# ARKANSAS 4-H VETERINARY SCIENCE

DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System

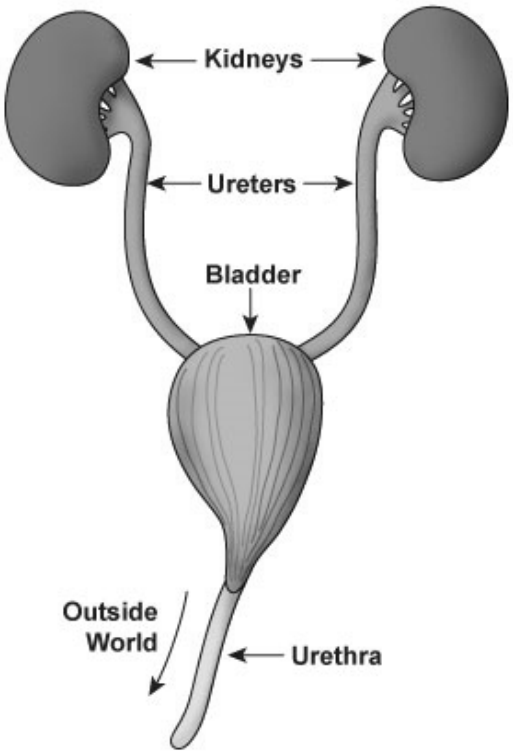
# URINALYSIS

# Why Urine?

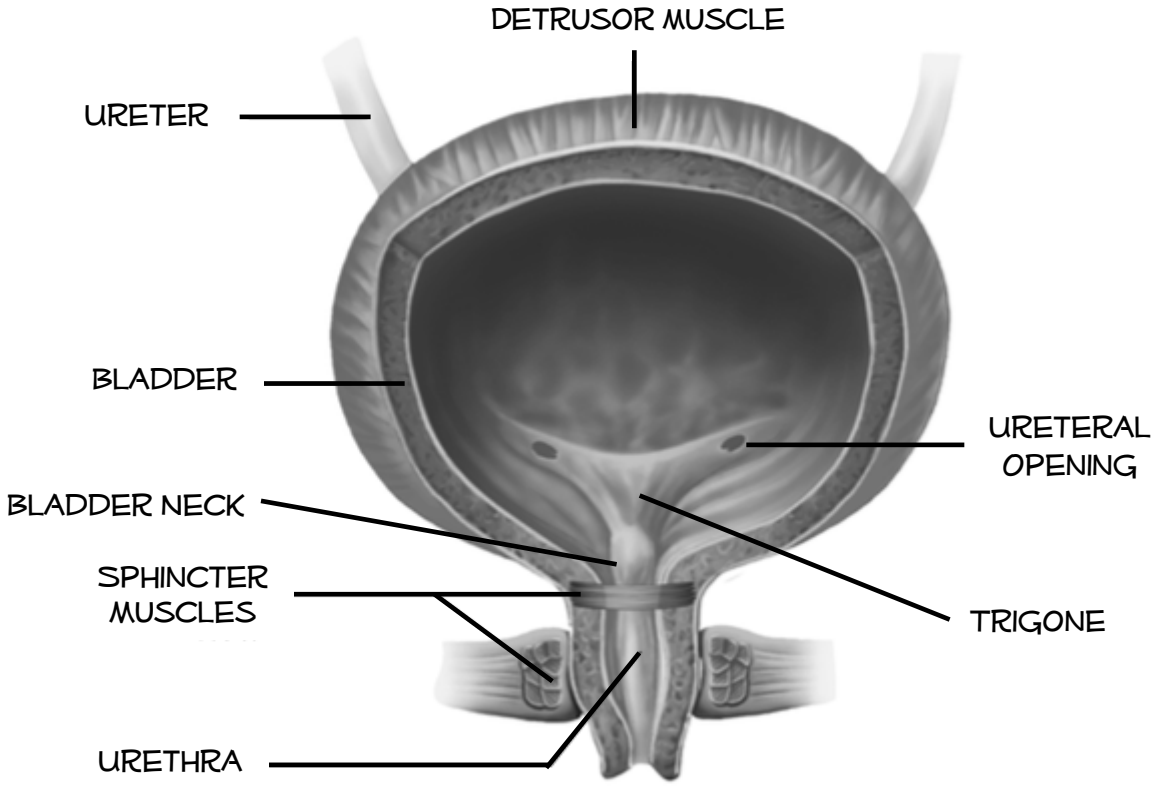
- Urine is the end product of a filtering process that removes waste from the body
- The color of urine can give you information about hydration level as well as possible underlying disease
- A urinalysis should be performed at least yearly for healthy pets, and more often for older animals and those with existing or chronic health issues
- Important elements of a urinalysis include a visual inspection of the urine sample, a dipstick test, and microscopic evaluation of urine sediment

# The Urinary System

- The urinary tract consists of the kidneys, the ureters, the bladder, the urethra, and finally, the urethral opening at either the end of the penis or just within the vagina
- Kidneys filter out waste products from the blood
- Ureters connect the kidneys to the bladder
- The urethra is a tube that is controlled by a sphincter muscle that empties the bladder to the outside world

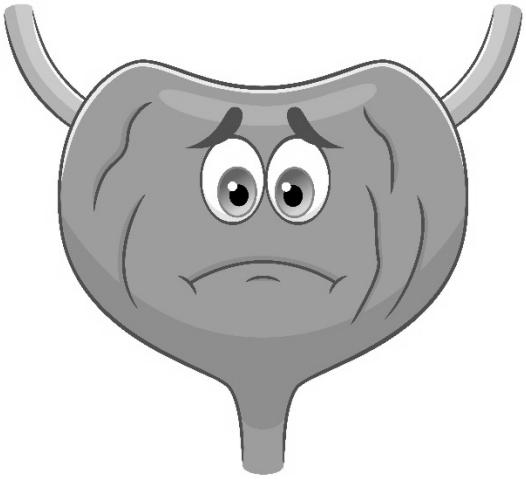


# The Bladder


DETRUSOR MUSCLE
URETER
BLADDER
URETERAL OPENING
BLADDER NECK
SPHINCTER MUSCLES
TRIGONE
URETHRA

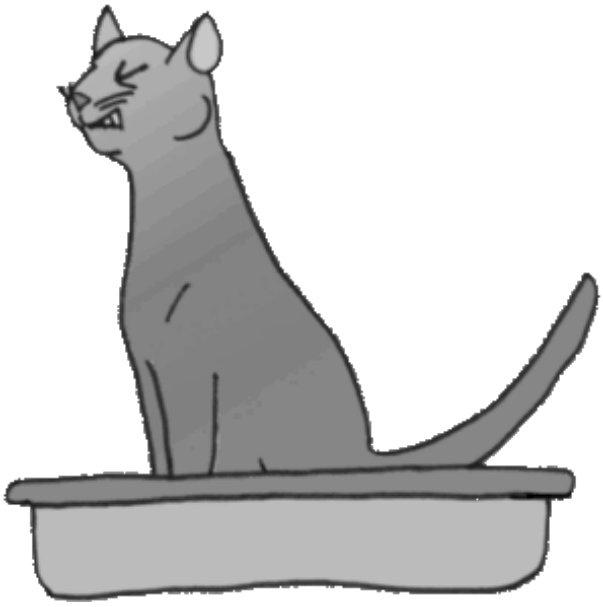
# Urinary Tract Problems

- Inflammation of bladder caused by stress
- Bacterial or fungal bladder infections
- Inflammation of bladder from urinary crystals
- Inflammation of bladder from bladder stones
- Inflammation of the urethra
- Damage to ureters by trauma, passing kidney stones, surgical accident or cancer
- Damage to kidneys by dehydration, infection, toxins or cancer



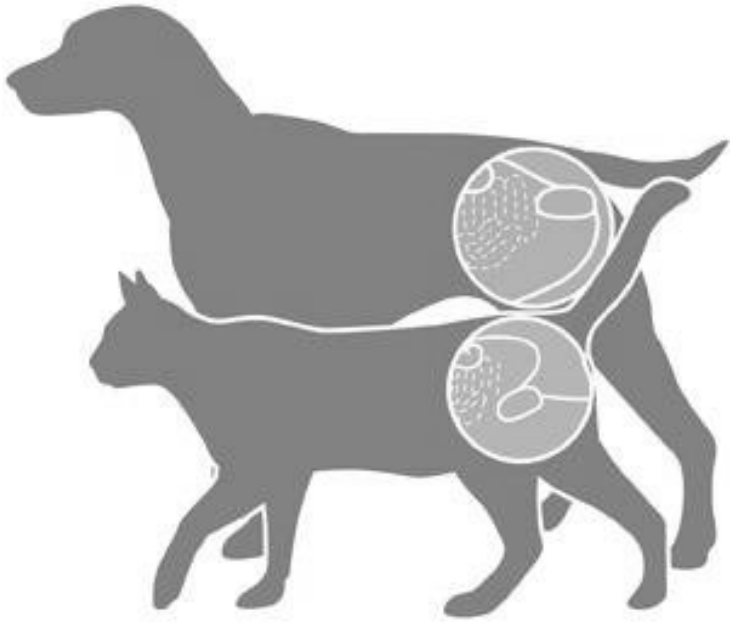
# Feline Idiopathic Cystitis

- Inflammation of the bladder with an unknown cause
- Can quickly lead to kidney and heart problems
- Can lead to total blockage of urethra in males
- Frequent attempts to urinate
- Straining to urinate
- Urinating in inappropriate places in the house
- Crying out during attempts to urinate
- Blood-tinged urine



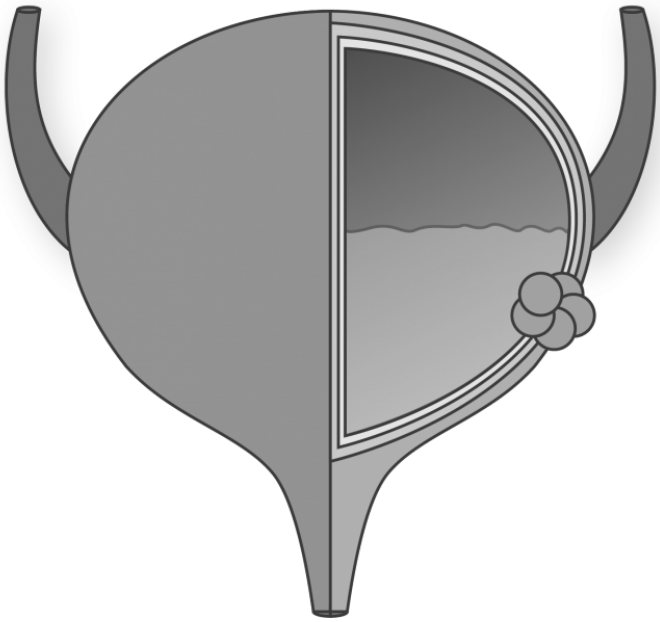
# Bladder Infection

- Bacterial or fungal contamination via urethra
- Can lead to kidney infection
- Frequent attempts to urinate
- Straining to urinate
- Urinating in inappropriate places in the house
- Crying out during attempts to urinate
- Blood-tinged urine
- Cloudy and odorous urine



# Bladder Cancer

- Causes an obstruction within the urinary tract
- More common in dogs
- Transitional cell carcinoma is most common type
- Cancer is very aggressive
- Symptoms are similar to bladder infection
- Should always be considered if blood is in urine



# Visual Characteristics of Urine

## Color

Clear to yellow is normal

Dark yellow to brownish yellow indicates dehydration

Brown to dark brown indicates muscle damage

Pink, Orange or Dark Red indicates blood

## Clarity

Clear is normal

Cloudy may indicate infection or inflammation

Precipitates may indicate neoplasia (cancer)

## Urine stream

Urination should occur in a steady stream

A slow stream indicates a problem

Leakage (incontinence) indicates a problem

Posturing to urinate without urine is called anuria

# The Dipstick Test

**Urine pH** is affected by many variables, including time since the last meal, diet, a number of medications, lung and kidney function, and renal and systemic diseases.

**Blood** in urine can occur with disease anywhere in the urogenital tract.

**Leukocytes** (white blood cells) in urine indicates active inflammation in the urogenital tract.

**Glucose** in urine means that either the glucose in blood is elevated or there is a kidney disease that prevents full reabsorption of glucose.

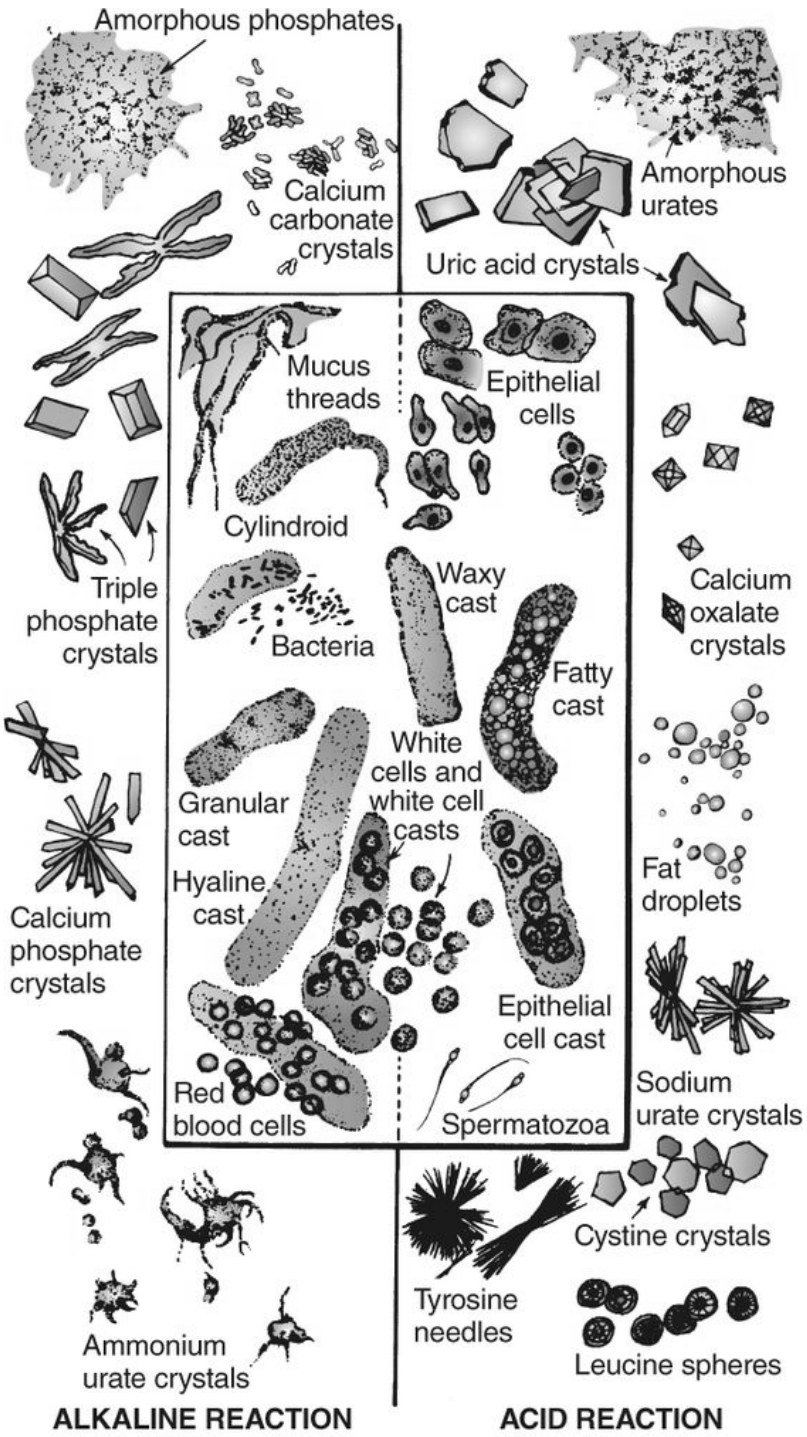
**Bilirubin** in urine occurs with hemolysis (break down of red blood cells) or liver disease.

