

**"This infestation is far more serious than I was anticipating."**



# MANAGING MICE AND RATS IN SCHOOLS

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- **Why Manage Rodents?**

- Liability**

- Bites**

- Disease**

- Contamination**



- **Biology and Ecology**

- **Inspection and Monitoring**

- Pest signs**

- Rodent conducive conditions**

- Rodent vulnerable areas**

- **Control**

- **Resources**



**Why be  
concerned  
?**



Published: Friday, 12th March, 2010 12:44pm




## Schools plagued by pests

**PEST control companies are being run off their feet in a bid to keep plagued Border schools vermin free.**

Reports of rats, mice and wasps are on the rise in classrooms across the region.

Statistics released under the Freedom of Information act show extermination experts have visited the region's schools an incredible 184 times in the past two years.

Everything from rats to slugs and silverfish have been found in the schools - with moles, wasps and ants also making unwelcome appearances.

 [Comments \(0\)](#) |  [Print](#) |  [Email](#)









# *Homo sapiens!*

12,000 – 15,000 rodenticide poisonings per year







"Willie Wilco"

# GOPHER GETTER

## TYPE 1 BAIT

### READY TO USE

#### ACTIVE INGREDIENT:

STRYCHNINE..... 0.50%

ALKALOID

INERT INGREDIENTS ... 99.50%

TOTAL..... 100.00%

**KEEP OUT OF REACH  
OF CHILDREN  
DANGER POISON**

#### FIRST AID

##### IF SWALLOWED:

• CALL A PHYSICIAN OR POISON CONTROL CENTER IMMEDIATELY. If less than ten (10) minutes have passed since the poison was swallowed, 1 or 2 glasses of water and induce vomiting by touching back of throat.







26 4 year-olds



# HUMAN HEALTH IMPACT



RATS AND MICE ARE RESPONSIBLE  
FOR MORE HUMAN ILLNESS AND DEATH  
THAN ANY OTHER GROUP OF MAMMALS



# RAT BITES

- Intangible cost of rat-associated injury and illness
- Over 10,000 rat bites per year in the U.S.
- Infants and defenseless adults are particularly subject to attack by rats



# NEW ORLEANS METRO REAL-TIME NEWS

2009 NEW ORLEANS, LA

*RAT BITES COVER BABY FOUND DEAD IN HER  
CRIB IN WESTWEGO*

BY ALLEN POWELL II, THE TIMES-  
PICAYUNE FRIDAY JULY 17, 2009, 6:20 AM

# Allergen issue Asthma





# RODENT-BORNE DISEASES

- **RAT-BITE FEVER** –  
transferred from rat to humans  
by the bite of a rat.





- **LEPTOSPIROSIS** –result from direct or indirect contact with infected urine.
- **SCRUB TYPHUS** - transmitted to humans through the bite of mites that live on the rodents.
- **MURINE TYPHUS FEVER** – rats are hosts of flea vectors.
- **SALMONELLOSIS** –gastroenteritis can be spread through food or water contaminated with rat and mouse feces containing.
- **PLAGUE** and **HANTA VIRUS**

# ECONOMIC IMPORTANCE

- Rats cause enormous economic loss
  - Consume and contaminate food
  - Cause fires by gnawing the insulation from electric wires
- Commensal rodents cost billions of dollars each year in the US
  - Destruction to computers and sensitive equipment
  - Structural damage to homes and businesses





