Bats, Rats, and Rabies: Oh my! Species and Zoonoses of Public Health Interest

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Cambridge
Public Health
Department

Why are zoonoses important?

- 60% of known infectious diseases can be spread by animals
- 75% of emerging infectious diseases are zoonotic
- Companion animals: over 70 known diseases
- Impact/are impacted by the environment
  - Reservoir hosts shed pathogens into the environment
  - Changes in the environment, habitats impact reservoir or vector movement

Methods of Transmission

- Direct
- Indirect (surfaces, fomites)
- Vector-borne
- Foodborne
- Waterborne
- Airborne (special circumstances)

General Outline

Rabies

- Transmission, risk to pets and people
- Reservoir species and MA data
- Quarantine vs. euthansia and testing
- Treatment (post-exposure prophylaxis; PEP)

Dogs/cats: parasites (external and internal - worms, flea and tick-borne disease), bite wound infections

Poultry/H5N1

Rats: Leptospirosis, other health risks

Rabies

- Family - Rhabdoviridae
- Genus - *Lyssavirus*, species RABV
  - Species-specific variants
    - e.g. raccoon rabies virus (RRV), etc.
- Transmission
  - Bite of infected animal
    - Skin abrasion/contact with infected material
  - Rare: organ transplants

From: Boutelle C, Bonaparte S, Orciari LA, et al. Rabies surveillance in the United States during 2023. *Journal of the American Veterinary Medical Association*. Published online July 18, 2025. doi:10.2460/javma.25.05.0344

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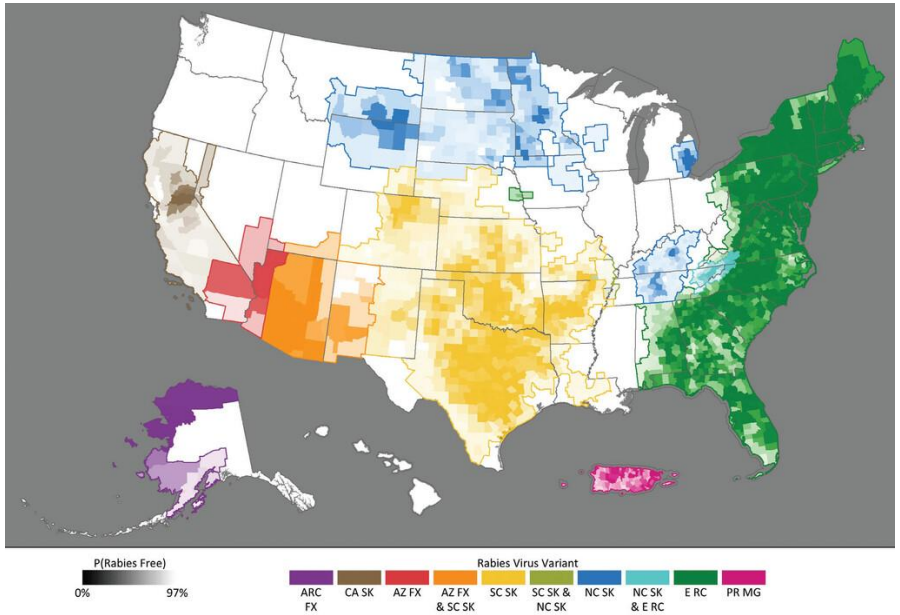
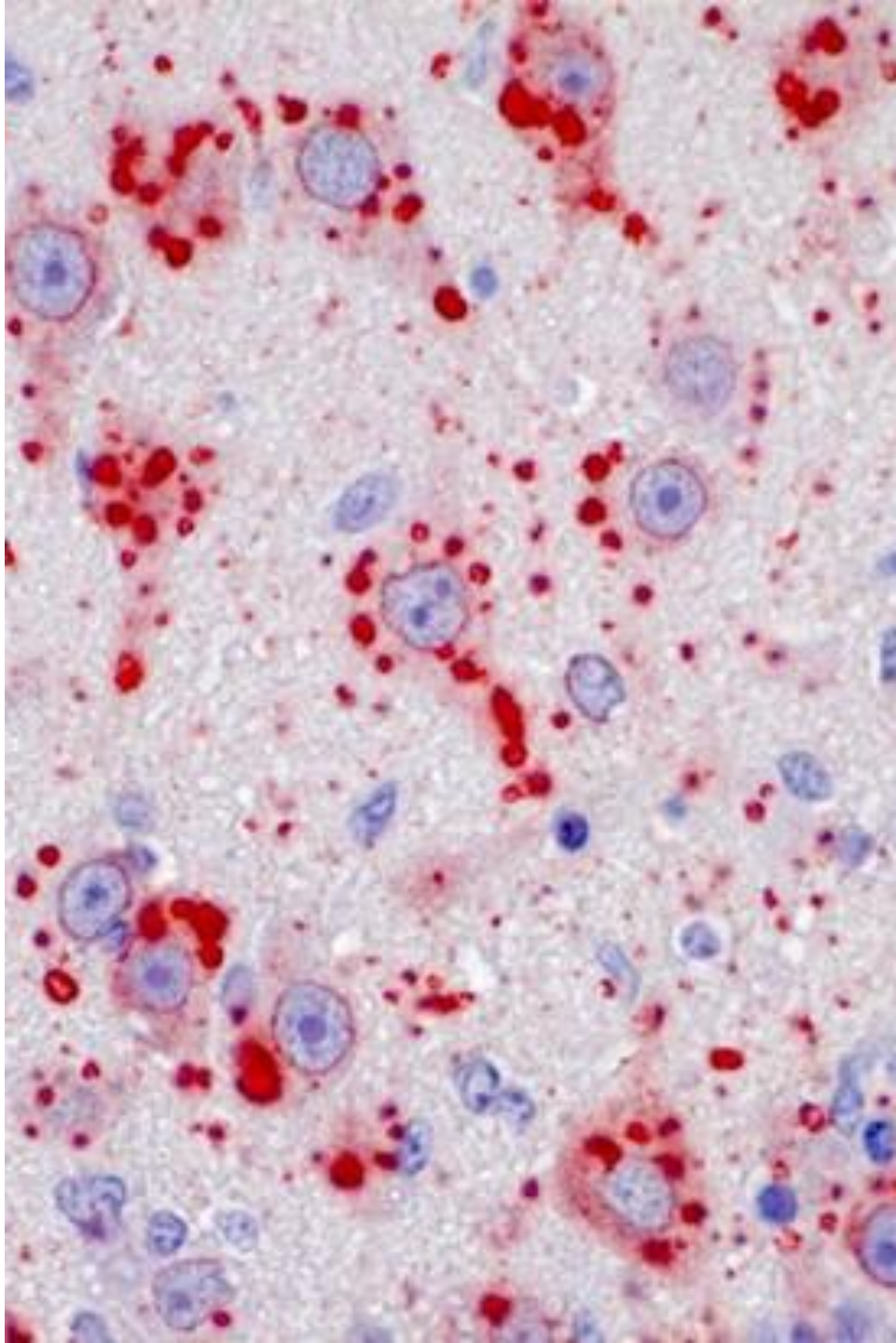