**Protein** in urine is due to pre-glomerular, glomerular, or postglomerular disease. The glomerulus is a cluster of capillaries around the end of a kidney tubule, where waste products are filtered from the blood.

**Ketones** in urine are formed when the body is unable to get sufficient energy from glucose and must metabolize large quantities of fatty acids instead.

**Specific gravity** is an indirect measure of kidney function.

# Urine Sediment



# COLOR WHEEL OF POOP

# What can poop tell us?

## Color

Dog poop should be chocolate brown. Color in dog food may contribute to color of dog poop.

## Shape

Dog stool should be shaped like logs and maintain their form. If droppings are round, the dog may be dehydrated.

## Consistency

Dog poop should be compact, moist and easy to pick up – yet feel like Play-Doh when squished. Diarrhea or watery feces can be an indication of intestinal upset.

## Size

The volume of a dog's waste should be proportionate to the amount of food he consumes. Poop size increases as the fiber content in his food increases.

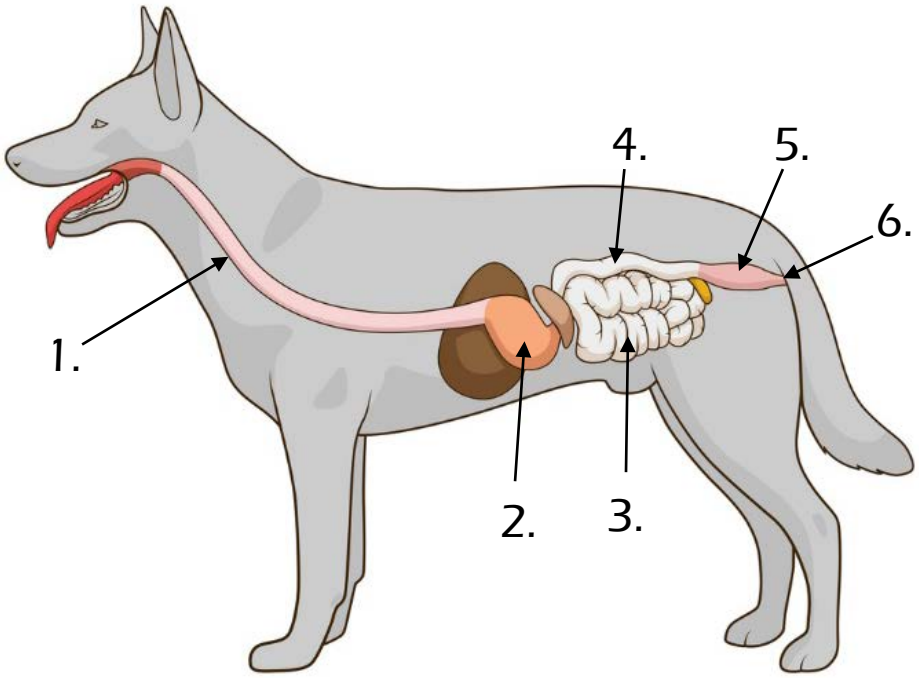
## Content

Mucus in poop? Could be an indication of an inflamed colon. Excessive grass? Could indicated that he's stressed or has gastric upset. If our dog has a dermatological problem and he's losing hair or licking a lot, expect to see increased hair in his stool. Small white bits? Your dog may have tapeworms – time for the vet!

# What does the color of poop mean?

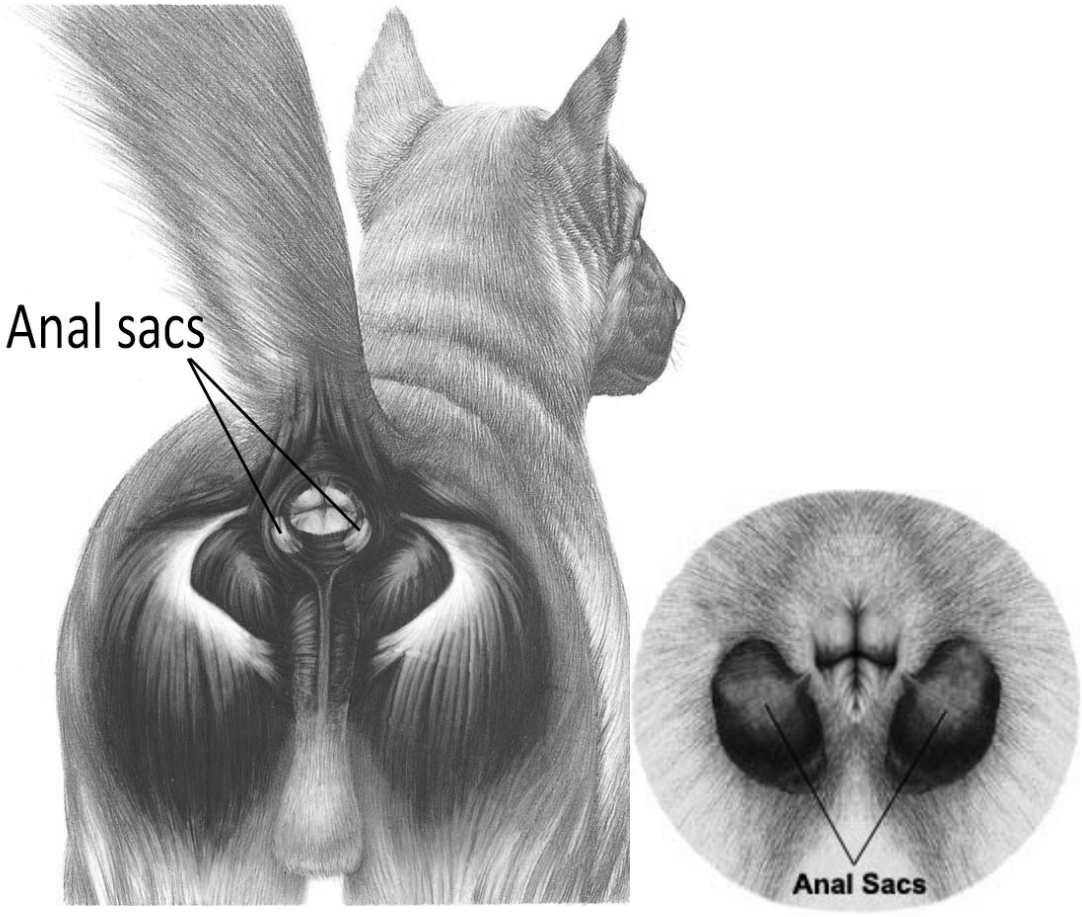
# The Gastrointestinal Tract

1. Food (ingesta) travels down the esophagus
2. Ingesta enters the stomach to be broken down by acid
3. Digesta moves through small intestines to be absorbed
4. Digesta moves through colon to become feces
5. Feces are stored in rectum
6. Feces leave body through the anus (defecation)

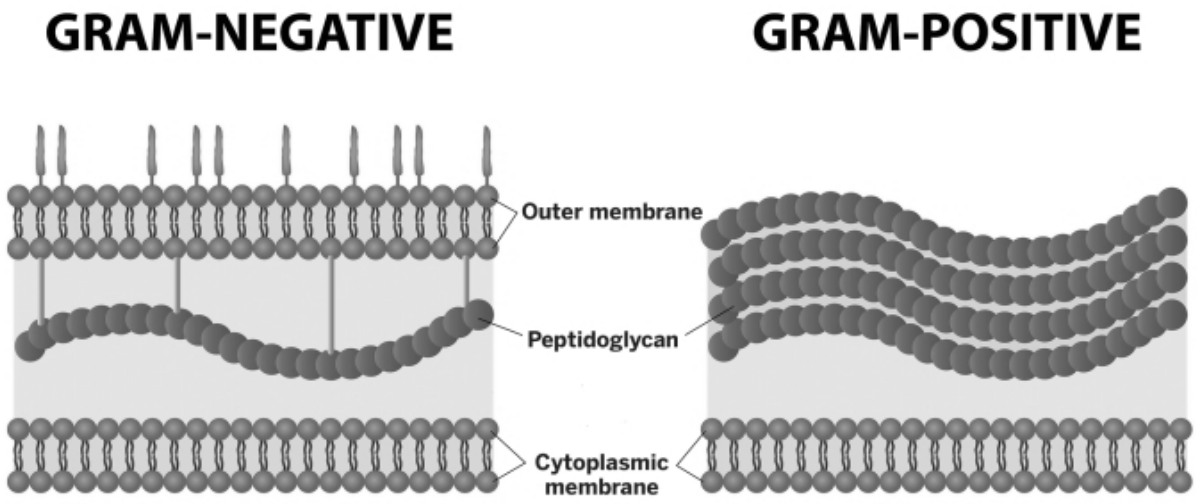


# The Anal Glands

- Anal sacs expel pheromone during defecation
- Also called scent glands
- Secretion is used for animal identification (territory)
- Inflammation can block ducts
- Sacs can rupture if not expressed regularly!