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# A few types of rodents

- Rats
- Mice
- Squirrels
- Chipmunks
- Woodchucks
- Voles
- Gophers



# DESCRIPTION AND HABITS OF DOMESTIC RATS AND MICE

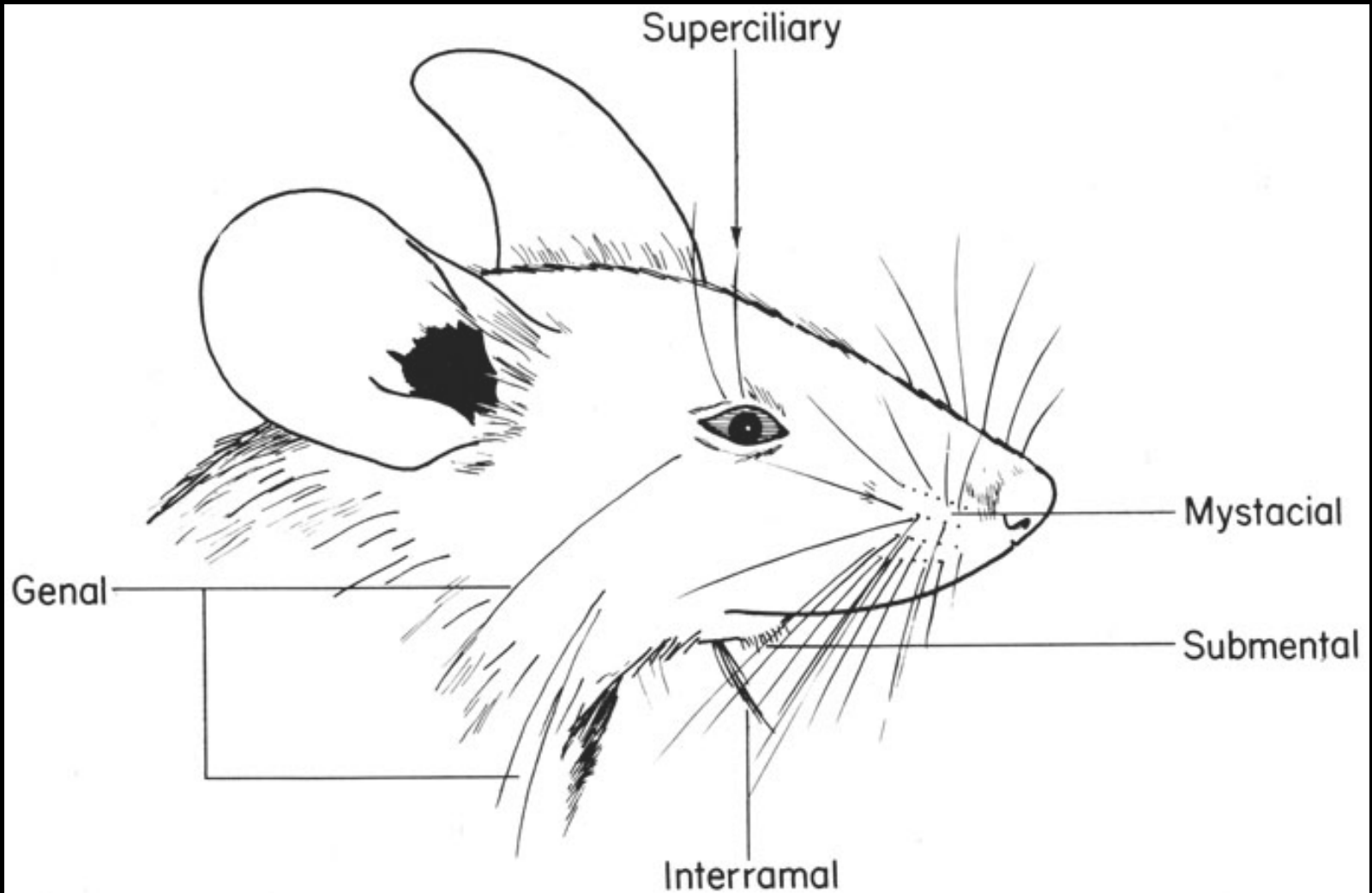
- Domestic Rodents – include Norway rats, roof rats, and house mice.
- Commensal – live at the expense of humans; eating our foods, living in our homes, and sharing their diseases with us **without contributing anything beneficial to the relationship.**







# VIBRISSAE (WHISKERS)

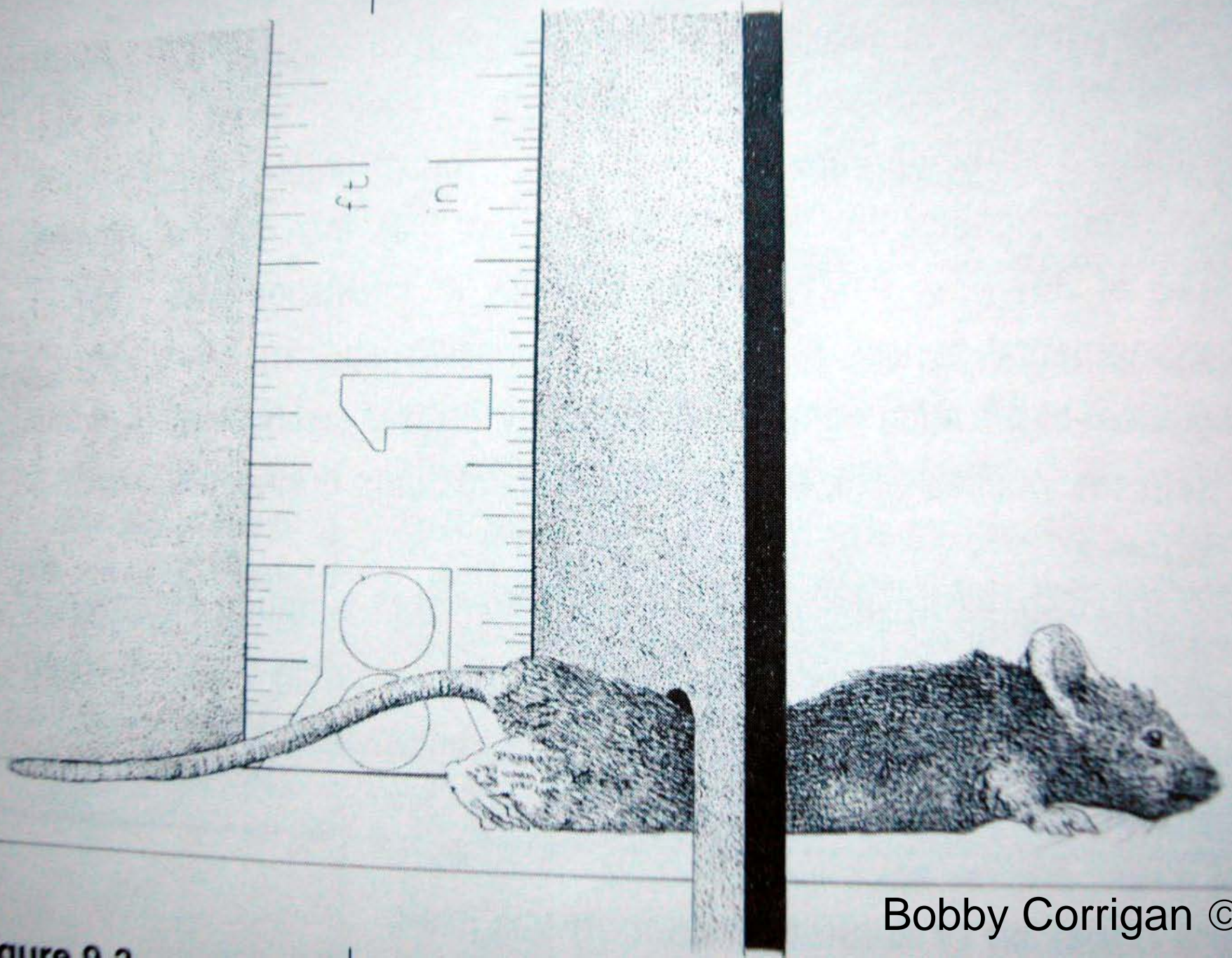








and 3/4in/19mm in width. (Figure 3-2) Note:



Bobby Corrigan ©

Figure 3-2

- **Burrowing rodent**
- Brown rat, house rat, barn rat, sewer rat, and wharf rat
- 7-18 ounces, 200-500 grams
- Length of head and body, 6 - 8.5 inches
- Total length w/tail, 13 to 18.6 inches
- Usually brown with coarse fur, whitish belly, blunt nose
- Small ears rarely over  $\frac{3}{4}$  inch long

## NORWAY RAT (RATTUS NORVEGICUS)













# NORWAY RAT

- Large droppings, up to  $\frac{3}{4}$  inch long capsule shaped
- Sexual maturity in 3 – 5 months after birth
- Gestation period, averages 22 days
- 12 – 18 young per litter
- Approx. 4 – 7 liters per year
- Average life span is about 1 year
- Range is about 100-450 feet





**Outdoors** – burrows in the ground and under foundations of buildings, in rubbish, garbage dumps and sewers.

**Indoors** – between floor and ceilings, in walls, enclosed spaces, shelving, appliances, piles of rubbish, and other spaces concealed from view.

## NORWAY RAT





# NORWAY RAT

- **Food**

- **Garbage**, meat, fish, vegetable, fruit, and cereal baits are well accepted; daily requirement,  $\frac{3}{4}$  to 1 ounce of dry food, more of moist food.

- **Water**

- Daily requirement, to 1 ounce.



- **Smaller** than Norway rat and a **more agile climber**

## ROOF RAT (RATTUS RATTUS)

- Black rat and ship rat
- Abundant in the tropical regions of the world
- Slender and graceful
- Body weight 4 -12 ozs.
- Length, head and body 6.5 – 8 inches.
- Tail, 7.5 – 10 inches long, longer than head plus body
- Total length, 14-18 inches



# ROOF RAT

- Fine body fur, **variable colors**
  - black to slate-gray
  - brownish above and grayish –white below
  - brownish above and white-to-lemon-yellow below
- Pointed nose, large eyes, prominent ears ( $> \frac{3}{4}$  inch - can be pulled over eye).
- Dropping medium size, up to  $\frac{1}{2}$  inch



# ROOF RAT

- Gestation period, average is 22 days
- Young, 6 -8 per litter
- Usually 4 -6 litters per year
- Life span, ~ 1 year
- Range, 100 – 150 feet





# ROOF RAT

- **Indoors** – in attics, between floors and ceilings, in walls and in enclosed spaces of cabinets and shelving
- **Outdoors** – in trees and dense vine growth
- Food – vegetables, fruits, and cereal grains preferred. Daily requirement  $\frac{1}{2}$  to 1 ounce of dry food, more if moist
- Water – up to 1 ounce each day





- Found throughout the world
- Slender and graceful
- Weight –  $\frac{1}{2}$  to  $\frac{3}{4}$  ounces
- Length of head and body:  $2\frac{1}{2}$  –  $3\frac{1}{2}$  inches long
- Tail: 3 – 4 inches long
- Fur: fine, brownish-gray on back, gray on belly
- Nose: pointed
- Ear: large, prominent, with some hairs, can be pulled over eye

## HOUSE MOUSE (MUS MUSCULUS)



# HOUSE MOUSE

- Eye: Large
- Droppings: small, up to  $\frac{1}{4}$  inch
- Sexual maturity: reached 1 1/2 to 2 months after birth
- Gestation period: averages about 19 days
- Young: 5 – 6 per litter
- Number of litters: as many as 8 per year
- Length of life: maximum less than one year



# HOUSE MOUSE

- **Food:** cereal grained preferred, but most types of edible materials; a nibbler - daily requirement -  $1/10^{\text{th}}$  ounce.
- **Water:** daily requirement -  $3/10^{\text{th}}$  ounce. **Can utilize metabolic water in food to survive.**







# GENERAL RODENT FACTS

- Poor vision, color blind
- Keen smell, taste, touch, hearing
- Mostly active evening, early morning
- Omnivores
- Hoarders
- Territorial
- Do not go beyond home range easily
- Provision nest with any soft material
- Reproductively prolific; may be pregnant while nursing pups
- Kinesthetic memory, orient via touch

# TOUCHING ON THE RUN

- Vibrissae on head as well as guard hairs on the body fur serve to orient the rodent.
- Sensory nerves at the base of hairs
- Allows rodent to run along a wall or through grass trail and gives animal information about its environment
- Subconscious recording of movements it takes to travel from nest to food or water
- Movements through its territory are pre-programmed



# PHYSICAL CAPABILITIES OF A RAT

- Pass through quarter-sized opening ( $\frac{1}{2}$ " )
- Use wires, conduits or pipes to gain access
- 180 fecal pellets/day
- Survive a 50' fall
- 13" reach
- Digs tunnels straight down w/o leaving dirt around the hole
- 36" vertical jump
- Tread water 3 days
- Swim underwater for 30 sec.
- Swim 1 mile in open water
- Gnaw on wood, lead pipes, cinder blocks, asbestos, aluminum, sheet metal, glass, and sun-dried adobe



# MOUSE FACTS

- Survive an 8' fall
- Runs at 12 ft /sec
- 50 fecal pellets/day
- 12" jump vertical



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t

- Thrive in cold storage room at 14F
- Enter structure with  $\frac{1}{4}$ " opening (dime)
- Eats 4 lbs of food and makes 18,000 fecal pellets / 6 mo
- Crayons color fecal pellets



NEVER UNDERESTIMATE  
RODENT INGENUITY...