Figure 1 Distribution of major rabies virus variants (RVVs) among mesocarnivores in the US, including Puerto Rico. Lighter shading indicates a higher probability of terrestrial rabies freedom as determined by a county-level terrestrial rabies freedom model. Counties with a probability of ≥ 97% are considered terrestrial rabies free (no color). ARC FX = Arctic Fox RVV. AZ FX = Arizona Gray Fox RVV. CA SK = California Skunk RVV. E RC = Eastern Raccoon RVV. PR MG = Puerto Rico Mongoose RVV. NC SK = North Central Skunk RVV. SC SK = South Central Skunk RVV.

Testing of animals

- Postmortem tests most reliable
  - Refrigeration, NOT freezing, of samples is important
  - Full cross-section of tissue from both the brain stem and cerebellum
- Approved methods:
  - Direct Fluorescent Antibody (DFA)
  - Direct Rapid Immunohistochemical test
  - Immunohistochemistry (IHC)
  - RT-PCR with pan-lyssavirus probe
- Serology
  - RFFIT (human and animals) and FAVN (animals) are also used to confirm an adequate vaccination response
  - Cannot differentiate between vaccination response vs infection
  - Not approved for diagnosis in lieu of brain testing



MA Booster/quarantine requirements for domestic animals: 330 CMR 10.00: Prevention of the Spread of Rabies

- All **dogs, cats, ferrets** required to be vaccinated no later than 6 months of age
  - And within 30 days of entry into MA
  - Animals considered “Currently Vaccinated”:
    - 28 days after initial vaccination and for the animal’s lifetime if it receives boosters at intervals per vaccine label directions
- If an animal/human is bitten by a domestic animal:
  - 10 day quarantine, minimum
- If a domestic animal is exposed:
  - Strict Confinement for 45 days, plus a booster if overdue
  - Unvaccinated domestic animal: euthanasia requested
    - If owner refuses - several options depending on suspected vs confirmed exposure to a rabid animal, and manner of exposure

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Species Considerations For Rabies Testing

Category 1

ALWAYS test following human or domestic animal exposure

Species in this group are either known rabies vectors or are considered likely to have the potential to transmit rabies.

- Bat
- Bear
- Beaver
- Bobcat
- Coyote
- Fisher
- Fox Otter
- Raccoon
- Skunk
- Woodchuck

Category 2

Test following human or domestic animal exposure if 10-day quarantine is not possible or not appropriate (i.e., animal is already ill)

Species in this group can only transmit rabies up to 10 days before showing symptoms.

