

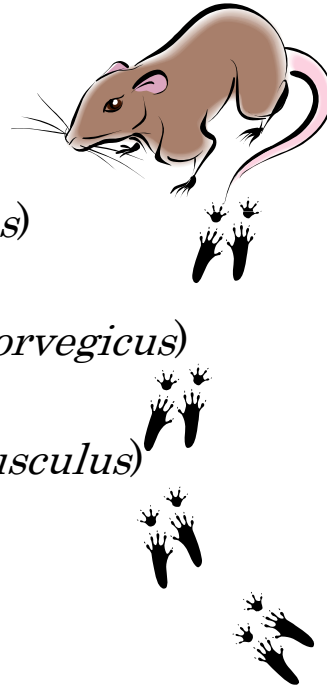


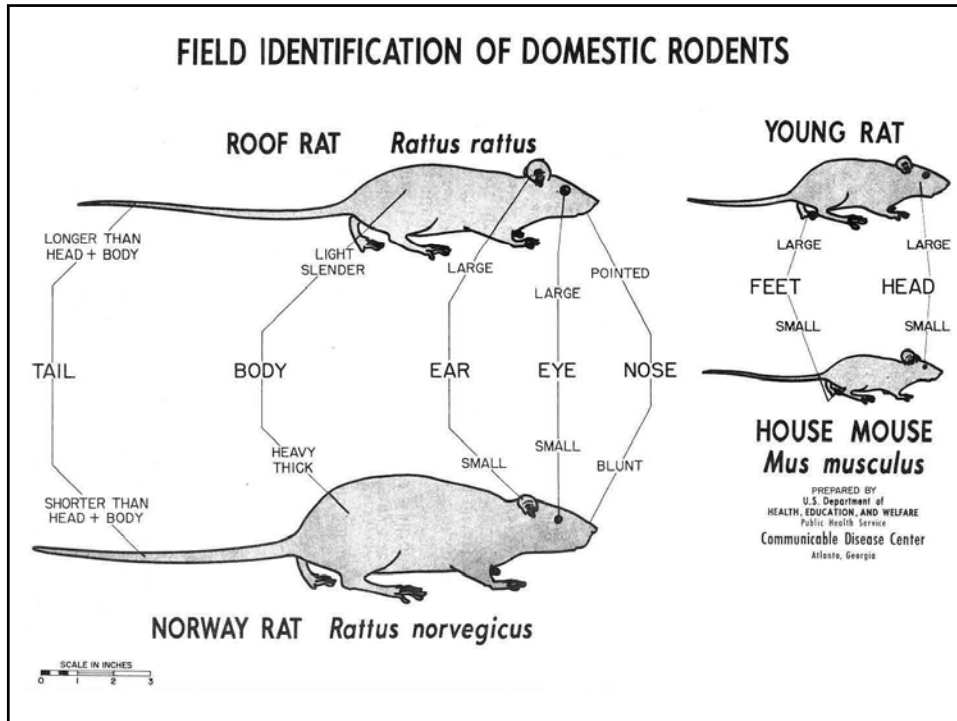
## Commensal Rodents and Associated Zoonoses

Liz Dykstra, PhD, BCE  
Public Health Entomologist  
Washington State Department of Health  
elizabeth.dykstra@doh.wa.gov  
360.236.3388