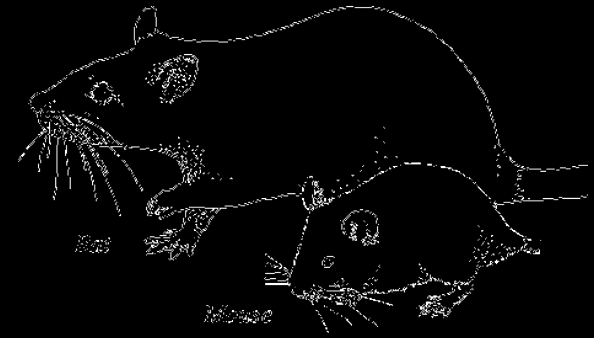
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# Recognizing Rat and Mouse Signs





Monitor



# RECOGNIZING NORWAY RAT SIGNS



# RECOGNIZING RAT AND MOUSE SIGNS

## Runways:

Greasy runways are found along walls, steps, and rafters.





# RECOGNIZING RAT AND MOUSE SIGNS

## **Rub Marks:**

Dark markings rodents make with their bodies along runway walls.





# RECOGNIZING RAT AND MOUSE SIGNS

- **Visual sightings**

- **Rodent Sounds:**

High pitched  
squeaks

- **Rodent Odors:**

Odors produced  
from urine and  
body glands.







# INDICATOR PESTS

Found near  
dead animals  
or trash



**Blow Fly**



**Hide Beetle**

Found near  
grain or bait  
stored in walls



**Indianmeal Moth**



**Grain Beetle**



# Key Conditional Words for finding rats and mice in and around buildings:

- \* Warmth
- \* Near food
- \* Stationary items
- \* Let droppings be your roadmaps (to bait and trap placement)

**Structural Guide-Words for quickly  
locating rats and mice in and around  
buildings:**

Shadowy corners

Ledges (e.g., sill plates)

Lines (heating, electrical conduits).

Door thresholds

Fascia boards

Voids (furniture, equipment, ceiling, etc.)

Thick vegetative cover

Cavernous shrubs

# RODENT VULNERABLE AREAS (RVAS)

- Warm walls with penetrations
- Compressor motor voids of everyday kitchen equipment
- Warm uncapped concrete hollow block
- Undisturbed boxes on top of cold boxes in refrigerators and freezers.





**Feces are commonly deposited in visible accessible areas, but rodents also commonly deposit feces in out-of-sight areas. Always check the out-of-sight areas.**





BobbyCorrigan, RMC PMC ©





BobbyCorrigan, RMC PMC ©







# Evidence of Clutter Bugs







# NESCO 6-QT. ROASTER OVEN



1. Couvrir le bœuf avec confit de saucisses
2. Cuite de cuisson et de réchauffage
3. Réchauffage de cuisson en pression amovible
4. Réchauffage de cuisson de cuisson "Circle of Heat"
5. Cuite de cuisson de cuisson (150° to 425° F.)

Also includes a helpful User's Guide and Recipe Guide







BETWEEN





# PREVENTION AND CONTROL: DUMPSTERS



Dumpsters should be

- free of holes
- covered
- placed on cement



Screen drain holes



Empty dumpsters regularly;  
they should never overflow



# RECOGNIZING RAT AND MOUSE SIGNS

**GNAWINGS:**  
Rat incisor  
teeth grow 4  
to 6 inches a  
year. Must  
gnaw each  
day to keep  
their teeth  
short.



# HARDNESS INDEX FOR RAT INCISORS

<b>Object</b>	<b>Numerical Rating</b>
<b>Rat teeth</b>	<b>5.5</b>
<b>Iron</b>	<b>4.0</b>
<b>Copper</b>	<b>2.5 – 3.0</b>
<b>Aluminum</b>	<b>2.0</b>
<b>Lead</b>	<b>1.5</b>

Source: Mallis Handbook of Pest Control, 1990





# RODENT MANAGEMENT:



- Repair all door thresholds
- 1/4" opening for mice (pencil)
- 1/2" opening for young rats (dime)
- 3/4" opening for adult rats (quarter)





- Repair holes in outside walls
  - cement mortar





BobbyCorrigan, RMC PMC ©

# EXCLUSION TECHNIQUES (CONCLUDED)

- Hardware cloth over ventilation openings
  - 19 gauge or greater
  - 1/4" or smaller mesh