- Cat
- Cow
- Dog
- Ferret

Category 3

Requires MDPH or MDAR* approval for testing (handled case by case)

Species in this group are occasionally found to be rabid although bites from these animals have never resulted in a human case of rabies in the United States.

- Alpaca/llama
- Chinchilla
- Deer
- Domestic/pet rabbit
- Goat
- Guinea pig
- Horse Mink
- Moose
- Muskrat
- Opossum
- Pig
- Porcupine
- Sheep
- Squirrel
- Weasel

Category 4

Rabies testing NOT indicated

Species in this group are virtually never found to be rabid and bites from these animals have never resulted in a human case of rabies in the United States.

- Chipmunk
- Gerbil
- Hamster
- Mole
- Mouse Rat
- Shrew
- Vole
- Wild rabbit/ Cottontail

*Massachusetts Department of Agricultural Resources: 617-626-1810

For exposures involving an animal species not specifically listed OR unusual circumstances, consultation with the Massachusetts Department of Public Health Division of Epidemiology and Immunization is available 24/7 at 617-983-6800.

Updated May 2018

Post exposure steps

Determine if exposure

If exposure - test animal if possible (wild animals - see species consideration table).

Quarantining domestic spp. - 10 days, regardless of vaccination status

- Rabies antigen level
- Euthanasia required if showing signs

See compendium/state laws for additional guidance (vaccination history)

Preservation of tissue - refrigeration ONLY

Post Exposure Prophylaxis

If wild animal testing positive or samples can't be obtained

- See MA species consideration table

WASH THE WOUND, and use povidone-iodine - reduces risk up to 30%

4 dose rabies vaccine schedule for those without PrEP: days 0, 3, 7, 14 (immune disorders = fifth dose, day 28)

Human Rabies Immunoglobulin (HRIG): once at the beginning of the course, in/around wound

Pre-exposure Prophylaxis

Advisory Committee on Immunization Practices (ACIP):

- Issues recommendations for rabies vaccination
  - Now: 2 doses, days 0 and 7
- Created risk groups to categorize people at risk of rabies
  - Occupational or recreational risk - working with live/concentrated virus in a lab, frequently handle bats, vet staff/animal control officers, spelunkers, etc.
- Has guidelines for booster vaccine frequency
  - Modified guidelines for immunocompromised individuals
- No Immunoglobulin needed

Concerning bats

- Most species are protected
  - White nose syndrome = population decline
  - Keystone species
- Removal from homes can only be done in May or from August through mid-October
- Direct contact or found in a room with a sleeping person, young child, or someone not able to confirm contact - possible bite exposure

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Other wildlife/environmental

Raccoons

- Baylisascaris

Rabbits

- Tularemia

Giardiasis

Mosquito-borne

- (EEE, WNV)

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Other common pet zoonoses

Parasitic

- Roundworms, toxoplasmosis
- Flea-borne:
  - Tapeworms, bartonellosis
- Tick-borne:
  - Lyme disease

Bacterial

- Bites (*Pasteurella multocida*)
- Pathogens from raw food, milk
- Brucellosis, leptospirosis
- Drug-resistant infections (i.e. MRSA)

Fungal

- Dermatophytosis (Ringworm)