# Types of Bacteria in Feces



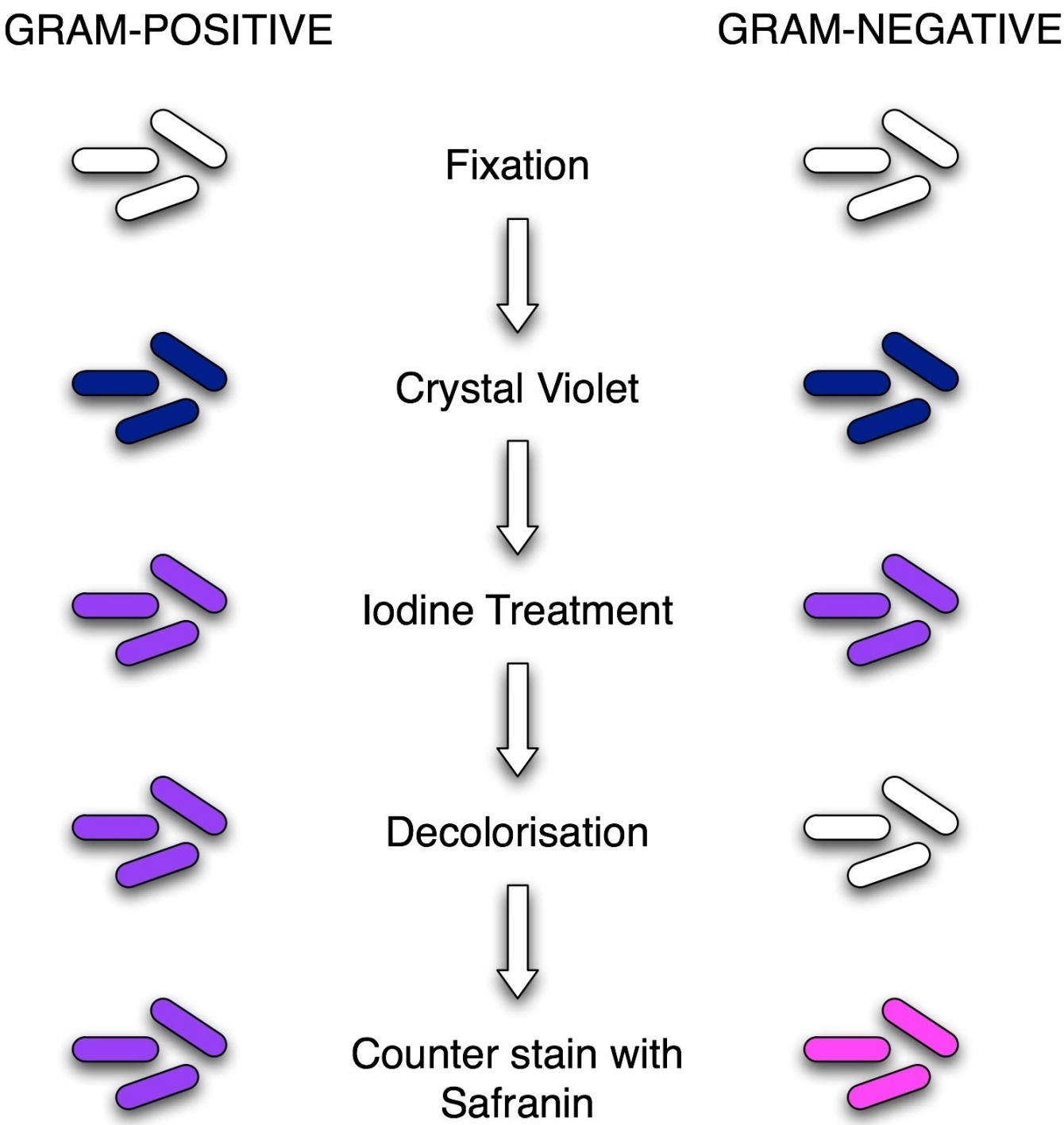

<u>Gram-Positive bacteria in feces</u>

*Clostridia s*
*Enterococcus*

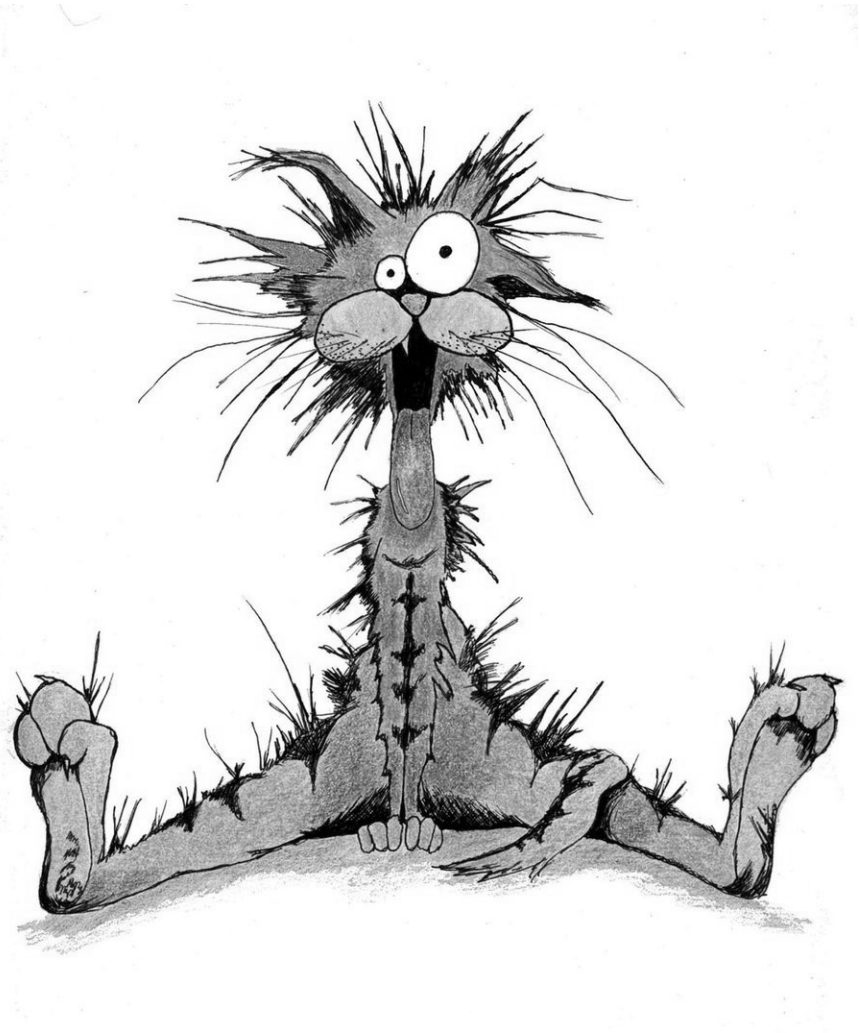
<u>Gram-Negative bacteria in feces</u>

*Campylobacter*
*Escheria coli*
*Salmonella*
*Proteus*

# The Gram Stain



# STRESS AND THE IMMUNE SYSTEM



# The Big Picture

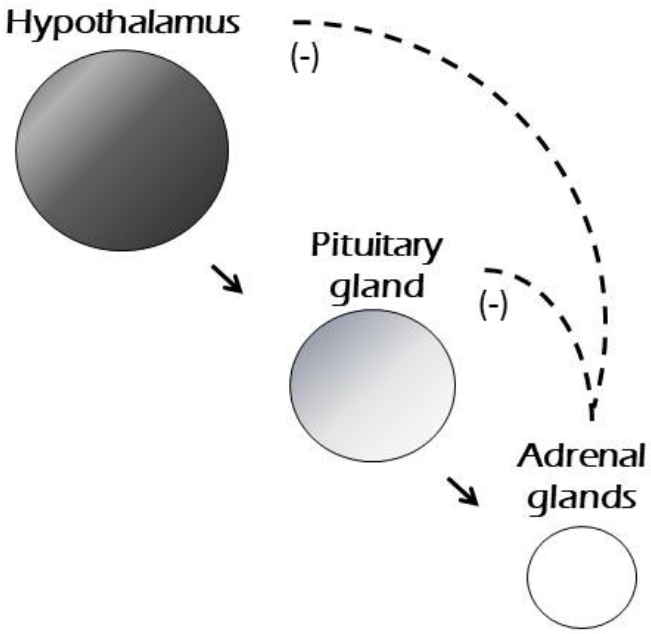
- Stress is a biological and psychological response to a threatening event
- Also known as the flight-or-flight response
- Stress hormones are released due to a communication between the brain and adrenal glands
- Adrenaline increases heart rate and cortisol releases sugar stores – both hormones act to prepare the body for fight-or-flight
- The immune system is a collection of billions of cells that travel through the bloodstream
- The main types of immune cells are white blood cells
- Stress hormones can suppress the immune system by lowering the number of white blood cells

# Stress and the Digestive System

- Stress responses have an effect on digestion
- During stress digestion is inhibited
- After stress digestive activity increases
- Increased digestive activity can cause diarrhea or ulcers
- Release of stress hormones may also cause ulcers by increasing stomach acid production
- Cats are more susceptible to ulcers
- Most mammals are susceptible to stress-related diarrhea

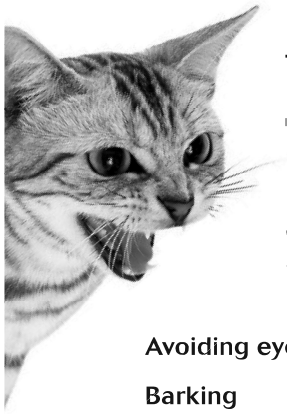
# Stress and the Cardiovascular System

- Stress hormones increase heart rate and blood pressure through the HPA Axis
- HPA stands for the hypothalamus, pituitary gland and adrenal glands.
- Chronic stress shuts down the negative feedback loop of the HPA Axis
- The kidneys in cats are very sensitive to high blood pressure and can become damaged
- Stress hormones worsen symptoms of animals with heart disease



# Signs of anxiety and fear

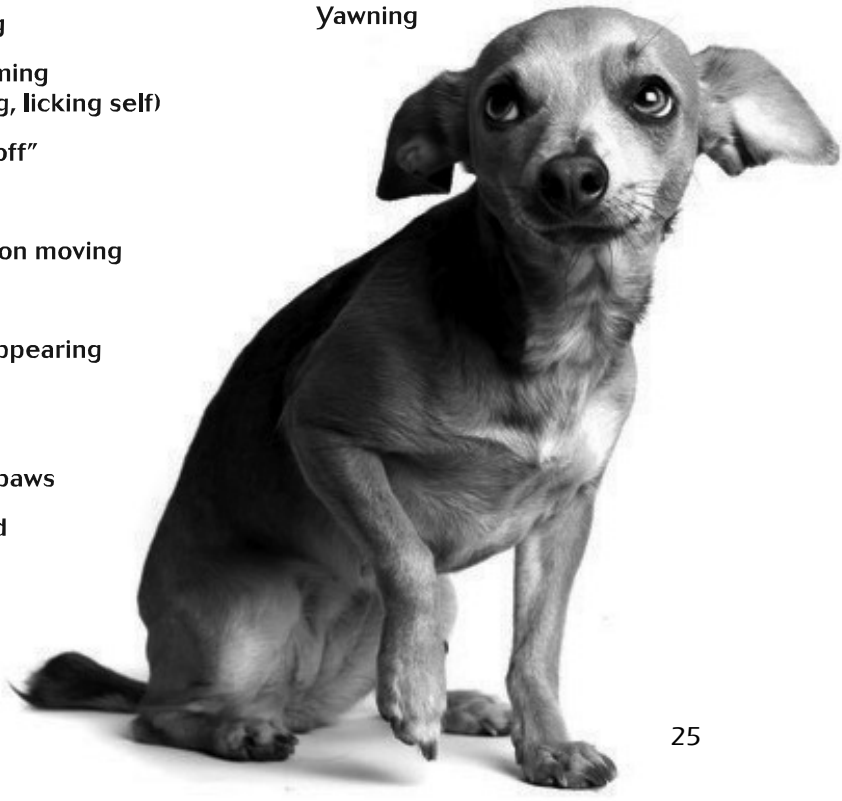
*From Dr. Marty Becker*



## Take note of these signs to save your pet from stress.

Take a look at the long list below, and you may not be surprised that many signs of anxiety and fear in dogs or cats are commonly overlooked. Repeated episodes of fear can result in your pet experiencing unnecessary stress and, thus, a reduced quality of life. If you notice any of these signs frequently, schedule a visit with your veterinarian to help determine the cause, and learn how to lessen and eventually prevent future episodes.

- Avoiding eye contact
- Barking
- Biting
- Blinking, squinting
- Clinging to owner
- Cowering
- Defecation
- Dilated pupils
- Dribbling urine/ submissive urination
- Ears lowered or flattened
- Freezing or walking slowly
- Furrowed brows
- Growling
- Hardened eyes (direct stare with pupils dilated)
- Hiding
- Hissing
- Hypersalivation
- Hypervigilance
- Jumping and startling easy at slight changes—hyperalert state
- Licking lips
- Lifting one paw
- Lip curling
- Mouth closed tightly or pulled back
- Mouth pursed forward
- Mouthing
- Nails extended
- Nipping
- Pacing
- Panting
- Piloerection (raised hair)
- Rigid forward stance
- Running off
- Screaming
- Self-grooming (scratching, licking self)
- "Shaking off"
- Shedding
- Slow-motion moving
- Snapping
- Sniffing/appearing distracted
- Staring
- "Sweaty" paws
- Tail tucked
- Taking treats harder than usual, being pickier with treats, or not taking treats at all even if hungry
- Trembling
- Turning away (C-shape)
- Turning head
- Whining
- Whiskers erected
- Wide-eyed/sclera showing
- Will not settle down and rest, or will for a moment but back up and moving again
- Won't accept treats
- Yawning

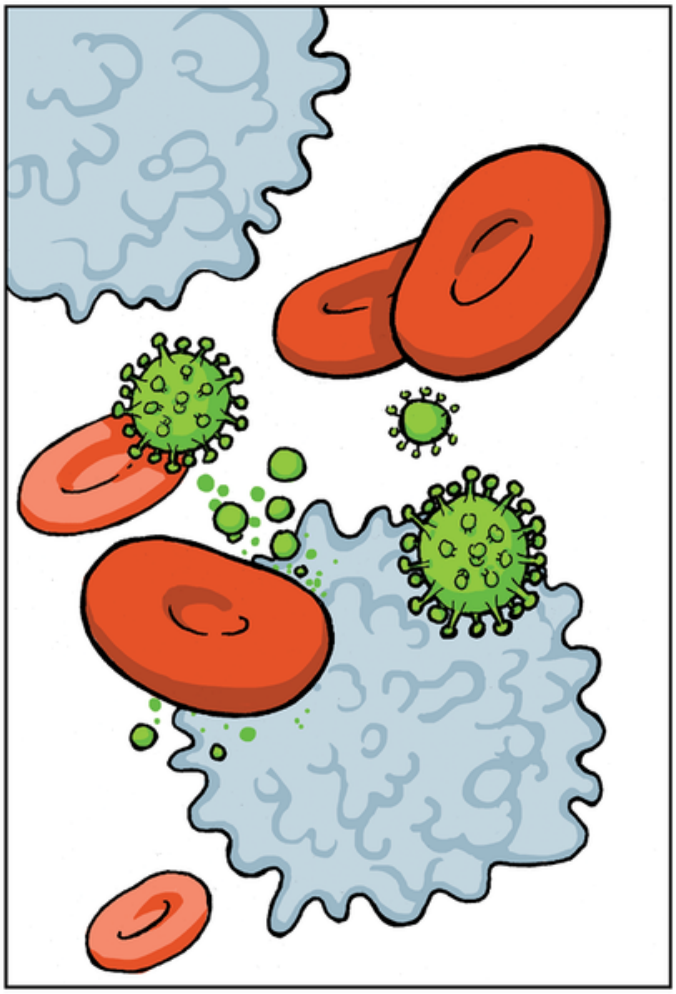


# Addressing Animal Stress

- All living creatures experience stress...even plants!
- The flight-or-flight response is necessary for survival
- Long-term stress is the real problem
- Veterinarians must address animal stress every day
- There are several ways to keep animals calm

  - Keep room quiet with low lighting
  - Spray calming pheromones
  - Cover animal in a towel or apply mask
  - Speak softly and approach slowly
  - Do not make eye contact