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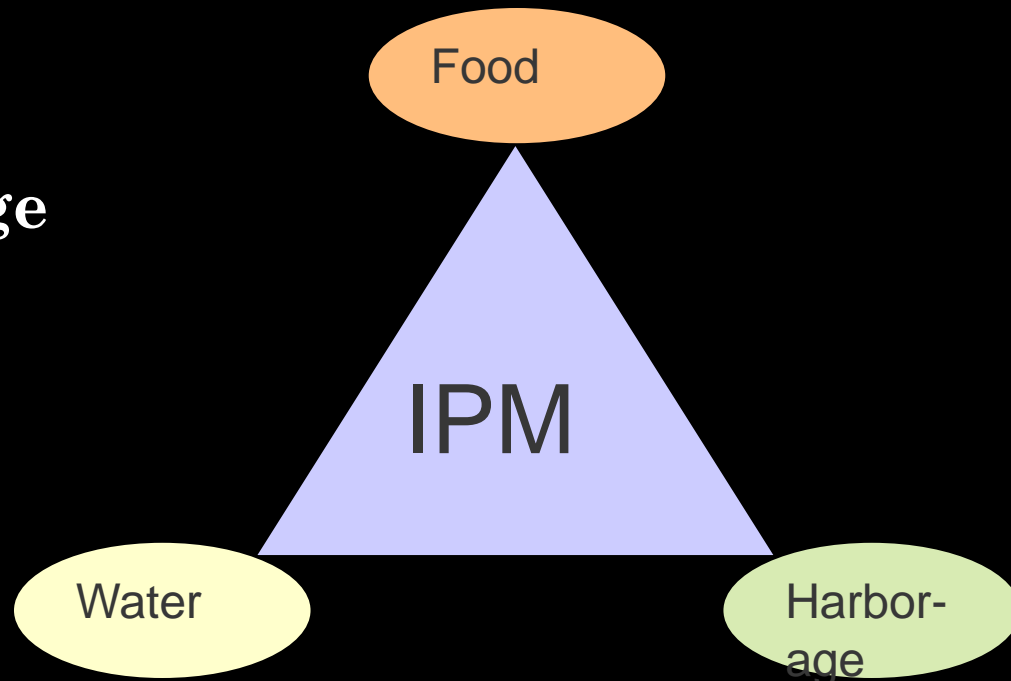
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# INTEGRATED PEST MANAGEMENT

- The foundation of IPM is managing the environment to eliminate pest access to:
  - Food
  - Water
  - Harborage



# CONTROL OF RODENT POPULATIONS

- Most lasting control achieved by permanent alterations of the physical environment of the rodent.
- Environment should be changed to cause increased competition and predation.
- Environmental sanitation is the first and foremost requirement for permanent rodent control.



# Rodent Control

IMPORTANT - RODENT EXTERMINATION WITHOUT ENVIRONMENTAL IMPROVEMENTS, PARTICULARLY GOOD SANITATION WILL BE INEFFECTIVE.

- **Poisons and Baits**
  - **Multi-Dose Poisons**
  - **Single-Dose Poisons**
  - **Sterilants**



- **Multi-Dose Poisons**

- **Anticoagulants (First Generation)**

- Hydroxycoumarin series

- Indandione

- Fumarin

- Diphacinone

- Warfarin

- Pival

- Coumarin

- PMP

- **Anticoagulants (Second Generation)**

- Brodifacoum

- Bromodialone

- Difethialone

- Difenacoum

- Must be eaten for several consecutive days\*

- Causes internal bleeding

- Provides a margin of safety

- Humane

# RODENT EXTERMINATION (CONT.)

- **Multi-Dose Baits**
  - Bait blocks
  - Pellets
  - Toss packs
  - Tracking powders







# RODENT EXTERMINATION (CONT.)

- **Single-Dose Poisons**

- Fatal to rodent after a single feeding
- Lethal after 15 minutes to 2-days dependent on type of poison
- Generally fatal to humans and pets

# RODENT EXTERMINATION (CONT.)

- **Single-Dose Poisons**

- Red squill
- Zinc phosphide
- Strychnine
- Sodium fluoroacetate
- Fluoroacetamide
- Vacor
- Norbormide



- » **EPA ban aluminum and magnesium phosphide pesticides** in residential areas, including homes, nursing homes, day care facilities, hospitals and schools, except on school athletic fields where the pesticide may still be used.
- » **Create a buffer zone** of 100 feet for using it in burrows. The old buffer zone was 15 feet.
- » **Post warning signs** in the areas where the fumigant is used that include a 24-hour emergency number and that remain in place for 2 days.

Rodenticide	Formulation	Effect	Concen- tration (%)	WHO hazard classification (Class) <sup>a</sup>
Brodifacoum	Bait, wax block	Anticoagulant <sup>b</sup>	0.005	Ia
Bromadiolone	Bait, oil-based, wax block, powder concentrate	Anticoagulant <sup>b</sup>	0.005	Ia
	Tracking powder		0.1-2.0	
Bromethalin	Bait	Acute	0.005-0.01	Ia
Calciferol	Bait	Sub-acute	0.075-0.10	NA
Chlorophacinone	Bait	Anticoagulant	0.005-0.05	Ia
	Oil-based concentrate		0.25	
	Tracking powder		0.20	
Coumatetralyl	Wax block, bait	Anticoagulant	0.0375	Ib
	Tracking powder		0.75	
Difenacoum	Wax block, bait	Anticoagulant <sup>b</sup>	0.005	Ia
Difethialone	Wax block, bait	Anticoagulant <sup>b</sup>	0.0025	Ia
Diphacinone	Powder concentrate	anticoagulant	0.1-0.5	Ia
	Water soluble concentrate		0.1-2.0	
	Bait		0.005-0.05	
Flocoumafen	Wax briquette	Anticoagulant <sup>b</sup>	0.005	Ia
Warfarin	Concentrate	Anticoagulant	0.5-1.0	Ib
	Tracking powder, bait		0.025-0.05	
Zinc phosphide	Bait	Acute	1-5	Ib