Bites

Pasteurella multocida and others

Present in oral microbiota of many animals

Often associated more with cat bites

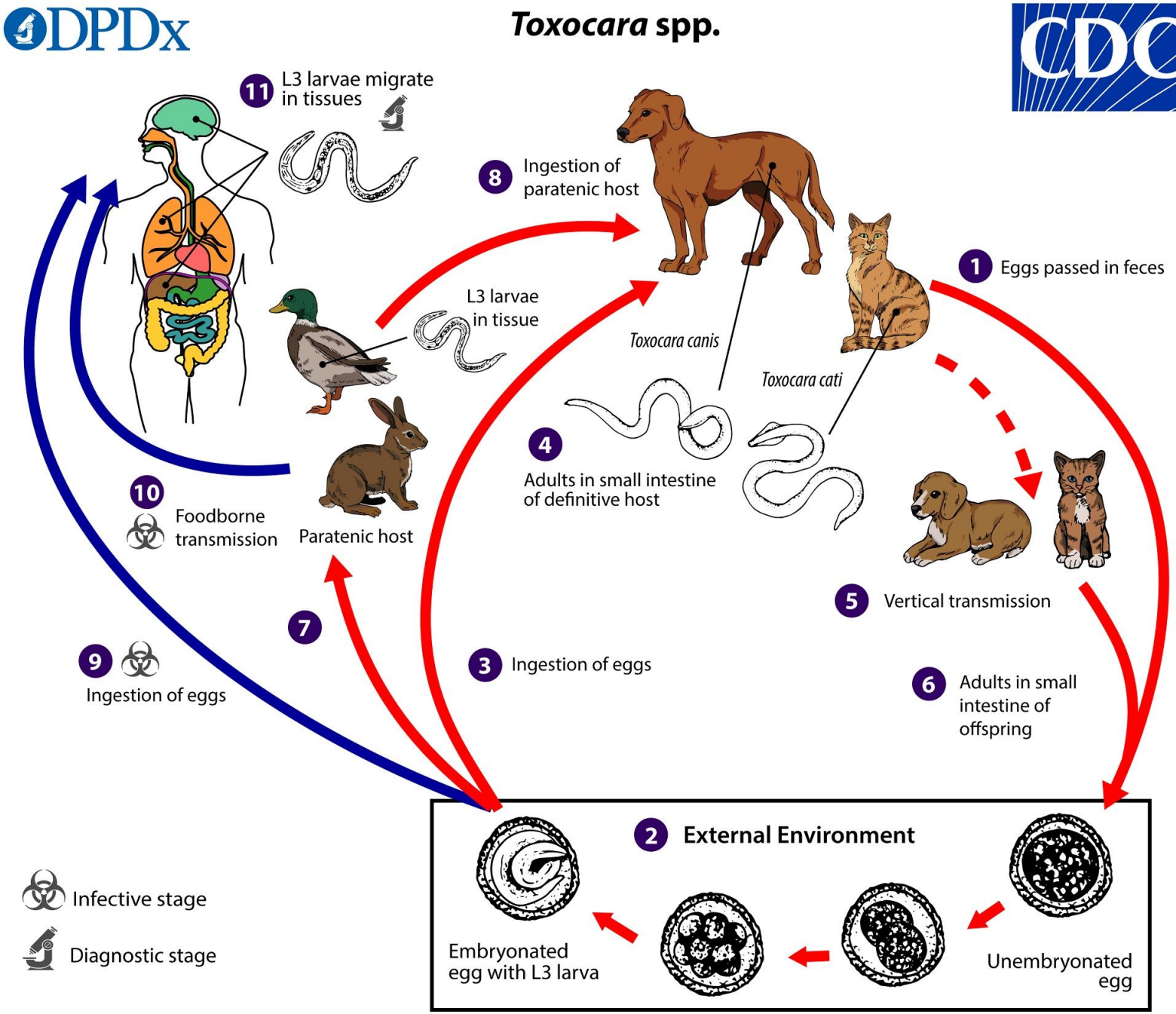
Treatment:

- Thorough cleaning of wound
- Amoxicillin/clavulanate
- Tetanus booster if due

Roundworms

Importance:

- Vertical transmission = virtually ALL kittens/puppies infected at birth
- Cleaning up pet waste
- Regular veterinary fecal flotation
- Year-round parasite medication