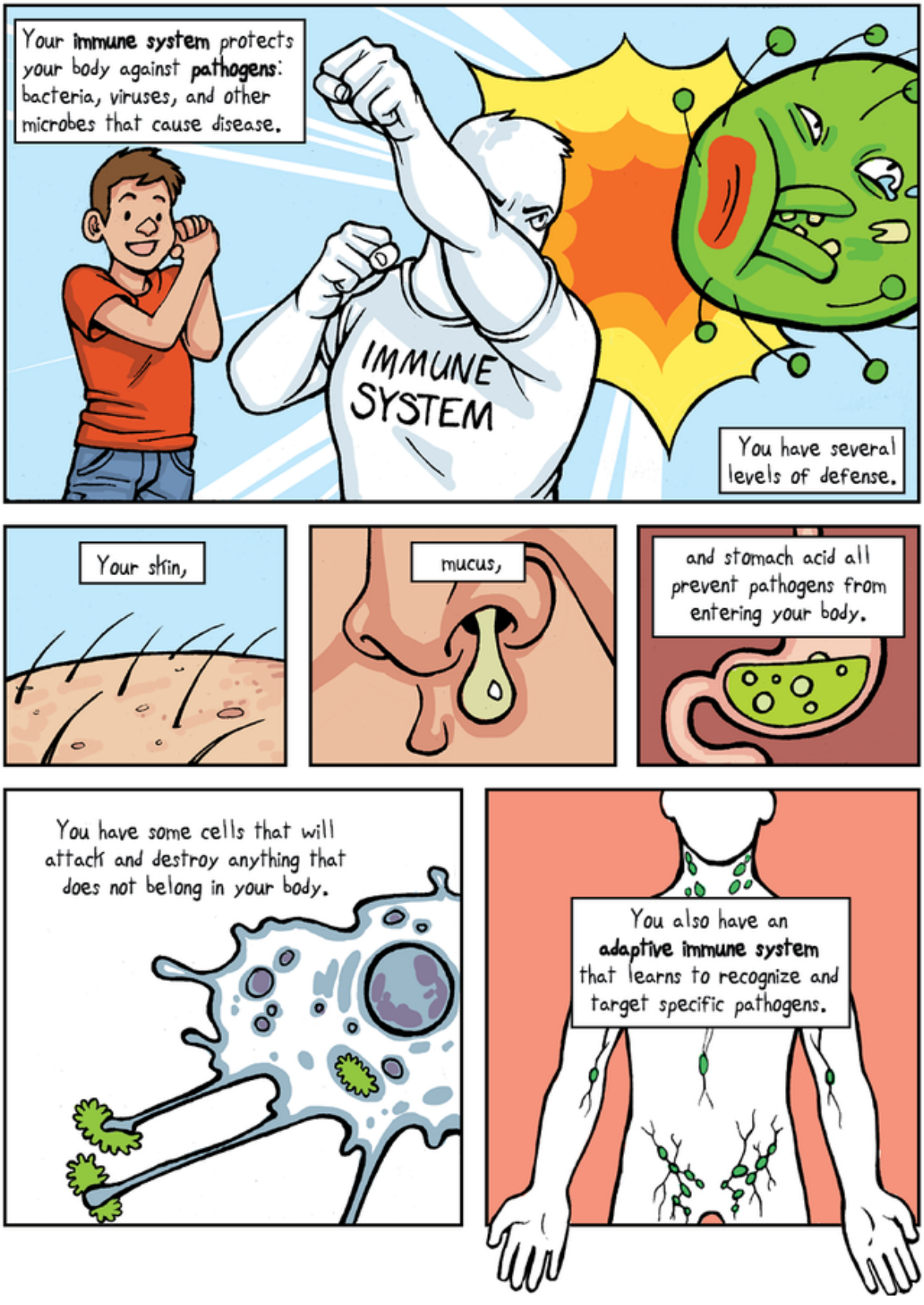
# THE IMMUNE SYSTEM



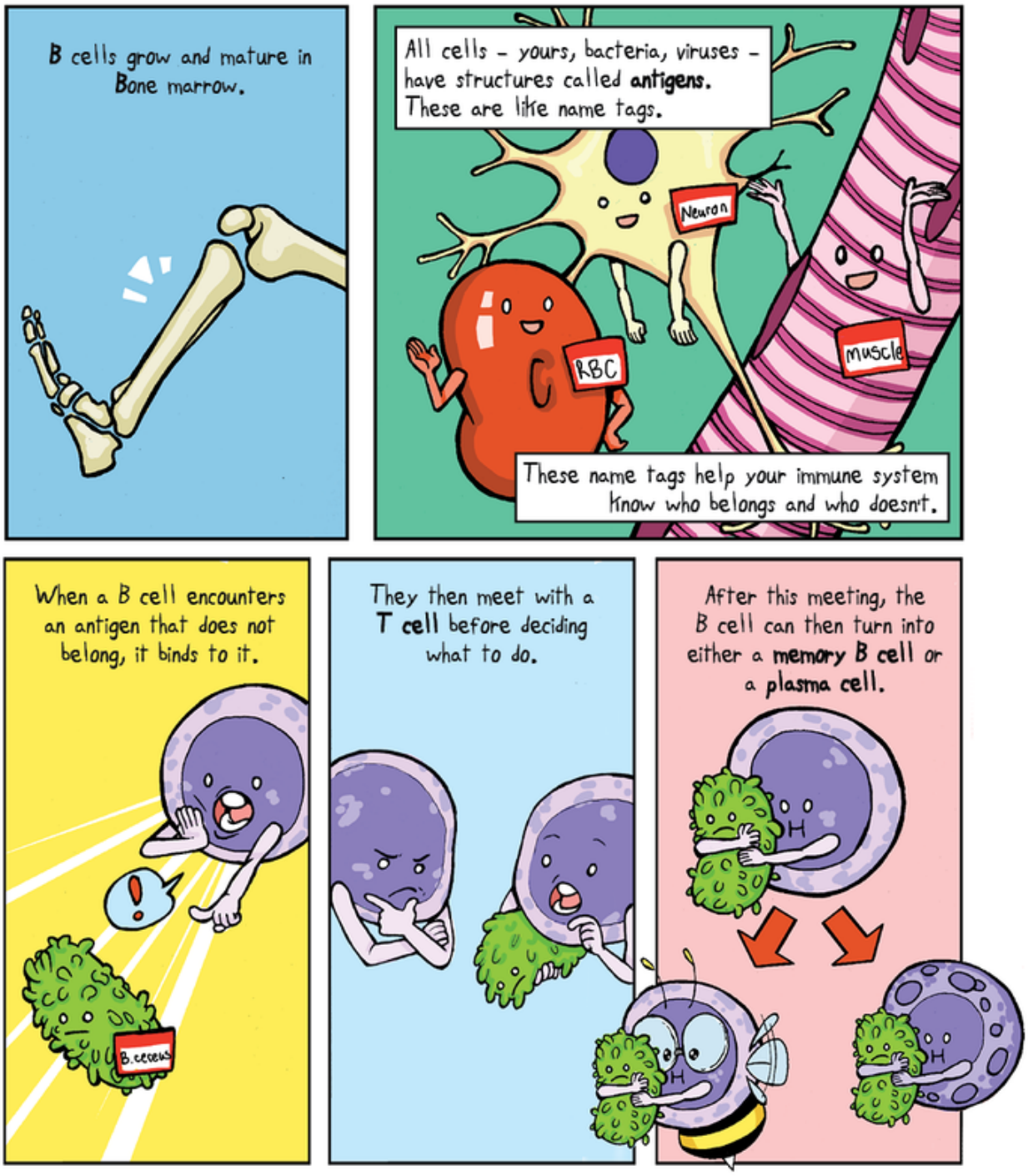
A STORY BY MEGAN LLEWELLYN

AUGUSTA UNIVERSITY

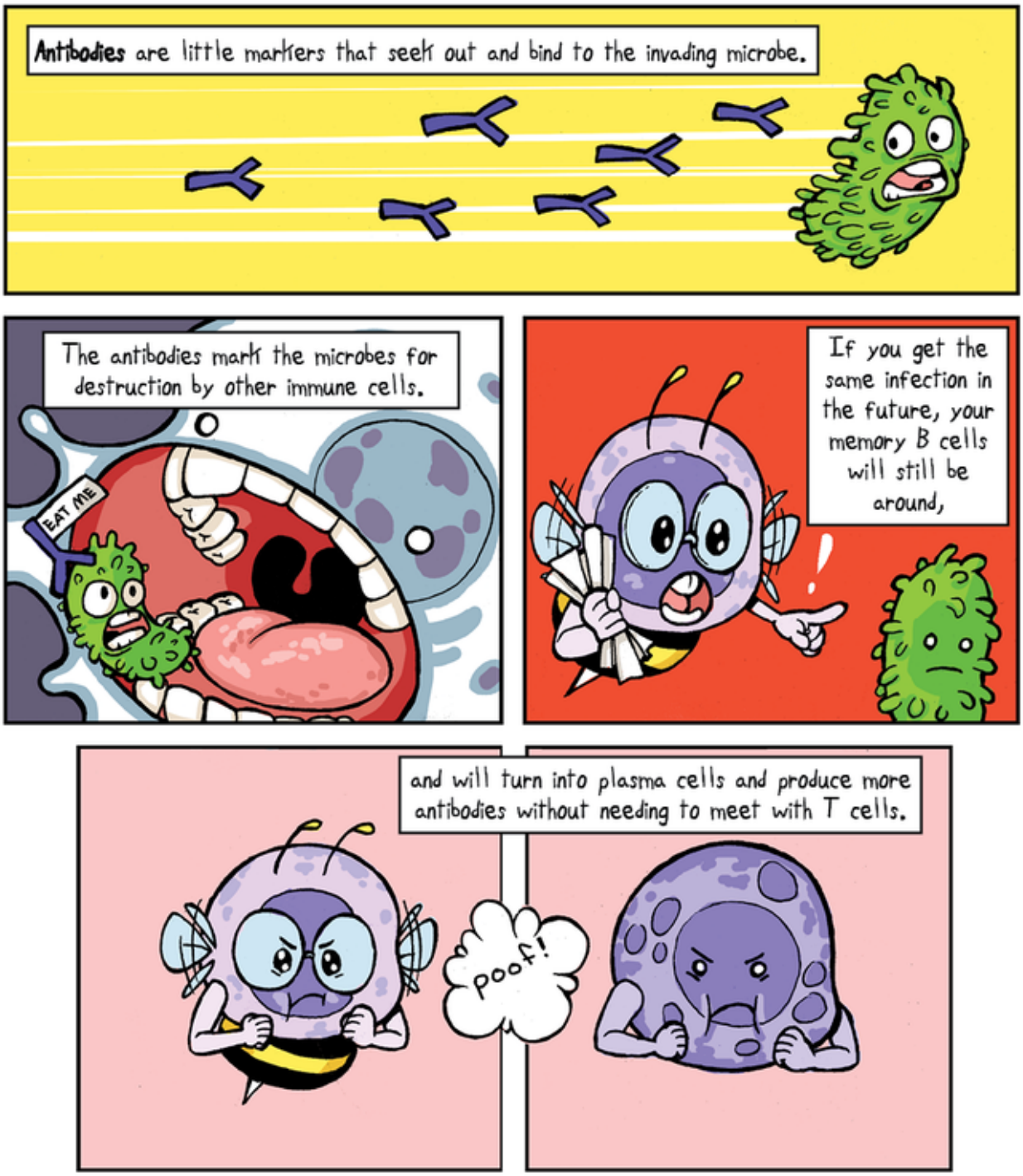
# ADAPTIVE IMMUNITY



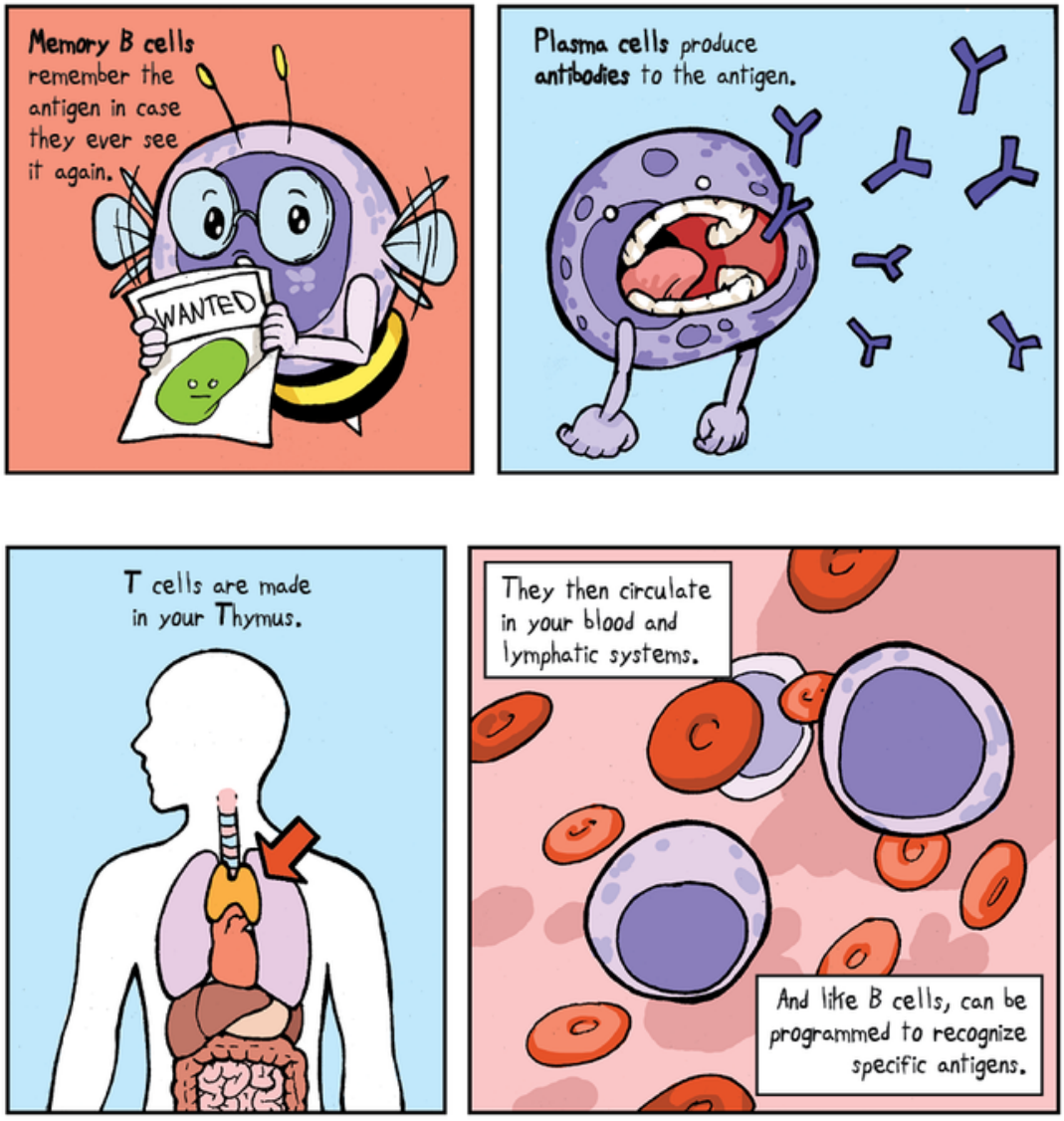
# ROLES OF B AND T CELLS



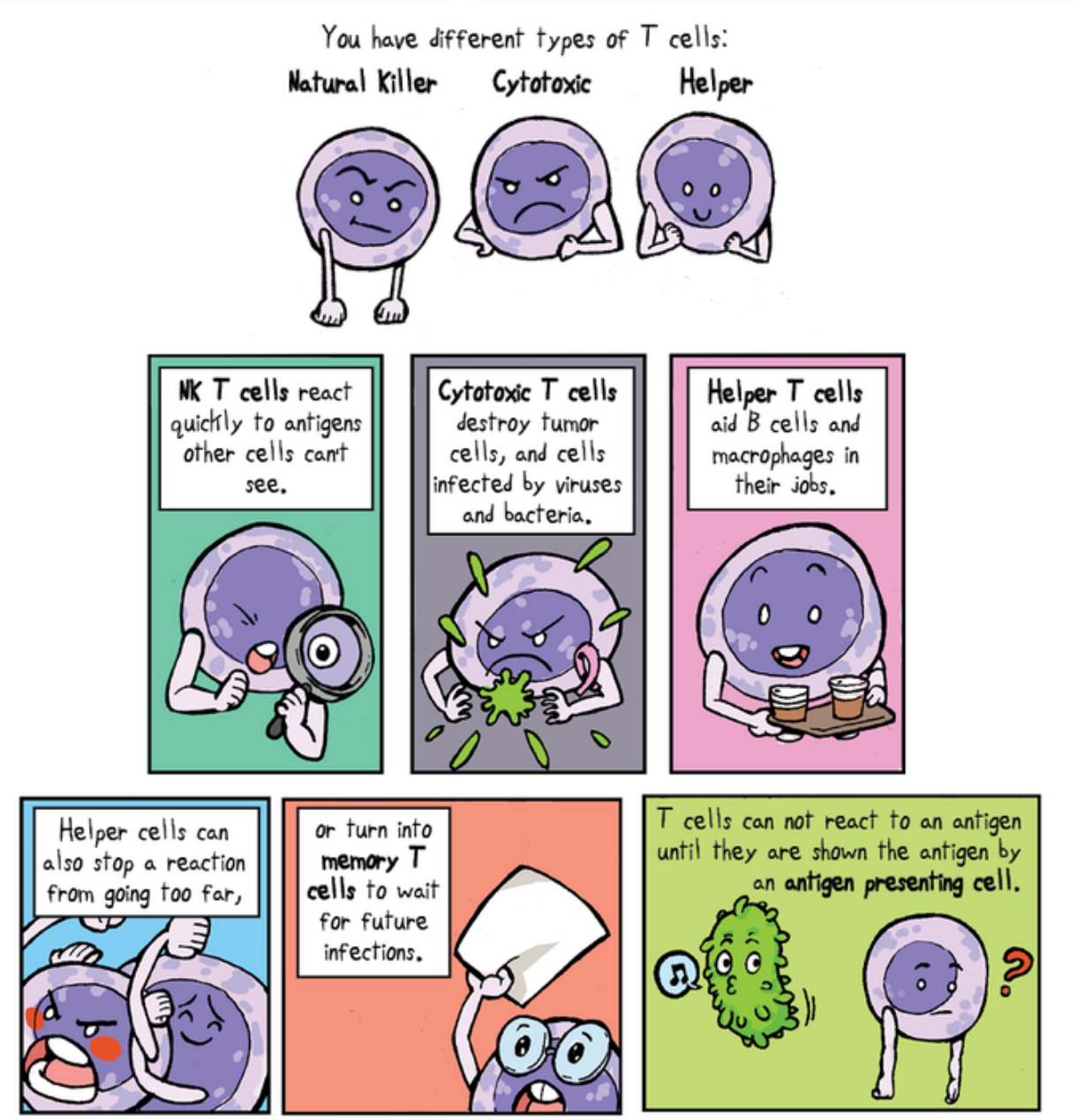
# THE ROLE OF ANTIBODIES



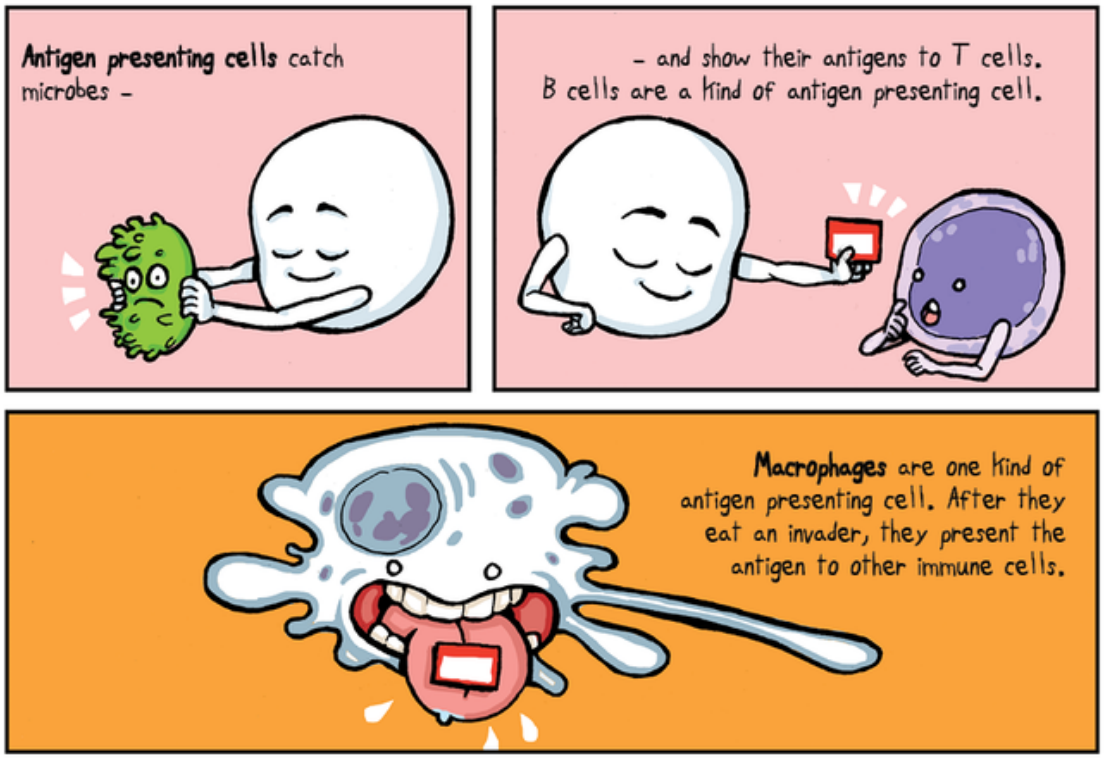
# MEET THE MAIN PLAYERS IN ADAPTIVE IMMUNITY