### Commensal Rodents

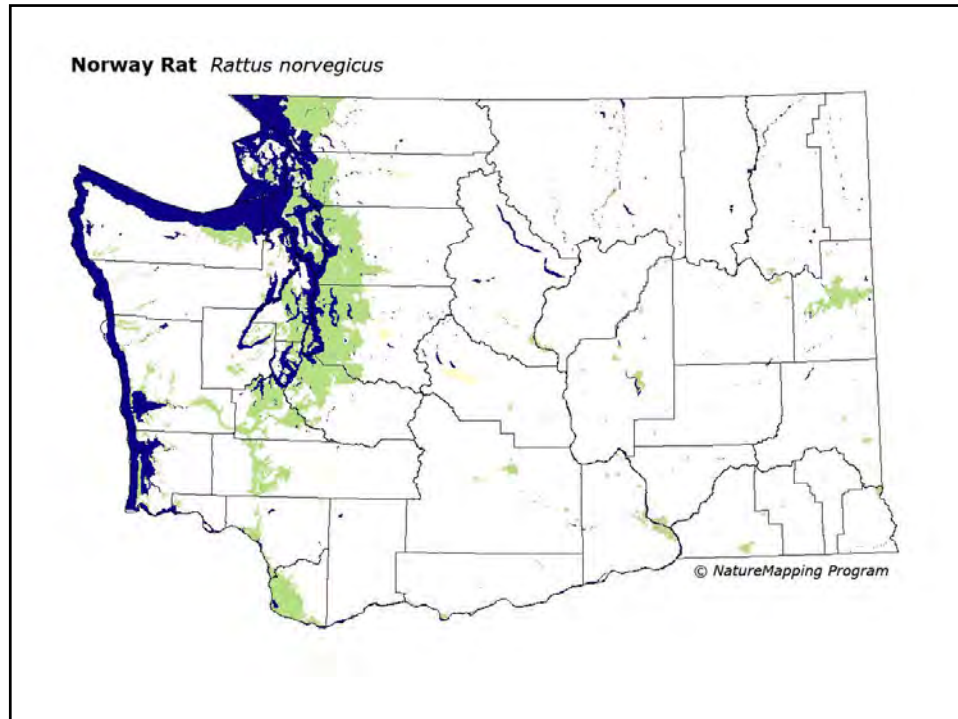
- ◉ Roof Rat (*Rattus rattus*)
- ◉ Norway Rat (*Rattus norvegicus*)
- ◉ House Mouse (*Mus musculus*)





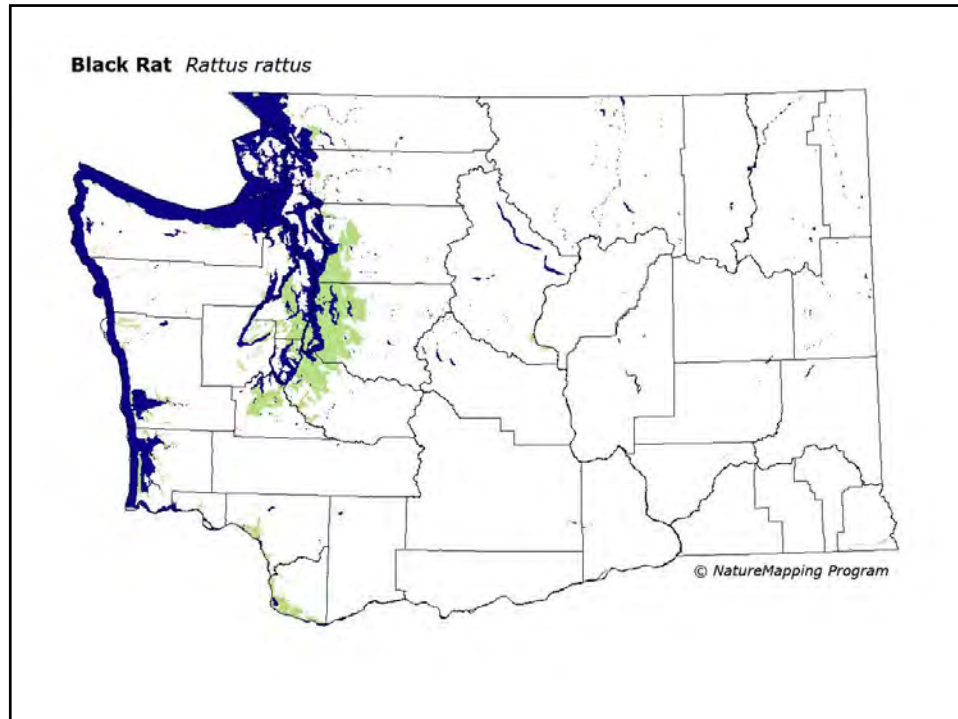
## Norway Rat *Rattus norvegicus*

- ◉ Brown rat, Wharf rat
- ◉ Mongolian origins
- ◉ Home Range = 90'-450'
- ◉ Food preferences: omnivores
- ◉ Burrower