**Ia = extremely hazardous; Ib = highly hazardous; NA = not available**  
**b Second generation anticoagulant**

# RODENT EXTERMINATION

## – Baiting Recommendations

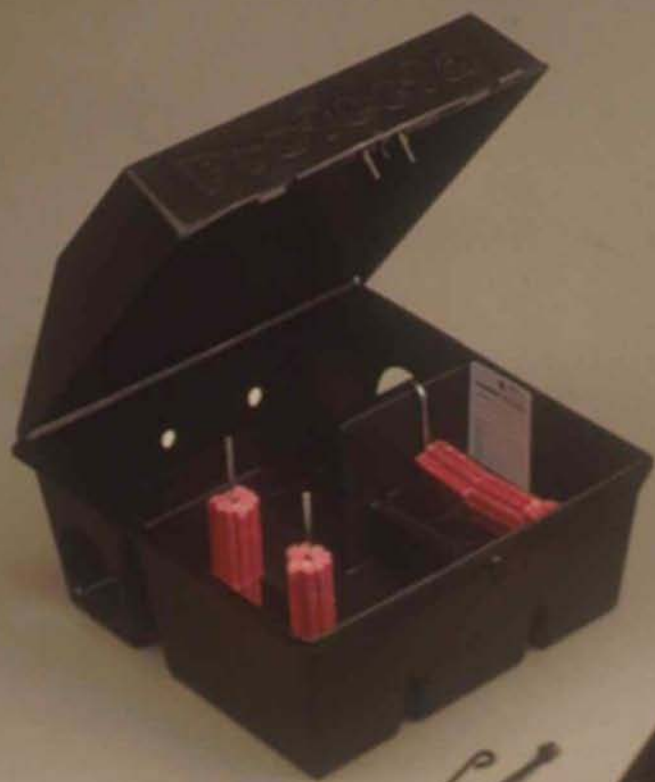
- **Place baits out of reach of children and pets**
- Maintain wholesome and attractive fresh bait
- Place baits in areas where rodents frequent
- **Use bait stations**



# EPA RISK MITIGATION DECISION FOR TEN RODENTICIDES

MAY 28, 2008

- **To minimize children's exposure to rodenticide products used in the home, residential and general consumers are restricted as follows -**
  - rodenticide baits only sold in bait stations
  - loose baits (pellets and meal) banned for sale  
(12,000 – 15,000 exposures/year in ages under 6)
- **To reduce wildlife exposure and ecological risks -**
  - Limits for general consumers on 4 of the 10 rodenticides that pose the greatest risk to wildlife (brodifacoum, bromodiolone, difenacoum, and difethialone).
  - Bait stations required for all outdoor, above ground uses.





BobbyCorrigan, RMC PMC ©







**Exterior wall rodent  
monitoring stations may be  
necessary...**

**but distant fence-line stations  
may not provide any  
additional protection. Fence-  
line stations can pose an  
unacceptable threat to non-  
target species.**

# PREVENTION AND CONTROL: TARGETED CHEMICAL USE

- The label is the law
- Note rodenticide labels requiring tamper-resistant stations
- Read the label on both the station and the bait
- The bait station should be secured, locked, and labeled.
- If the rodents are inside, consider using traps.



An opened bait station



# RODENT EXTERMINATION

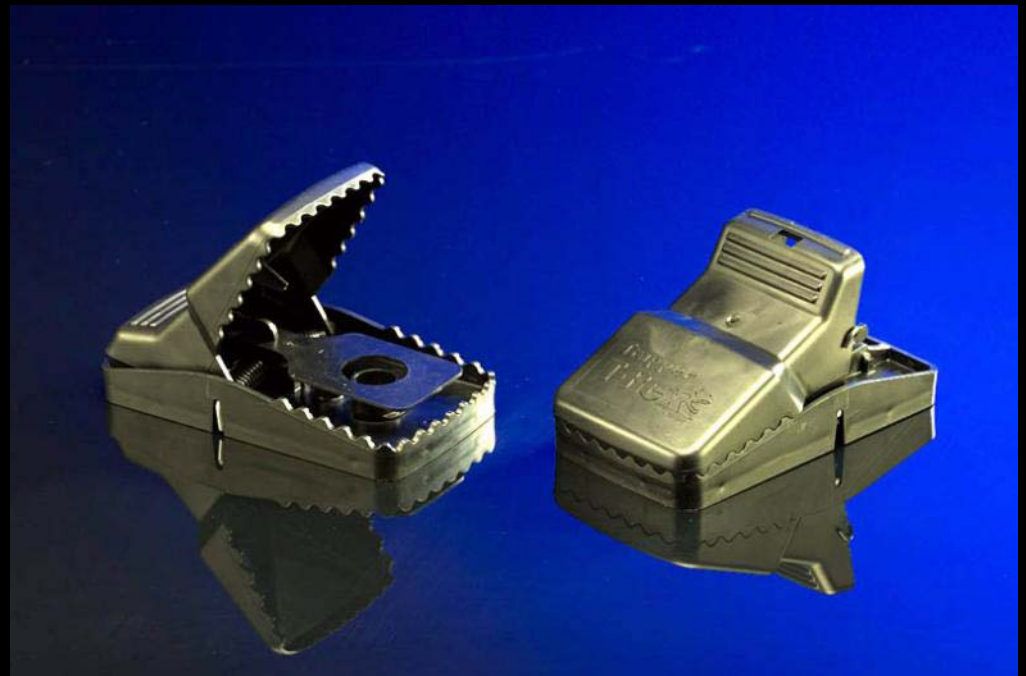
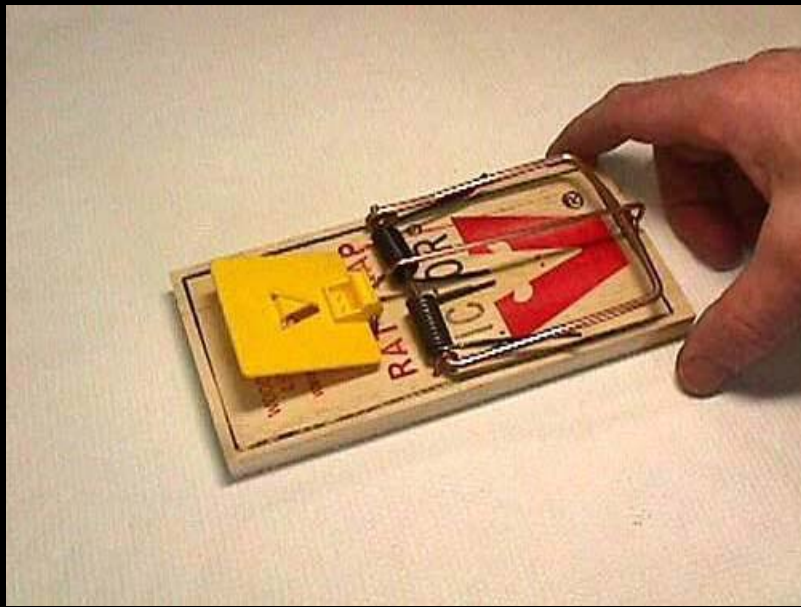
- **Trapping**
  - Useful when poisons fail or are too risky
  - If the odor of unrecovered rodents is a problem
  - To capture rodents for parasite and blood sample studies
  - Place trap in areas rodents frequent