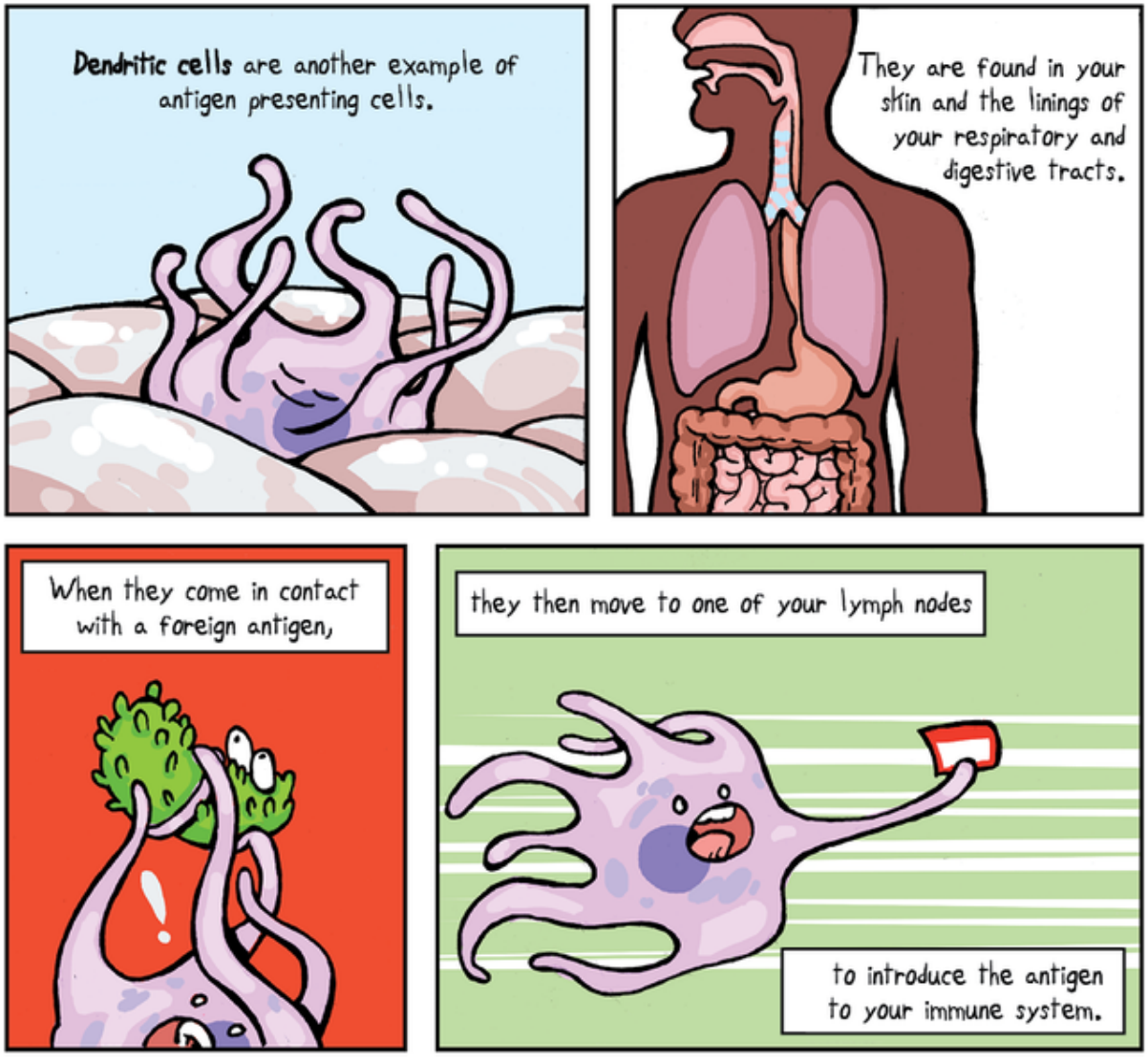
# THE THREE TEES



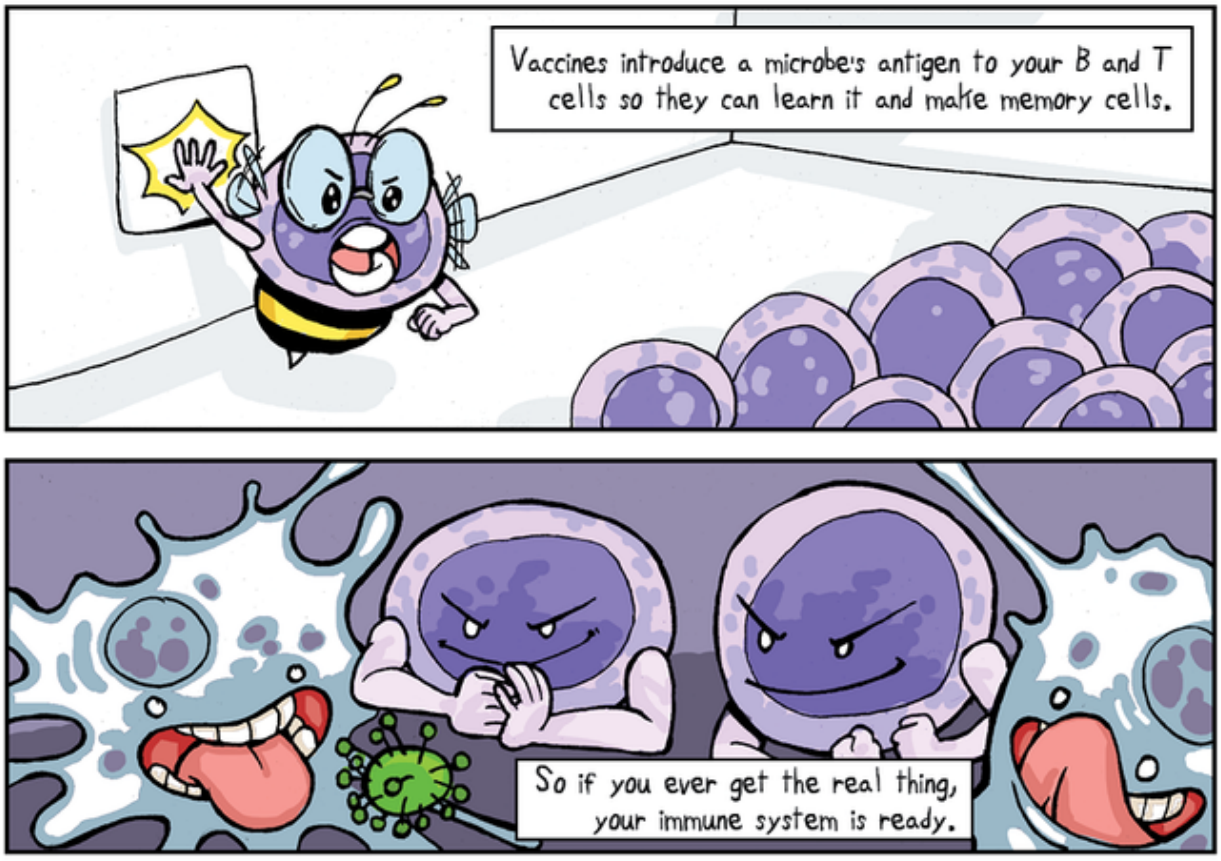
# THE PRESENTERS



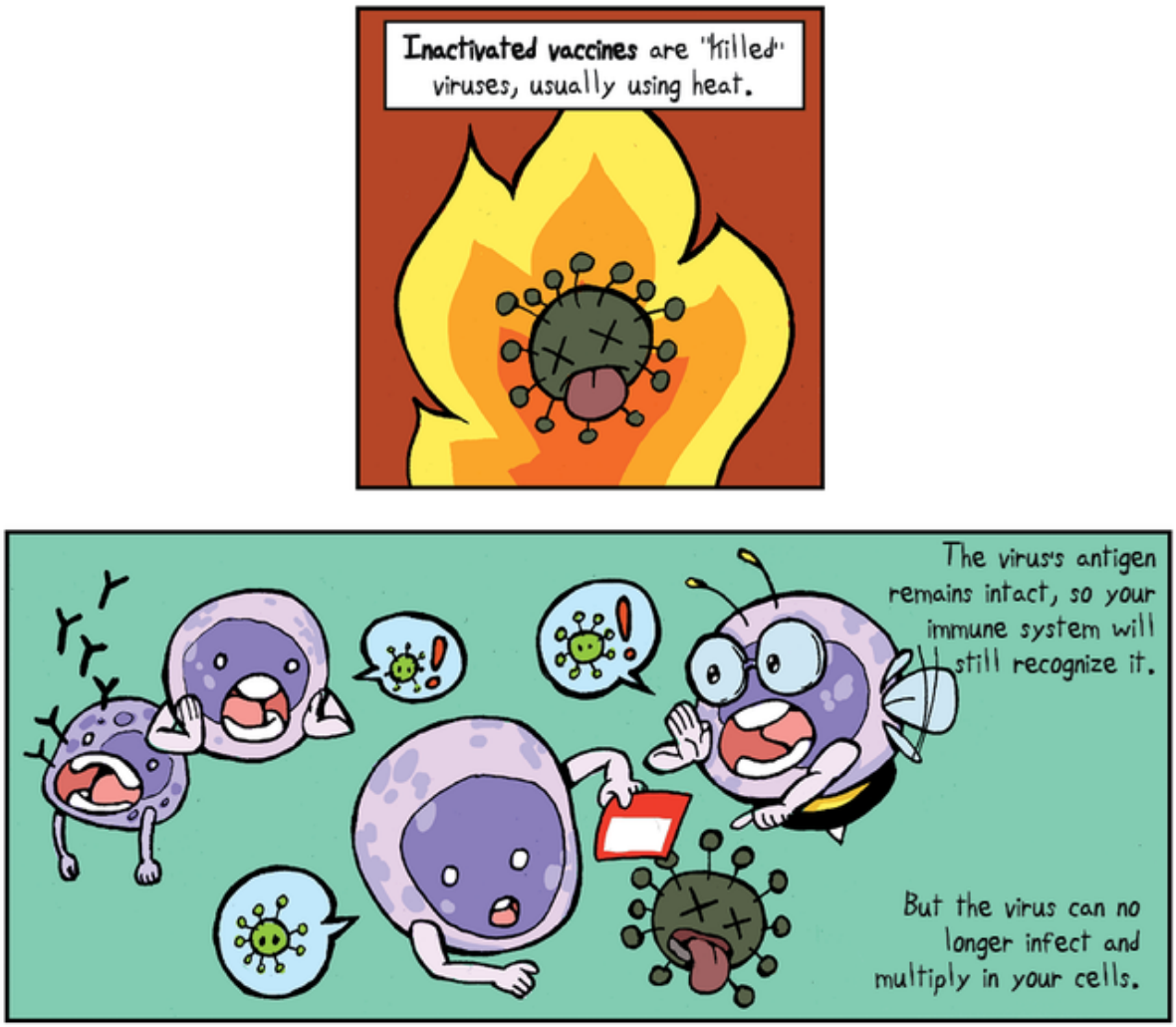
# THE MIGHTY DENDRITIC CELL



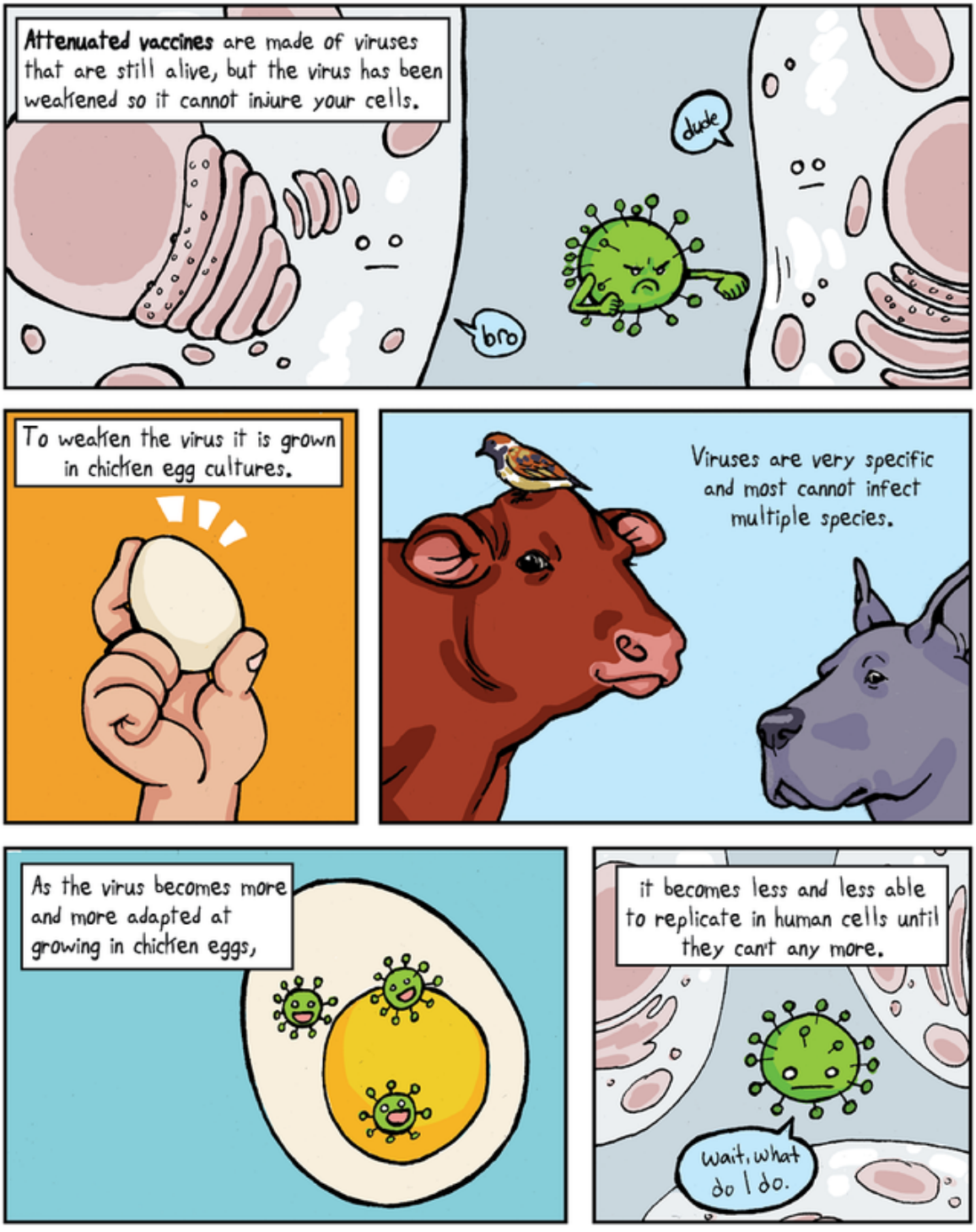
# HOW VACCINES WORK



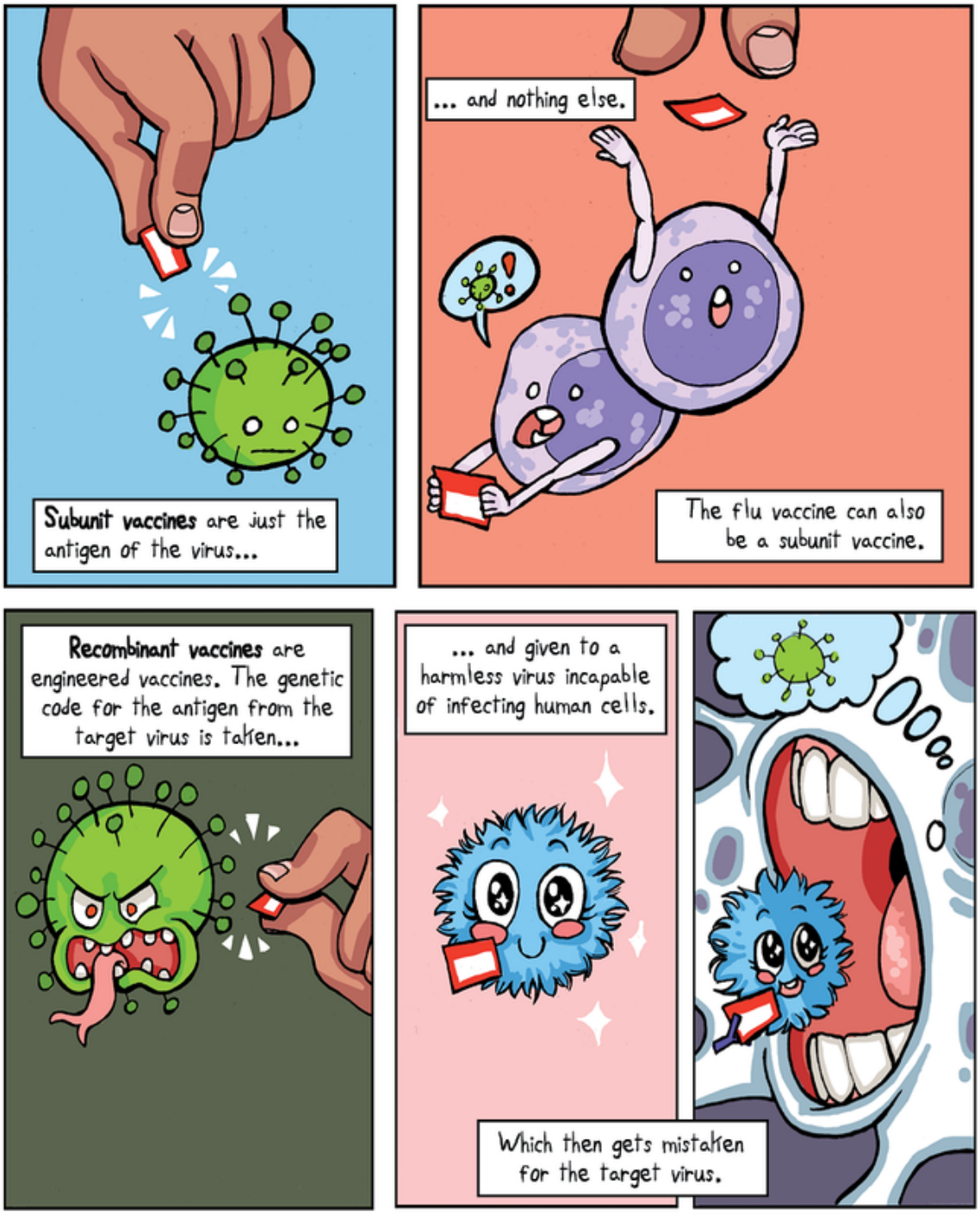
# KILLED VACCINES



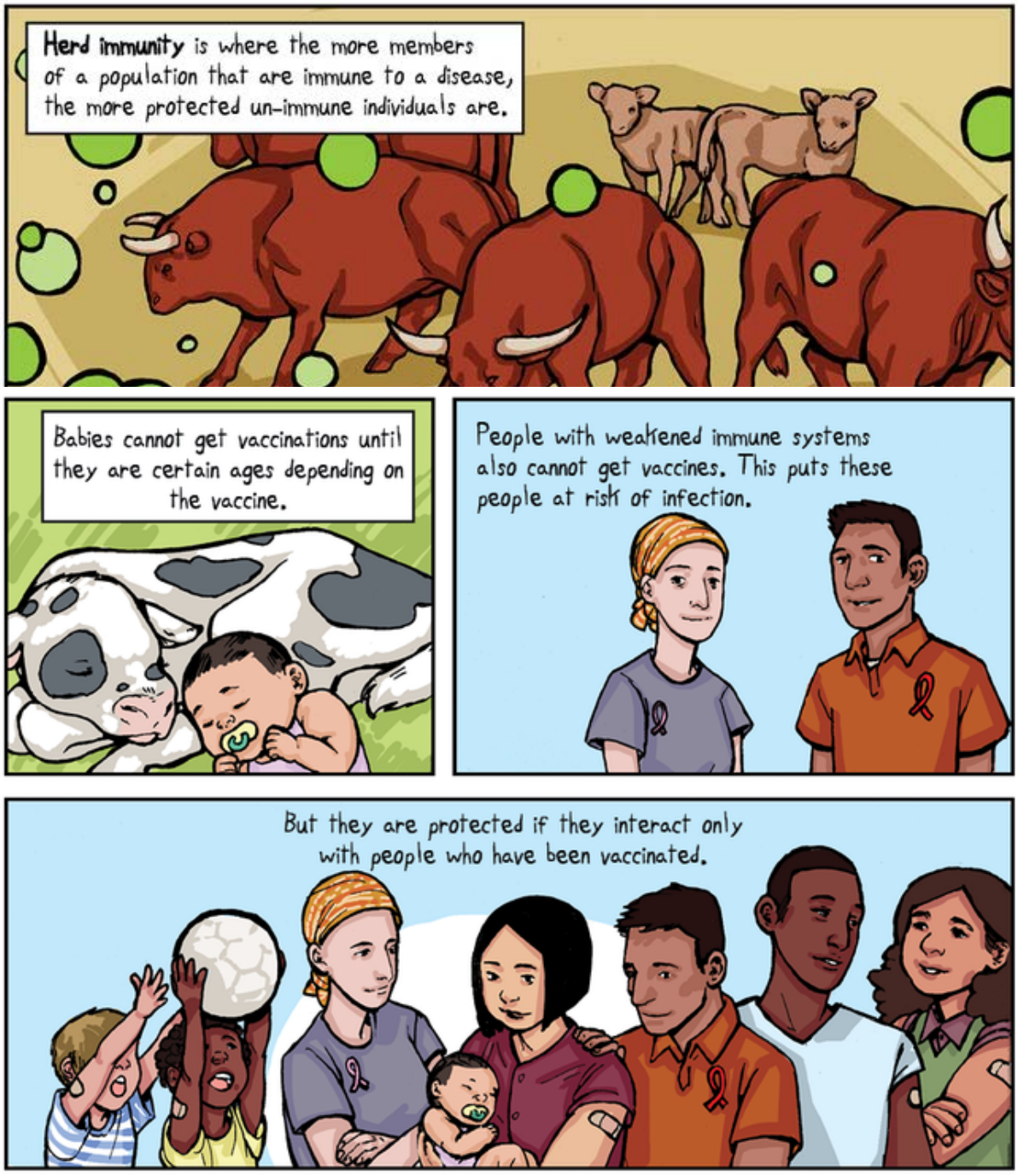
# MODIFIED-LIVE VACCINES



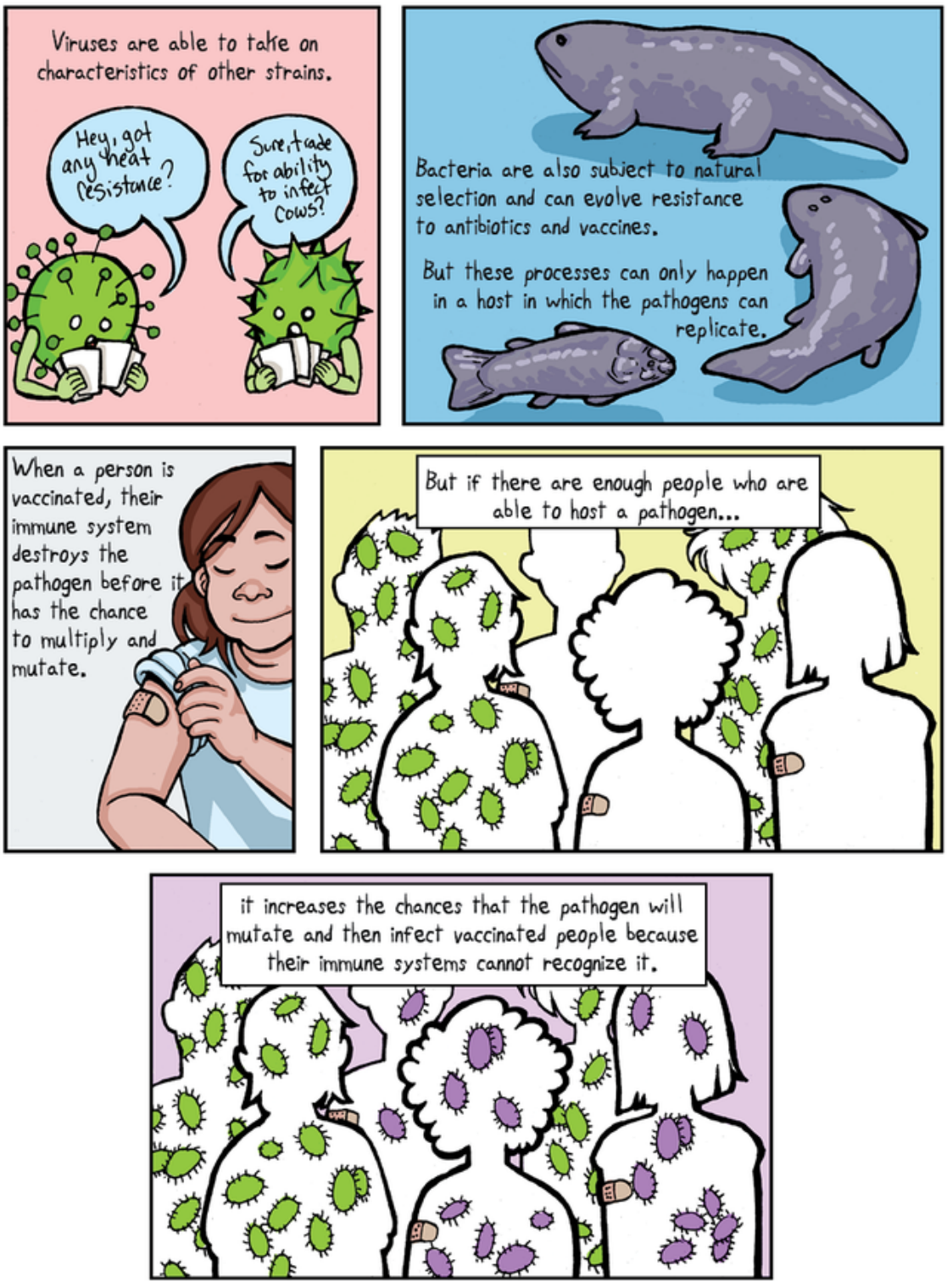
# OTHER VACCINES



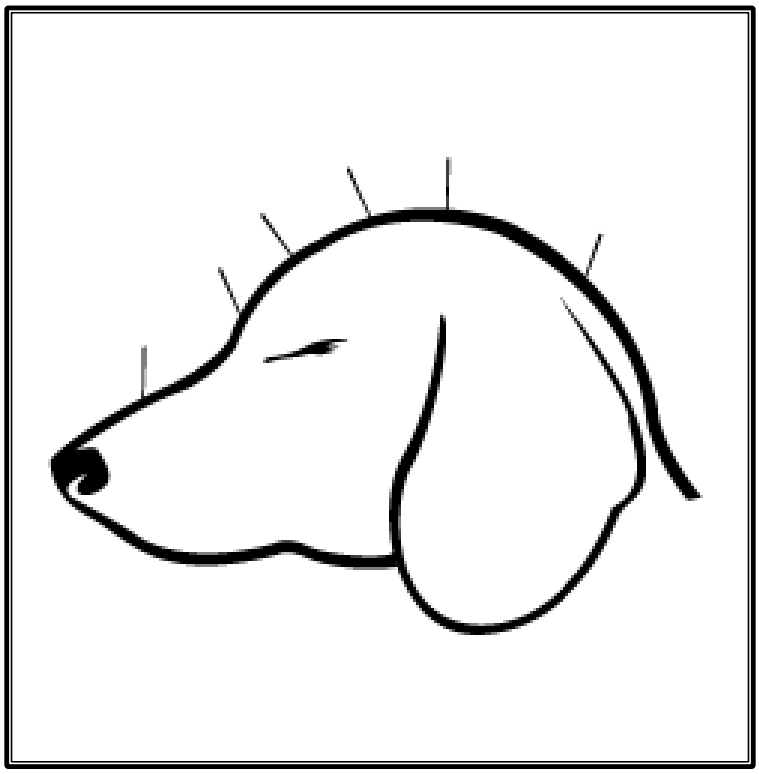
# HERD IMMUNITY



# HERD IMMUNITY CAN PREVENT MUTATION



# PRINCIPLES OF ACUPUNCTURE



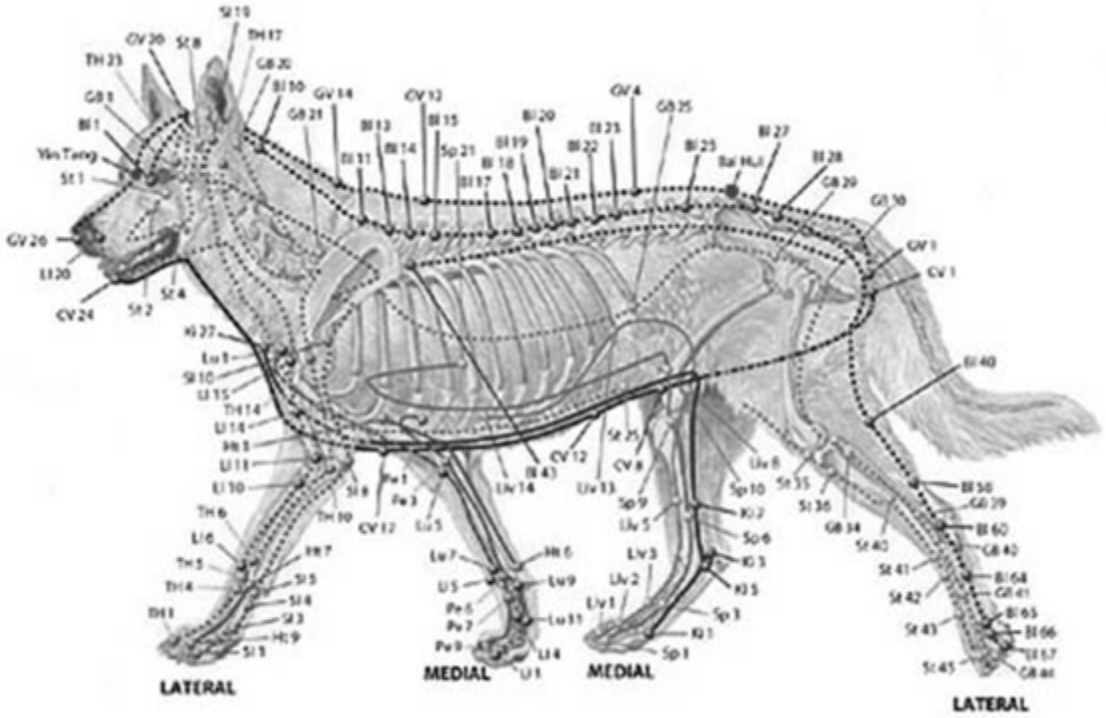
# WHAT IS ACUPUNCTURE?

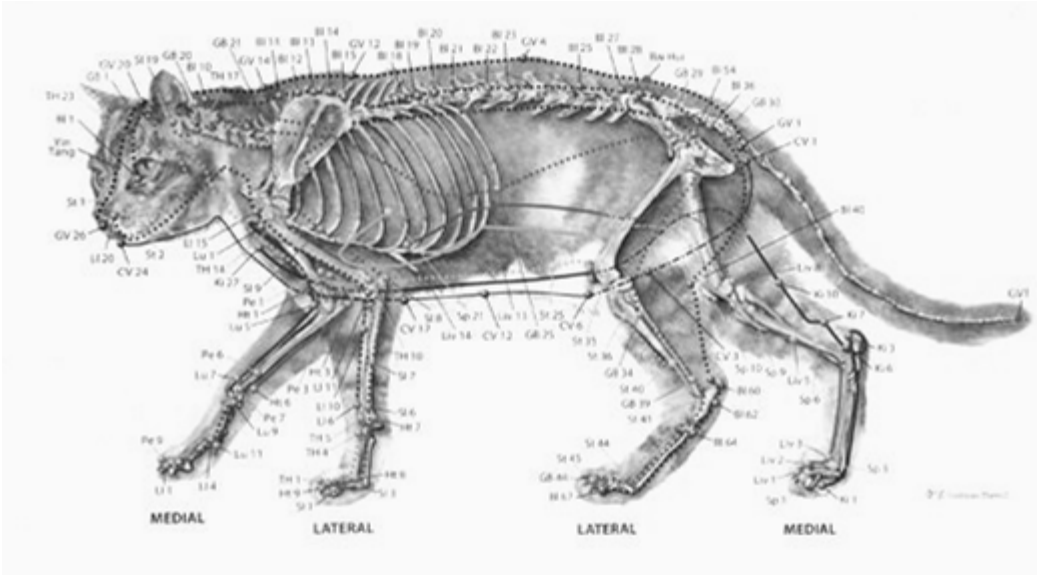
- Points on skin surface connect to nerves
- Needles are inserted into skin to stimulate nerves
- Procedure is performed to create a healing response
- Considered alternative or holistic medicine
- Contact points have specific actions when stimulated
- Can be used with or without electric current
- Alieves symptoms of several diseases and disorders
- Needles are painless to the patient