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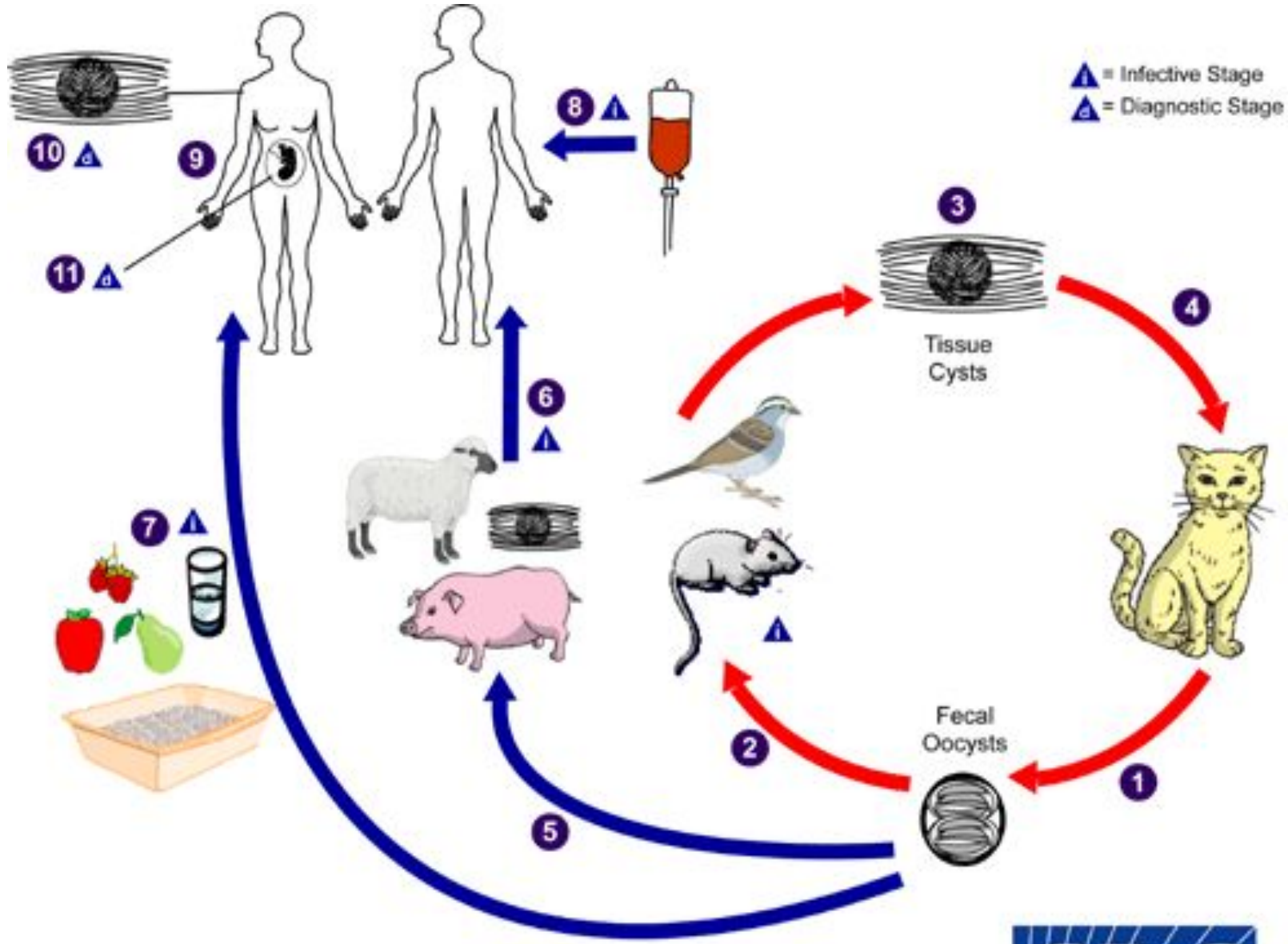
Toxoplasmosis

Importance:

- Contact with cat feces
  - Scoop litterboxes daily!
- Feline contact with food-producing animals
- Pregnant women, immunodeficient individuals most at-risk
  - CNS disease
  - Congenital ocular disease



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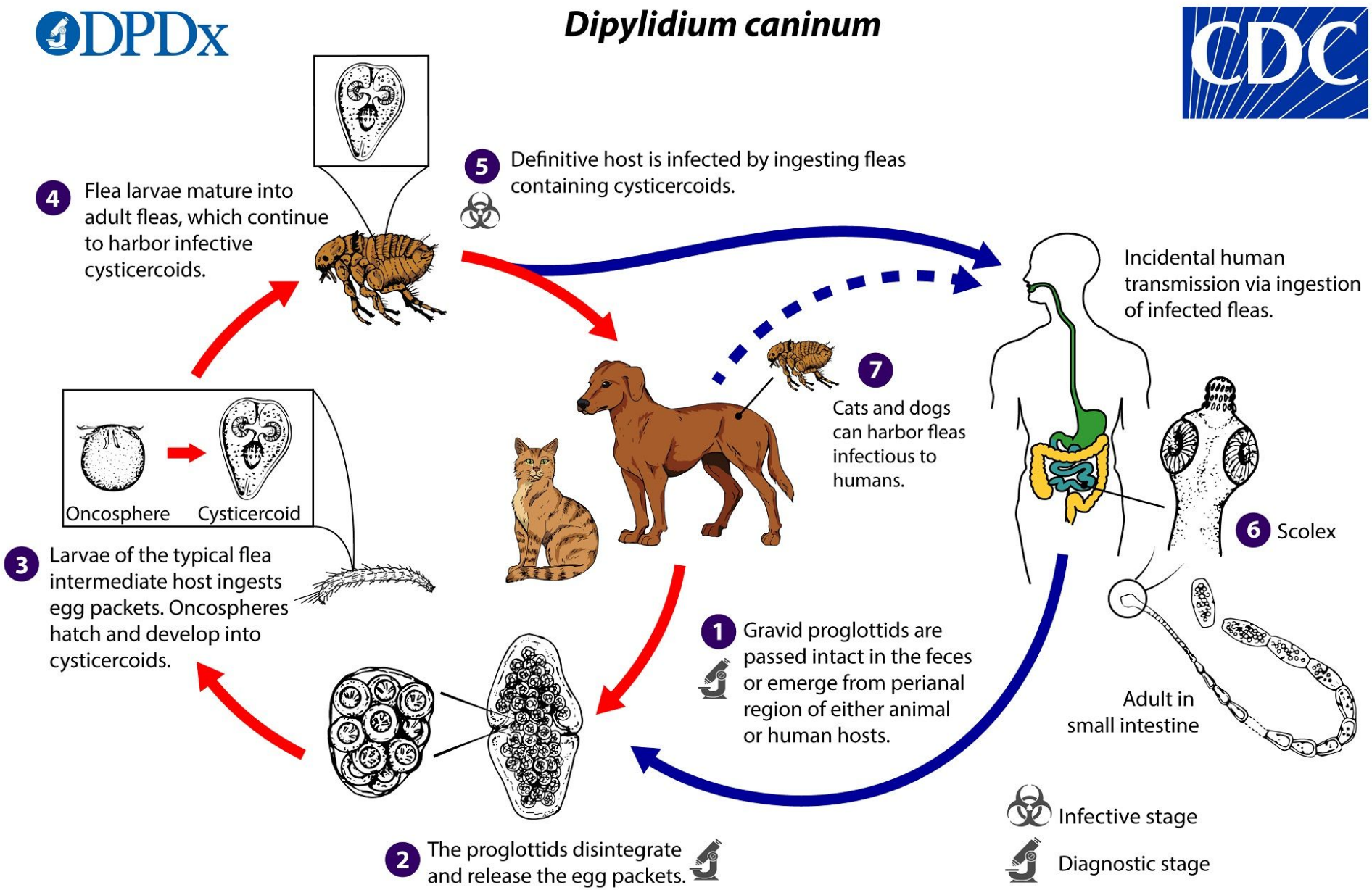
From fleas