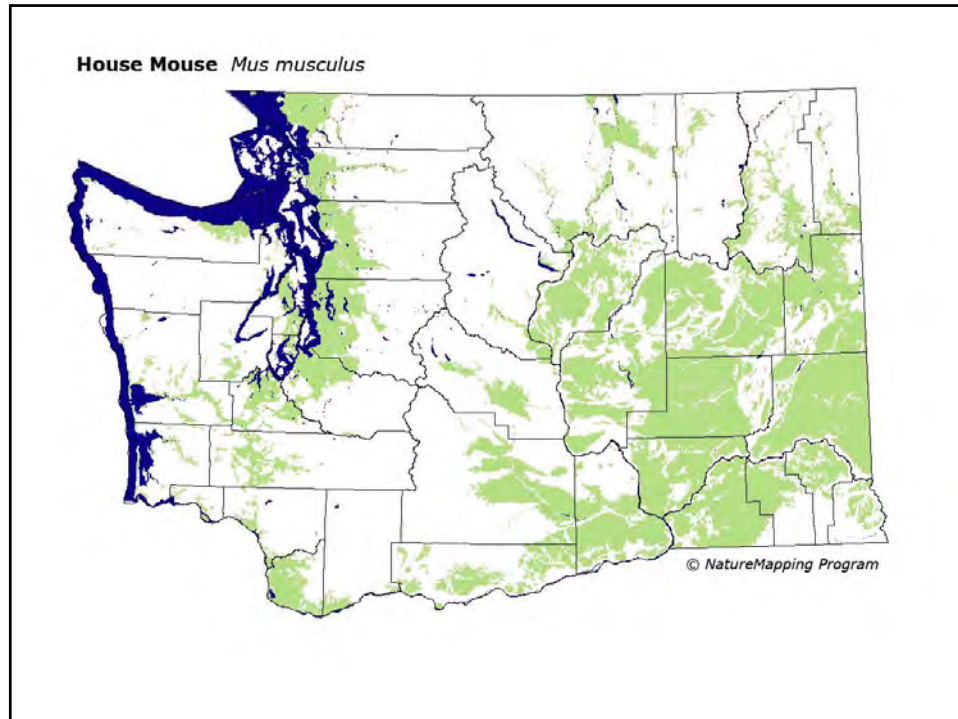
## Roof Rat

- Black rat, Ship rat
- SE Asia origins
- Home Range = 100'-300'
- Food preferences: nuts, fruits, seeds, vegetables, slugs, snails
- Climber



## House Mouse

- Caspian Sea area origins
- Home range – 30'-50'
- Natural food = grass seeds, bird seed
  - Loves German cockroaches
- Gravitates towards warmth



## Rat Bites

- Of >2 million animal bites occurring annually in U.S.
  - ~1% are **RAT BITES**
  - 10 bites /100,000 in large cities
  
- Risk Factors
  - Children ≤5 years
  - Warmer months
  - Substandard housing
  - Face, hands/arms, legs/feet
  - Occurred while victim sleeping

## Mouse Allergens

- Important contributing factor to occupational and inner-city childhood asthma
- Risk Factors for increased exposure
  - Type of home
    - High rise apartments, mobile homes, & duplex/triplex residences
  - Date of Construction
    - Older homes
  - Low household income
  - Floor cleaning method
  - Presence of rodents
  - Presence of cockroaches

## Arthropods Associated with Commensal Rodents\*

Arthropod Group	Roof Rats	Norway Rats	House Mice	All 3 Rodents
Ticks	3	0	0	3
Mites	11	8	5	16
Fleas	8	7	3	8
Sucking Lice	3	3	0	4
Bots	3	0	0	3
<b>TOTAL</b>	<b>28</b>	<b>18</b>	<b>8</b>	<b>34</b>