# IS ACUPUNCTURE SCIENTIFIC?

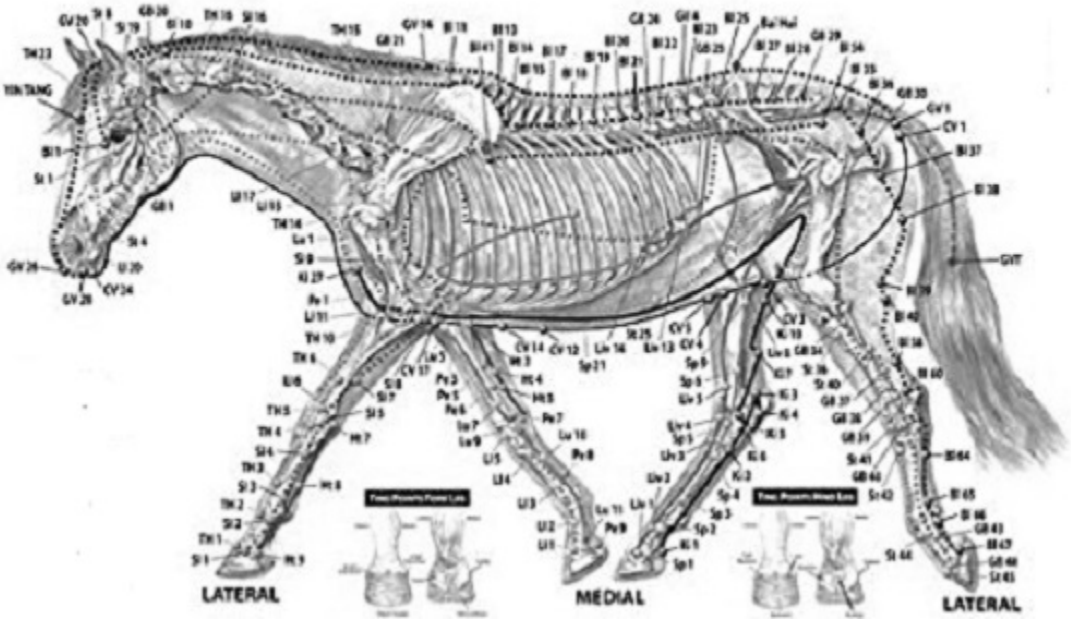
- Acupuncture points confirmed by functional MRI
- Inhibits COX-2 and NK-1 pathways that cause pain
- These pathways also cause inflammation
- Most studied in dogs with intervertebral disc disease
- Noticeable reduction of pain
- Noticeable improvement in paralysis

# ACUPUNCTURE POINTS SMALL ANIMALS

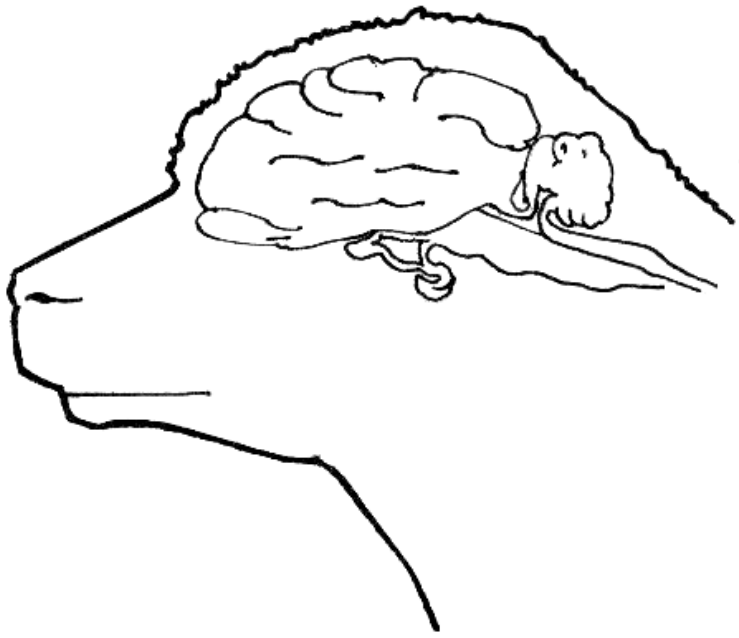


# ACUPUNCTURE POINTS IN THE HORSE



# SHEEP BRAIN DISSECTION



# DISSECTION GUIDE

1. Set the brain down so the flatter side, with the white spinal cord at one end, rests on the dissection pan. Notice that the brain has two halves, or hemispheres. Can you tell the difference between the cerebrum and the cerebellum? Do the ridges (called gyri) and grooves (sulci) in the tissue look different? How does the surface feel?

2. Turn the brain over. You'll probably be able to identify the medulla, pons, midbrain, optic chiasm, and olfactory bulbs. Find the olfactory bulb on each hemisphere. These will be slightly smoother and a different shade than the tissue around them. The olfactory bulbs control the sense of smell. The nerves to the nose are no longer connected, but you can see nubby ends where they were. The nerves to your mouth and lower body are attached to the medulla; the nerves to your eyes are connected to the optic chiasm.

3. Place the brain with the curved top side of the cerebrum facing up. Use a scalpel to slice through the brain along the center line, starting at the cerebrum and going down through the cerebellum, spinal cord, medulla, and pons. Separate the two halves of the brain and lay them with the inside facing up.

4. Use the labeled picture to identify the corpus callosum, medulla, pons, midbrain, and the place where pituitary gland attaches to the brain. (In many preserved specimens the pituitary gland is no longer present. It is not pictured.) Use your fingers or a teasing needle to gently probe the parts and see how they are connected to each other. What does that opening inside the corpus callosum lead to? How many different kinds of tissue can you see and feel?