Tapeworms:

Dipylidium cestodes

Prevention: flea control!



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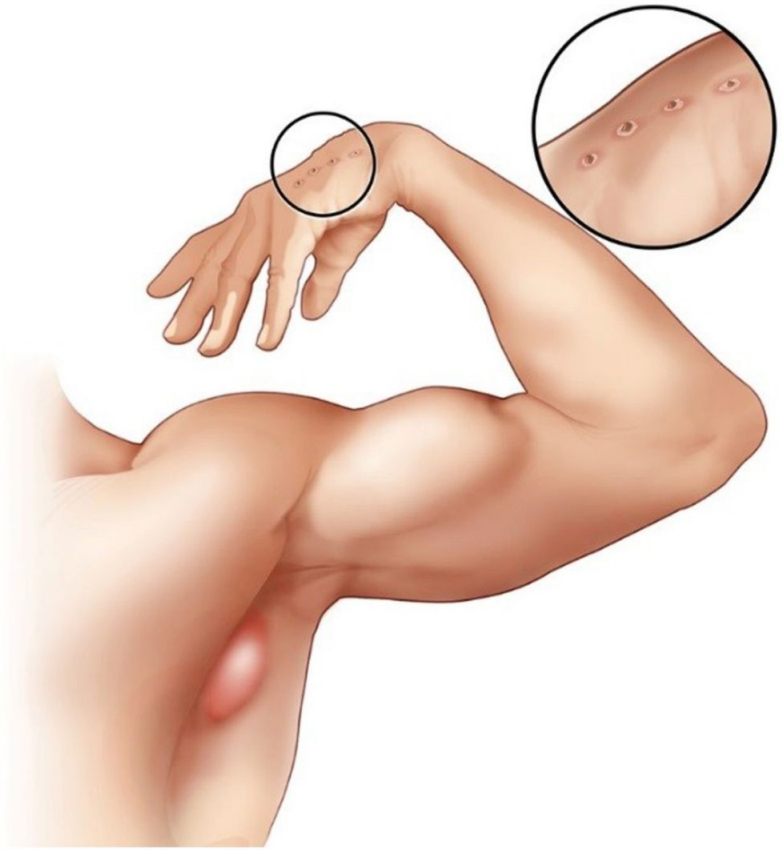
From fleas, continued

Cat scratch disease (CSD):

Bartonella henselae

Transmission - bite/scratch contaminated with flea feces

Prevention: flea control, keeping cats indoors



Other zoonosis examples from “exotic” pets

LCMV - rodents

Chlamydophila - birds

Mycobacterium marinum: “fish tank granuloma” - aquaria

MPox - exotic rodents initially

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Rats

Rattus norvegicus - brown rat

Well adapted to urban areas

Indicators of hygiene/sanitation issues

Boston Globe article from June 20th: “Rats in Boston are spreading a potentially deadly disease, research says”

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Rats - potential health issues

Diseases:

Asthma (from allergens)

- Rat n 1; urine protein

Leptospirosis (*L. interrogans* serogroup Icterohaemorrhagiae)

- Urine of infected animals/contaminated water
- Flu-like symptoms, kidney, liver disease

Rat bite fever

- *Streptobacillus moiliformis* - rare, not reportable

Salmonella/other enterics

Hantavirus

Yersinia pestis (fleas)

Rats - Control

Integrated pest management

NYC as a model:

- Website and educational materials
- Free community training
- Rat information portal
- Grant funding for leptospirosis surveillance; relationship with city veterinarians for reports of canine cases

Upcoming Boston summit

- Goal is for collaboration
- Management companies, landlords, municipalities, and sanitation companies
- Sharing of best practices, exposure to effective solutions/technologies

Chickens/Henkeeping

State law: 330 CMR 5.00: POULTRY

- Mostly for commercial farms

Know your local regulations and zoning

- NOFA/Mass (Northeast Organic Farming Association) has spreadsheet with towns; last updated May 2020

Concerns of attracting vermin

- Appropriate waste control, food storage, travel contingency plans

Zoonoses of prominent interest

- HPAI (H5N1), *Salmonella*, *Campylobacter*

HPAI, cattle and cats

Wildlife: Waterfowl most at risk

- Higher incidence in spring/fall due to migration

Prevention in backyard poultry flocks:

- Avoid access to standing water and wetlands, streams, ponds, etc.
- Prevent contact with waterfowl

Commercial flocks most at-risk: layers

Cattle: clinical illness in cattle herds. Supportive treatment has been effective

Cats: avoid feeding raw milk, meat; change shoes if walking amongst backyard poultry or bird feeders

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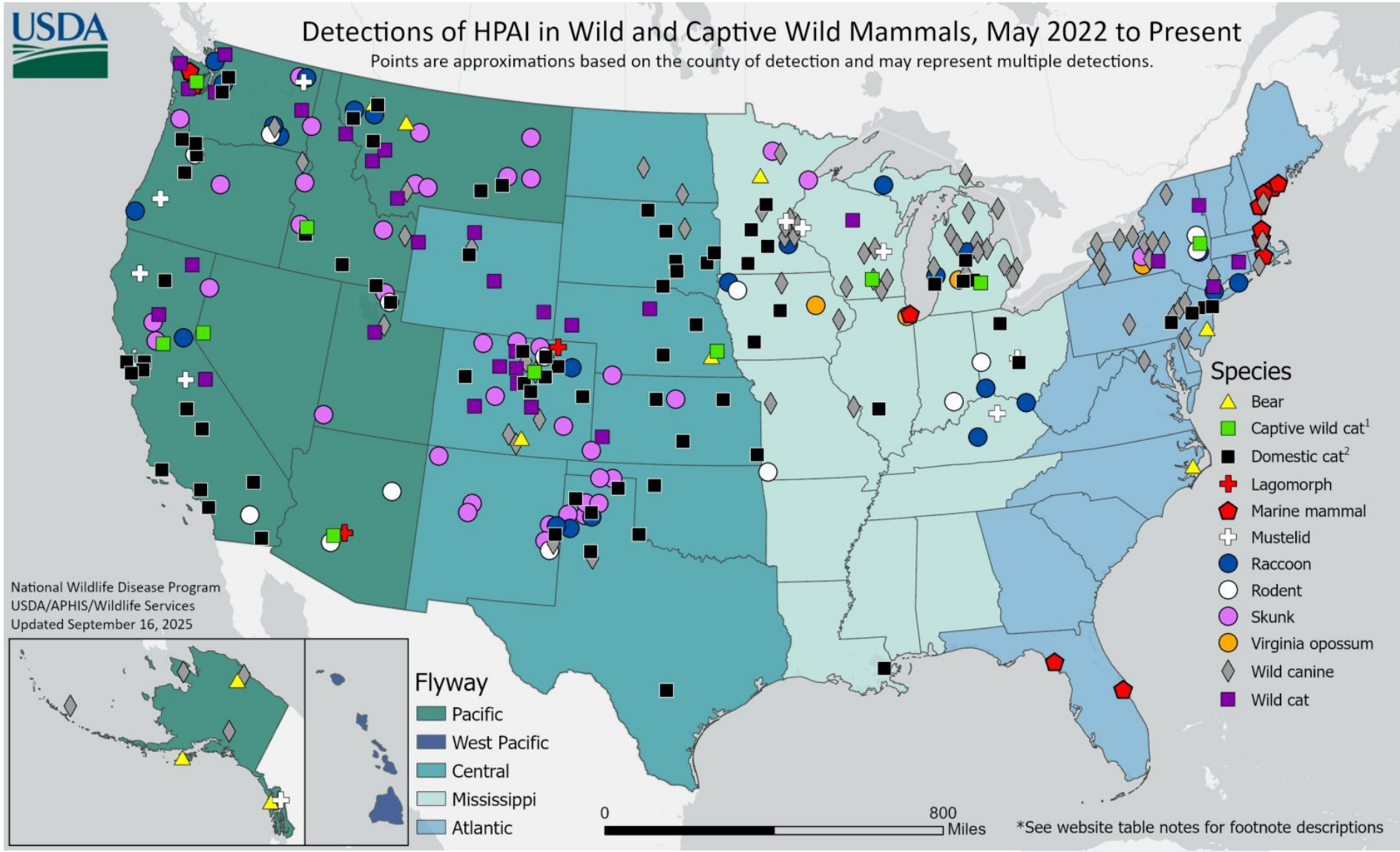
HPAI, cattle and cats