\*Data represents findings in Florida

## Zoonoses Associated with Commensal Rodents

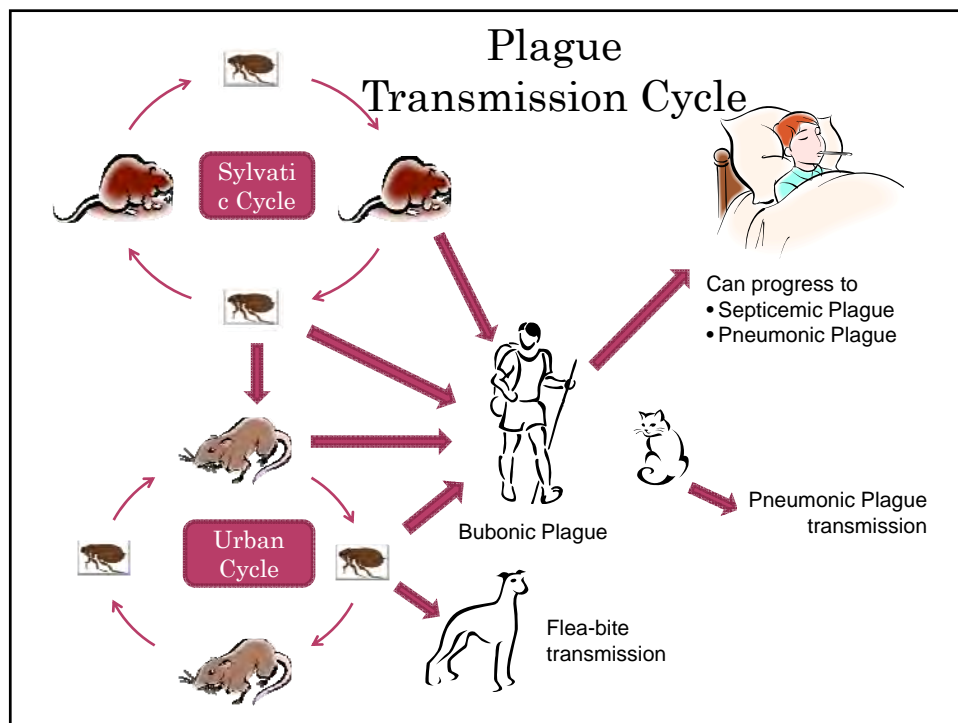
Pathogen	Number of Rodent-Borne Diseases
Virus	17
Rickettsial	9
Bacterial	20
Protozoan	3
Cestodes (Flatworms)	3
Trematodes (Flukes)	1
Nematodes (Roundworms)	3
<b>TOTAL</b>	<b>56</b>

## Zoonoses Associated with Commensal Rodents

Disease	Vector – Pathogen
Plague	Fleas – <i>Yersinia pestis</i>
Rat Bite Fever	<i>Streptobacillus moniliformis</i> <i>Spirillum minus</i>
Murine typhus	Fleas - <i>Rickettsia typhi</i> and <i>R. felis</i>
Leptospirosis	<i>Leptospira interrogans</i> serovar <i>icterohaemorrhagiae</i>
Toxoplasmosis	<i>Toxoplasma gondii</i>
Angiostrongylosis	<i>Angiostrongylus cantonensis</i>
Lymphocytic Choriomeningitis	<i>Arenavirus</i>
Rickettsialpox	House Mouse mite – <i>Rickettsia akari</i>
Salmonellosis	<i>Salmonella</i> spp.

## Plague

- ◉ Bacteria – *Yersinia pestis*
- ◉ Three forms
  - Bubonic
  - Septicemic
  - Pneumonic
- ◉ Vector – fleas
  - Oriental rat flea
  - Sylvatic Rodent fleas
- ◉ Reservoirs – rodents
  - Primarily wild rodents in U.S.
  - Roof rats, Norway rats



## Plague

- ◉ Incubation
  - 2-6 days
- ◉ Symptoms
  - **Bubonic plague:** enlarged, tender lymph nodes, fever, chills and prostration
  - **Septicemic plague:** fever, chills, prostration, abdominal pain, shock and bleeding into skin and other organs
  - **Pneumonic plague:** fever, chills, cough and difficulty breathing; rapid shock and death if not treated early
- ◉ Treatment – antibiotics
- ◉ ~14% (1 in 7) of all plague cases in US are fatal

## Plague in Washington

- ◉ 1907
  - 3 confirmed cases in Seattle;
  - 4 additional possible cases
- ◉ 1984
  - 1 case – Yakima, animal trapper
- ◉ November 1907
  - Seattle passes two ordinances to improve sanitary conditions and combat plague.
- ◉ Ordinance #17391
  - One of first rat proofing ordinances enacted anywhere in U.S.