# TYPES OF TRAPS

- Snap
- Metal lever
- Multi-catch
- Live
- Glue boards
- Electrocuting







# PREVENTION AND CONTROL: TRAPS

- Effective and reusable
- **More** is better
- Check often
- **Placement is key**



Trap jumped from the wall when it snapped.

# TRAP HINTS

- Weaker rats usually 1<sup>st</sup> to investigate a change – trapping non-breeding rats. Dominant rats often trap-shy & continue to breed
- When 1<sup>st</sup> entering a building, rats less suspicious since everything is new & need to learn the environment. This is why perimeter trapping works well.

# TRAP HINTS (CONTINUED)

- More traps = better
- Used traps more attractive than new
- Avoid handling a domestic animal before placing, baiting rodent traps
- Store traps in place w/o chemicals





# TRAP PLACEMENT (CONTINUED)



- Move every 7-10 days
- Change bait frequently
- Use boxes or other objects to funnel rodent into traps
- Be patient, persistent, creative

# PLACEMENT SPECIFICS - SNAP TRAPS

- Place so long axis is perpendicular to the travel route w/ trigger/bait pan across path
- 2 traps side by side ↑ chances of success
- 3 traps in a row – hard to hurtle
- 6 – 10' intervals for mice
- 20 – 30' intervals for rats

# TRAP PLACEMENT IS KEY

Place the trap against the wall where rodents travel. (The edge of the trap must touch the wall.)



**Trap set correctly so it snaps towards the wall**



# HOW TO TRAP RODENTS

Bait with what they're eating or using to nest

## Mice

1. Bait & set many traps
- 6 traps for each mouse
- At least 3' apart
- Set immediately

## Rats

1. Place many traps
2. Bait and leave UNSET until rats are readily feeding
3. Bait and set all traps

# REMOVAL OF DEAD RODENTS FROM TRAPS

- **Check traps regularly**
- **Spray dead rodents with a disinfectant**
- **Using heavy gloves, remove rodent from trap and place in double sealed bags**
- **Discard rodent in a sealed outdoor waste receptacle**
- **Disinfect gloves if they will be reused**
- **Decontaminate traps before reusing**
- **[www.cdc.gov/ncidod/diseases/hanta/hps/index.htm](http://www.cdc.gov/ncidod/diseases/hanta/hps/index.htm)**

# PERSONAL PROTECTION

- PPE for Trapping
  - Gloves and DEET in open areas
  - Minimum of N-95, gloves and DEET in confined areas
- PPE for Rodent Processing
  - Minimum of N-95 (N-100 or PAPR if hantavirus is suspected)
  - Full body protection (Tyvek or other) plus DEET
  - Double latex gloves and eye protection

*Note: Fit testing and training required for respirators.*





Rodents are cute...