Cats:

Infection from raw milk or meat

Signs: fever, neurologic signs, respiratory/ocular discharge

Importance: avoid raw milk/meat



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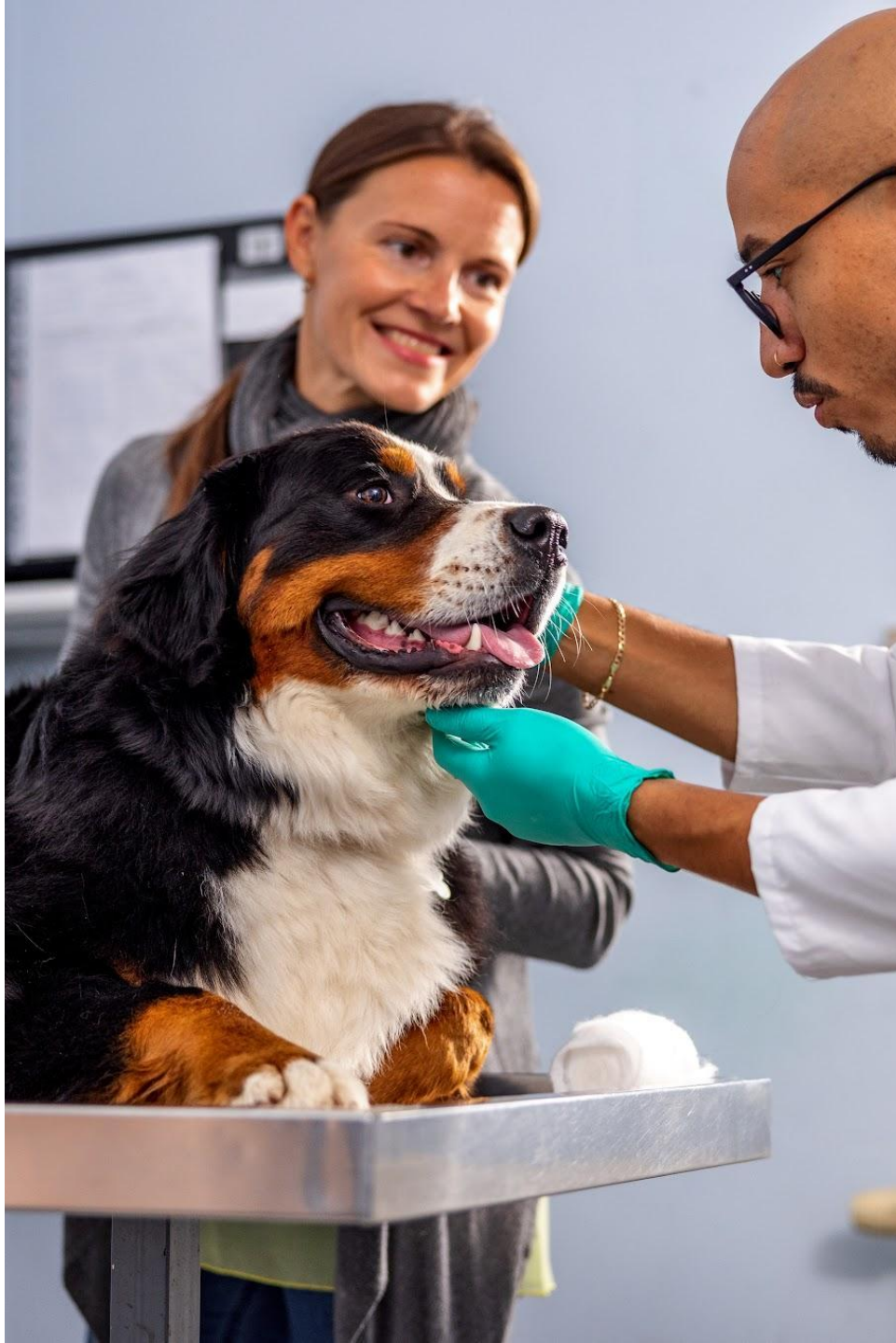
Important Takeaways

- Vaccinate, spay/neuter, provide parasite control for pets
- Do not feed pets raw food/milk
- Clean up waste
- Limit interspecies mingling in backyard farm settings
- Provide veterinary care/seek medical care if exposures
- Proper sanitation and multimodal pest control
- Wear insect repellant and appropriate clothing
- Wash your hands, cook your food, keep your kitchen clean!



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Questions?