## Rat Bite Fever

- ◉ *Streptobacillus moniliformis*
  - North America
  - Streptobacillary rat bite fever
  - First reported in U.S. in 1839
  - >200 cases documented in U.S.
- ◉ Haverhill Fever
  - Milk associated transmission
  - Haverhill, MA 1926
- ◉ *Spirillum minus* (aka Sodoku)
  - Asia
  - Spirillary rat bite fever
- ◉ Reservoirs – Rats

## Rat Bite Fever

- ◉ Transmission
  - Bite or scratch from infected rat
  - Handling infected rat
  - Ingestion of contaminated food or water
- ◉ Incubation 2-10 days
- ◉ Symptoms
  - Abrupt onset of fever
  - Vomiting
  - Headache
  - Myalgias & Arthralgias
  - Rash in 20% - 80% of cases
- ◉ Treatment – antibiotics
  - 7-10% case fatality if left untreated

## Rat Bite Fever in Washington

- ◉ Washington 2003 – Fatal Case
  - Female, 19 years
  - Dog groomer
  - *S. moniliformis*
  - 9 pet rats in apartment – 2 under antibiotic treatment for respiratory symptoms
- ◉ Prevention
  - Control rodent population
  - Pasteurize milk
  - Protect food from rodents
  - Laboratory mice, rats, and other rodents should be housed in separate environments

## Murine Typhus

- ◉ AKA Endemic or Flea-borne Typhus
- ◉ *Rickettsia typhi*
- ◉ Incubation 7-14 days
- ◉ Symptoms – non-specific
  - Fever (3-5 days duration)
  - Headache
  - Rash (20%-80% of cases)
  - Arthralgia
- ◉ Treatment – tetracyclines

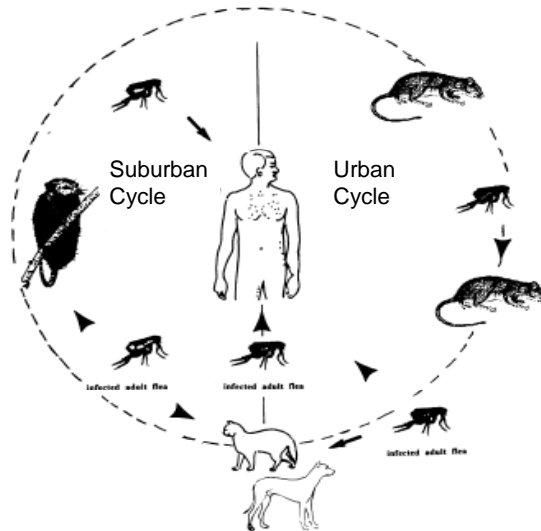
## Murine Typhus

### Urban Cycle

- ◉ Rats
- ◉ Oriental rat fleas

### Suburban Cycle

- ◉ Cats and Opossums
- ◉ Cat fleas
- ◉ Texas
  - April - June
- ◉ California
  - Summer - Fall



## Leptospirosis

- ◉ *Leptospira interrogans* var. *icterohemorragica*
  - ~19% of Washington canine lepto cases reported to Department of Health have “Ictero” titers of  $\geq 1:800$
- ◉ Rats – primary reservoir of “Ictero”
- ◉ Transmitted via contaminated urine or water through ingestion, breaks in skin, or mucous membrane
- ◉ 2007 WA Case – Vofirmed “Ictero” infection
  - Veterinarian urinated on while inspecting a pet rat for fleas
  - Contaminated minor open skin lesions on hands (was not wearing gloves)
  - ER visit followed by hospitalization

## Toxoplasmosis

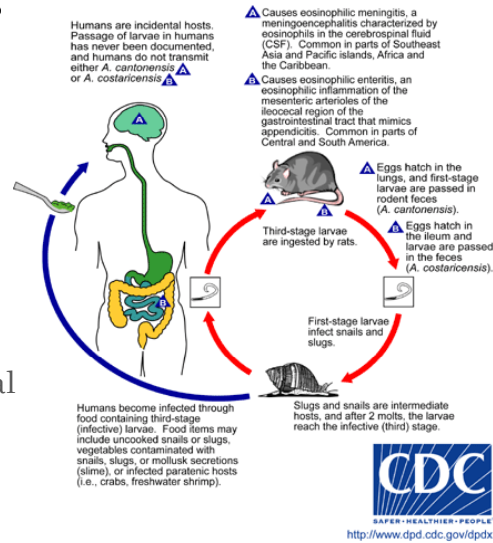
- ◉ *Toxoplasma gondii*
- ◉ Cat family – definitive hosts
  - Shed *T. gondii* eggs in feces
- ◉ Toxoplasmosis is communicable only in cats
- ◉ Rats - intermediate-host reservoir
- ◉ Avg. prevalence 35% in wild rat populations
- ◉ When eggs ingested by rodents, cysts form in various tissues, most commonly the brain
  - Cysts remain viable for life of host
- ◉ *T. gondii* cysts in rats results in increased activity and decreased neophobic behavior