Charlotte's Web



Stuart Little



Ratatouille



Flushed

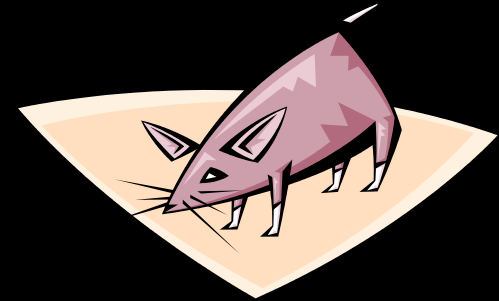
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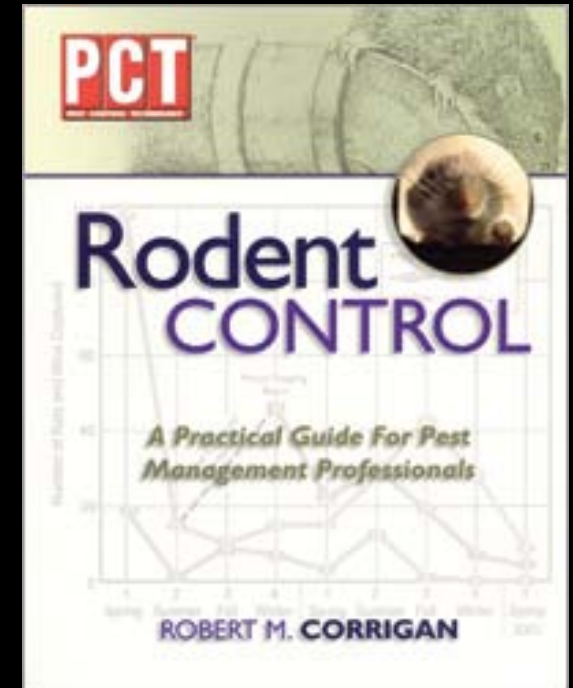
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Centers for Disease Control and Prevention

## Integrated Pest Management: Conducting Urban Rodent Surveys

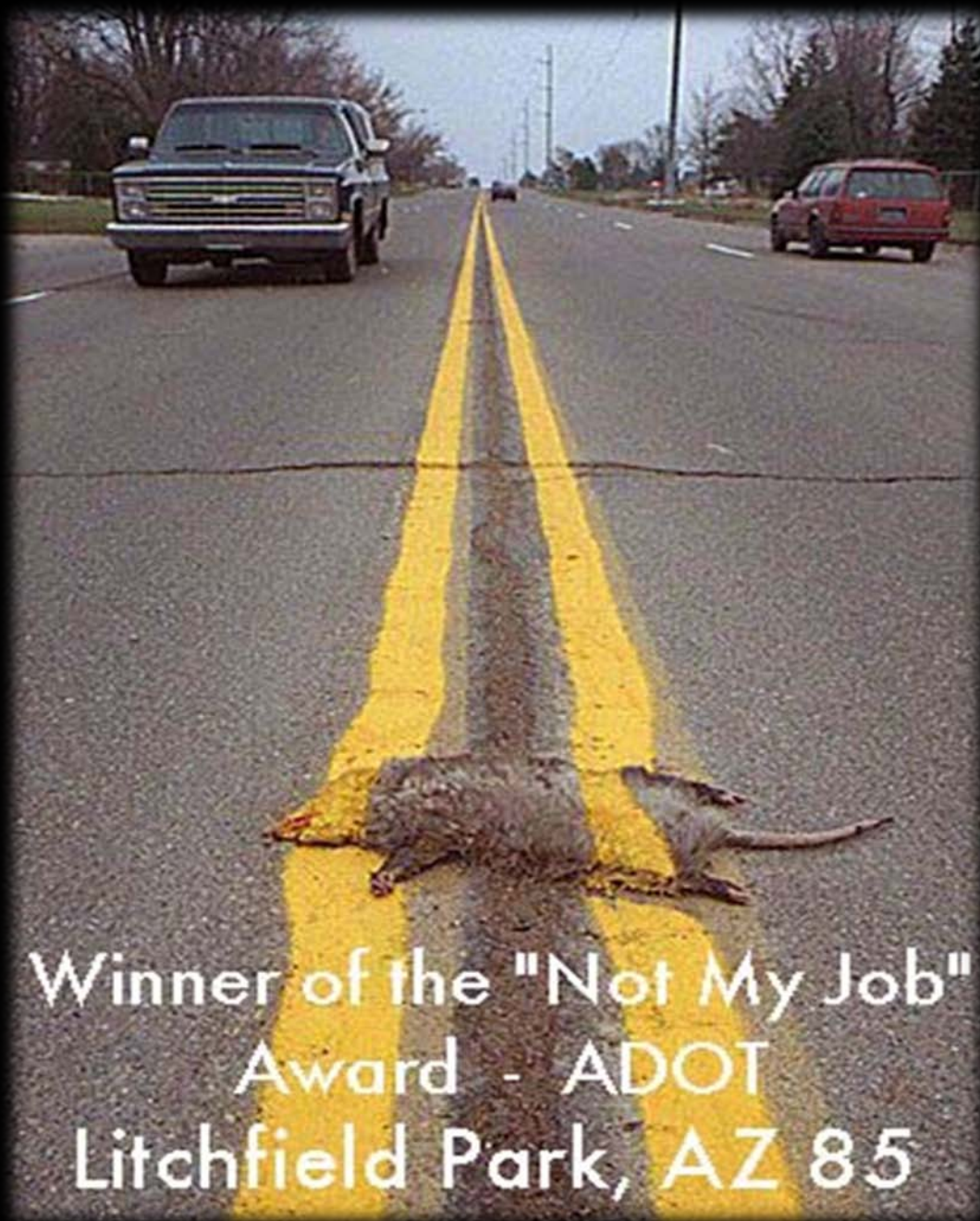


[HTTP://WWW.CDC.GOV/NCEH/EHS/DOCS/IPM\\_MANUAL.PDF](http://www.cdc.gov/nceh/ehs/docs/ipm_manual.pdf)





*I'm telling you...the mouse was big!!*



Winner of the "Not My Job"  
Award - ADOT  
Litchfield Park, AZ 85