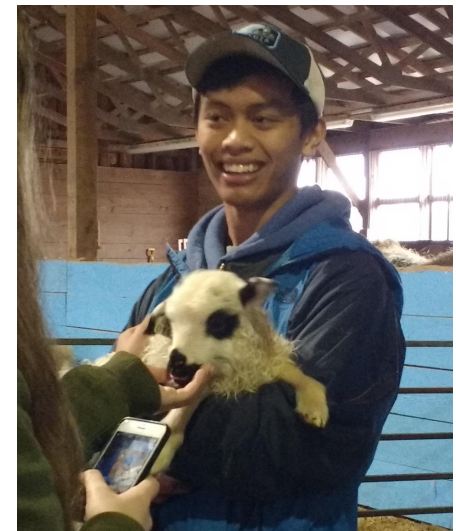
- *P. tenuis* in tissues: adult morphology (Gardiner and Poynton, 2006)
  - Eosinophilic cuticle (blue arrows)
  - Large intestine with multinucleate cells (red arrows)
  - Gonadal tract(s)
- *P. tenuis* in tissues: larval morphology



- Location: Mid-coast Maine
  - Pastures include high and low ground.
  - Seasonal stream between 2 study fields.
- 2 separate sheep breeding groups
  - 35 / 15-20 adult ewes
  - Rams with ewes September- November
  - Barn lambing February/ Dry lot & pasture lambing early April
- Rotational grazing across 90 acres
  - Rotations every 1-3 days
  - Early May- late November on fields & orchards
  - Late season on pasture with supplemental apple mash
- WTD presence in all pastures
- **5 suspected *P. tenuis* cases in 2021, 6 In 2022**
  - Necropsy performed on 2 lambs in 2022



- Age of lamb suggests unusually rapid onset of symptoms
  - Experimental studies report very rapid onset of paralysis with large numbers of larvae given PO or intraperitoneally
  - Most reports suggest that onset of symptoms can take months
  - Time of year: no exposure to pasture since birth
- Severity of abscesses suggests large numbers of larvae and possible translocation of microbes into perineural tissues.
- Questions:
  - Might *P. tenuis* be transmitted *in utero*?
  - Might *P. tenuis* be transmitted via milk?
  - Might *P. tenuis* be transmitted via hay?
  - Does *P. tenuis* overwinter in snails? (ref)
  - Is the period between ingestion of L3's and clinical signs shorter than reported?



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