## Angiostrongylosis

- ◉ *Angiostrongylus cantonensis* – roundworm
- ◉ Rat lungworm - pulmonary arteries of rats
- ◉ Intermediate hosts – terrestrial snails and slugs
- ◉ Transmission – ingestion of snails or slugs infected with third-stage larvae
  - Raw or undercooked infected snails or slugs
  - Pieces of snails and slugs accidentally chopped up in vegetables, vegetable juices, or salads
  - Foods contaminated by the slime of infected snails or slugs

## Angiostrongylosis

- Incubation –  
1-3 weeks average
- Symptoms –  
bacterial meningitis
  - Nausea
  - Vomiting
  - Neck stiffness
  - Headaches - often global and severe
- Illness usually lasts  
between 2-8 weeks
- No specific treatment



## Lymphocytic Choriomeningitis

- Virus
- Natural reservoir – House mouse (*Mus musculus*)
- Virus shed in saliva, nasal secretions, urine, milk, feces, and semen
- Incubation – 5-13 days
- Illness lasts – 1-3 weeks
- Clinical Symptoms
  - Fever, fatigue, malaise, anorexia, headache, sore throat, myalgia, photophobia, nausea, vomiting
  - Coughing, rashes, joint aches, chest pain
- Treatment – supportive

## Lymphocytic Choriomeningitis

- ◉ Prenatal infections can result in
  - Abortions, acute neonatal meningitis, developmental defects
- ◉ Prevention
  - Mouse proof home
  - PPE when cleaning rodent-infested premises
  - Safe handling to prevent bites
- ◉ If Pregnant...
  - Avoid touching wild or pet rodents & droppings
  - Avoid rooms where rodents are present
  - PPE if work with rodents (gloves, gowns, face masks)

## Rickettsialpox

- ◉ *Rickettsia akari* – SFG Rickettsia
- ◉ Primary reservoir - House mouse
- ◉ Vector – House Mouse mite
- ◉ Occurs primarily in urban areas
  - Crowded living quarters infested with house mice
- ◉ Incubation 9-14 days
- ◉ Often confused with chickenpox
- ◉ Lesion produced at bite site
  - Face, trunk, extremities usual sites
- ◉ Mild, nonfatal; usually resolves within 6-10 days
- ◉ Treatment - antibiotics

## Salmonellosis

- ◉ Two *Salmonella* serotypes closely associated with rodents & food poisoning
  - *S. typhimurium*
  - *S. enteritidis*
- ◉ Easily transmitted directly from contaminated surfaces to food
- ◉ Illness results from consumption of water or food contaminated with:
  - *Salmonella* bacteria
  - Feces from infected people or animals
- ◉ Rodents deposit several hundred feces in areas they frequent in the course of 1-2 weeks

## Summary

- ◉ Commensal rodents are found throughout the United States
- ◉ Along with destructive behavior, commensal rodents pose a significant disease risk
- ◉ Rodent control and preventative measures are necessary to reduce risk of disease transmission and impact on health
- ◉ For more information on rodent control:  
[www.doh.wa.gov/ehp/ts/Zoo/rodent.htm](http://www.doh.wa.gov/ehp/ts/Zoo/rodent.htm)

## References

- ◉ Centers for Disease Control & Prevention
  - [www.cdc.gov](http://www.cdc.gov)
- ◉ ISU Center for Food Security & Public Health
  - [www.cfsph.iastate.edu](http://www.cfsph.iastate.edu)
- ◉ Mallis, A. Handbook of Pest Control, 9<sup>th</sup> Edition
- ◉ Marsh, RE and RO Baker. Roof Rat Control. *Pest Management*, August 1987.
- ◉ Rodent Home Landscaping Checklist\*
  - [www.d-conproducts.com/pdfs/dCON\\_Checklist\\_1.pdf](http://www.d-conproducts.com/pdfs/dCON_Checklist_1.pdf)
- ◉ WHO. Public Health Significance of Urban Pests
  - [www.euro.who.int/\\_\\_data/assets/pdf\\_file/0011/98426/E91435.pdf](http://www.euro.who.int/__data/assets/pdf_file/0011/98426/E91435.pdf)

\*This link is provided for educational purposes only and does not constitute an endorsement by Washington State Department of Health or by the author of this presentation of this company.

## Acknowledgements

Sharon Hopkins, DVM

Leah Helms

Public Health Seattle and King County