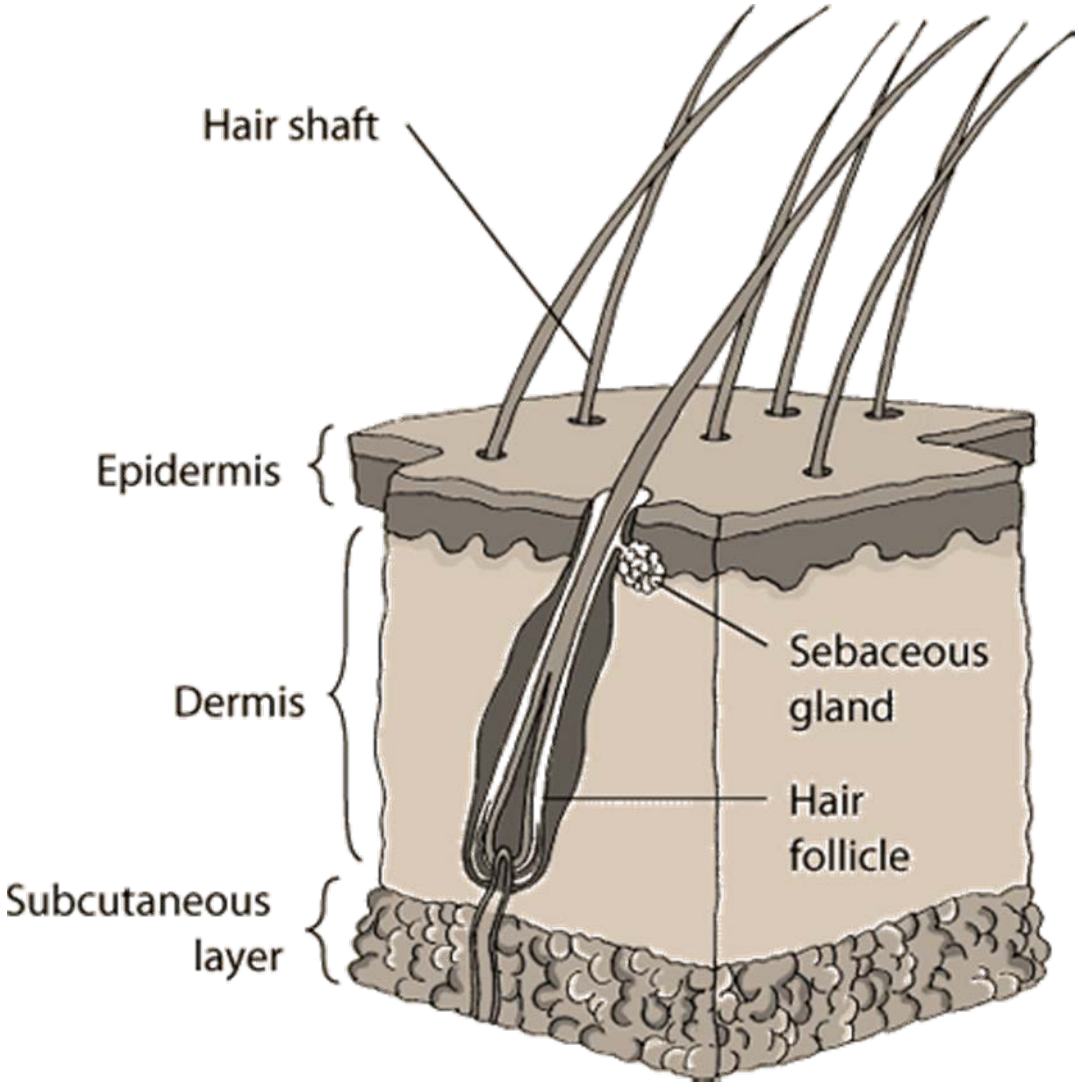
5. Look closely at the inside of the cerebellum. You should see a branching 'tree' of lighter tissue surrounded by darker tissue. The branches are white matter, which is made up of nerve axons. The darker tissue is gray matter, which is a collection of nerve cell bodies. You can see gray and white matter in the cerebrum, too, if you cut into a portion of it.

6. You can also use the letter labels on the anatomy picture to identify the following:

a. The **corpus callosum** is a bundle of white fibers that connects the two hemispheres of the brain, providing coordination between the two.
b. The **medulla** is located right under the cerebellum. In this the nerves cross over so the left hemisphere controls the right side of the body and vice versa. This area of the brain controls the vital functions like heartbeat and respiration (breathing).
c. The **pons** is next to the medulla. It serves as a bridge between the medulla and the upper brainstem, and it relays messages between the cerebrum and the cerebellum.
d. The **pituitary gland**, which produces important hormones, is a sac-like area that attaches to the brain between the pons and the optic chiasm. This may or may not be present on your specimen.
e. **Ventricles** contain cerebrospinal fluid
f. The **occipital lobe** receives and interprets visual sensory messages
g. The **temporal lobe** is involved in hearing and smell. You can find this by looking on the outside of one of the hemispheres. You will see a horizontal groove called the lateral fissure. The temporal lobe is the section of the cerebrum below this line.
h. The **frontal lobe** also plays a part in smell, plus dealing with motor function
i. The **parietal lobe** handles all the sensory info except for vision, hearing, and smell.
j. The **thalamus** is a 'relay station' for sensory information. It receives messages from the nerve axons and then transmits them to the appropriate parts of the brain.
k. The **pineal gland** produces important hormones.

# RASHES AND OTHER ITCHY STUFF

# STRUCTURES OF THE SKIN



# WHAT IS DERMATITIS?

- Dermatitis is inflammation of the skin
- Incited by allergies, infection, mites, hormones or medication
- Skin can become red, painful, itchy, crusty, flaky, oily or smelly
- Caused by a combination of several factors:

  - Skin barrier dysfunction
  - Cell mediated immune responses
  - IgE mediated hypersensitivity
  - Environmental factors

# DERMATOLOGY TERMS

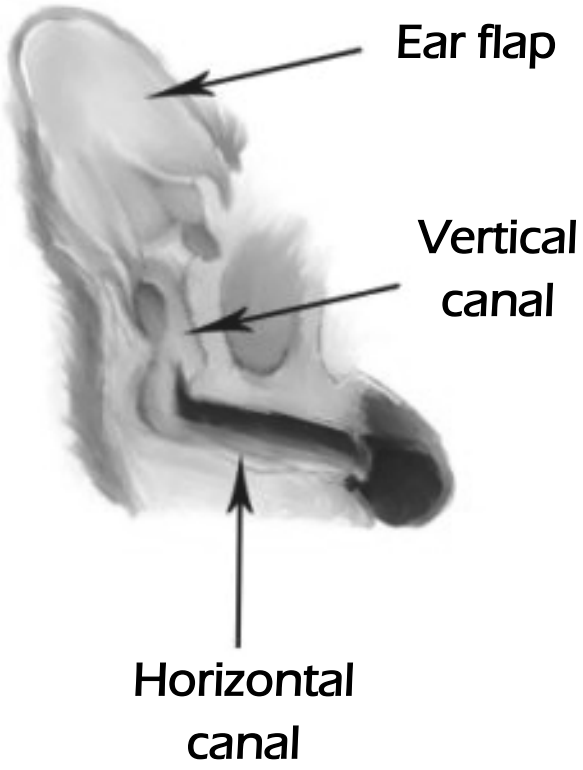
- Otitis externa – inflammation of the outer ear canal
- Atopic dermatitis – inflammation caused by allergens
- Pododermatitis – inflammation of paws
- Conjunctivitis – inflammation of eyelids
- Acute moist dermatitis – commonly known as hot spots
- Pyoderma – bacterial skin infection
- Dermatophytosis – fungal skin infection
- Demodicosis – inflammation caused by Demodex mite
- Flea allergy dermatitis – inflammation due to flea bites

# COMMON SKIN PROBLEMS

- *Otitis externa*
- Acute moist dermatitis
- Atopic dermatitis
- Flea allergy dermatitis
- Pyoderma
- Demodicosis
- Dermatophytosis

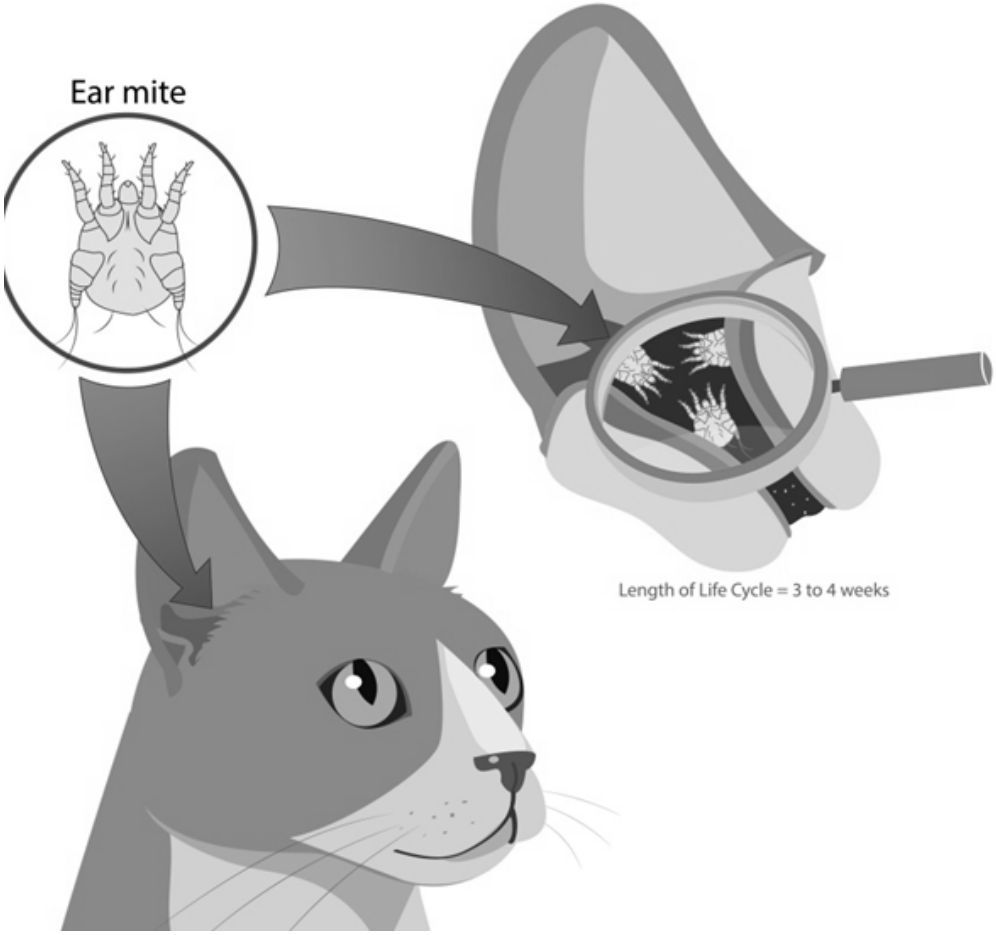
# OTITIS EXTERNA

- More common with breeds that have long ears
- Animal is genetically predisposed to skin inflammation
- Ear mites can cause inflammation
- Bacterial and fungal infections are usually secondary
- Excess scratching can cause a hematoma
- Diagnosed by an ear swab and microscopy



# EAR MITES

- More common in cats – itchy and miserable
- Diagnosed by microscopy
- Mites are killed by a prescribed otic insecticide
- An otic anti-inflammatory is usually prescribed



# EAR INFECTION

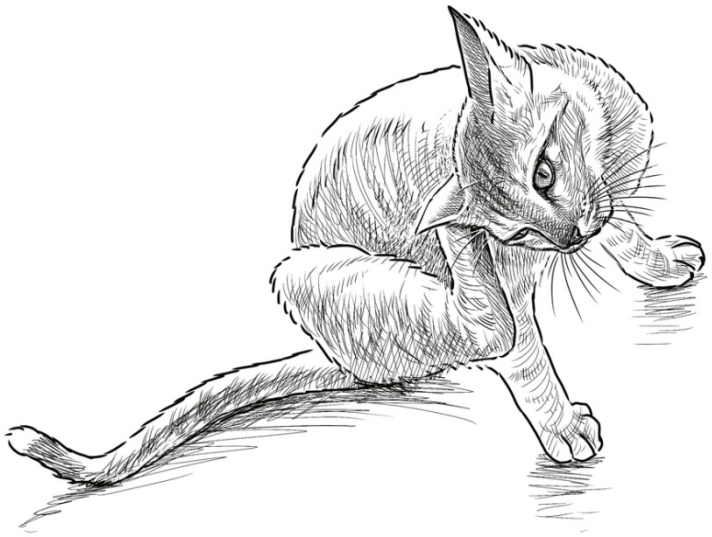
- Ears are itchy and/or painful
- Ear canal is red with yellowish, brown or black wax
- Yeast infection is most common
- Commensal bacteria can overgrow
- Pathogenic bacteria cause a true infection with pus
- Treated with an otic antibiotic-fungicide-steroid

# ACUTE MOIST DERMATITIS

- Cause is not fully understood
- Stimulated by licking, chewing or scratching
- Results in excess inflammation
- Skin is red, hot, painful and oozing
- Long haired breeds are more susceptible
- Steroids are usually needed to calm inflammation
- Secondary pyoderma may require antibiotics

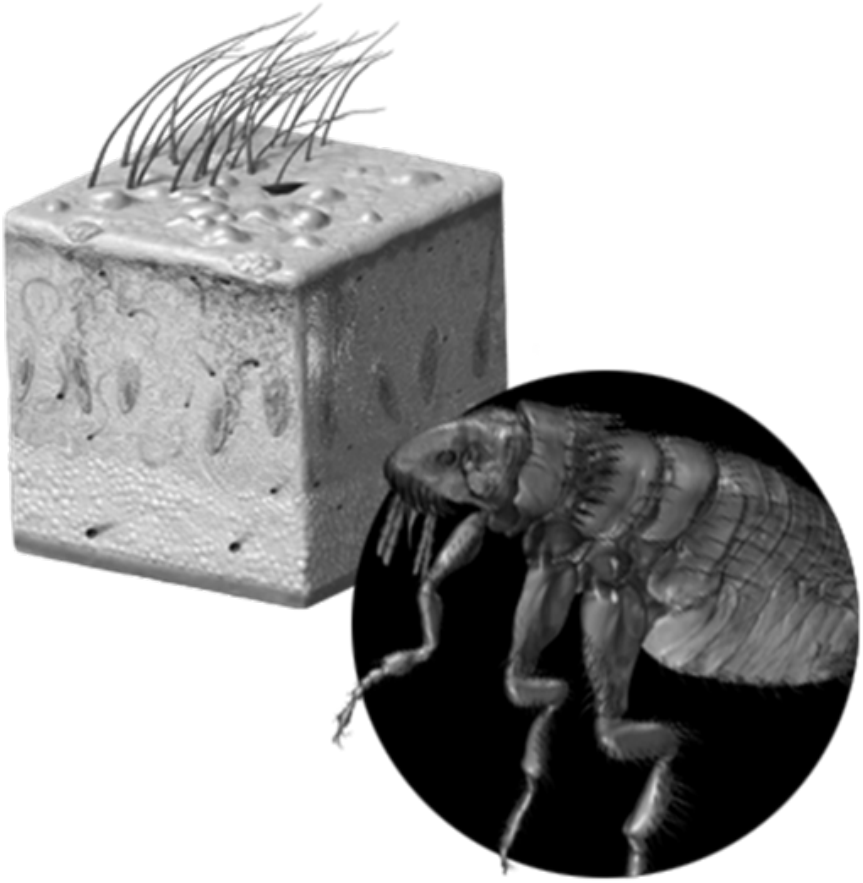
# ATOPIC DERMATITIS

- Caused by a response to an allergen (topical or oral)
- Goals are to treat inflammation and itchiness
- Treated with anti-histamines +/- steroids
- New generation of anti-inflammatories available
- Control by bathing with skin replenishing shampoo
- Control by reducing allergens in environment
- Immunotherapy is an alternative



# FLEA ALLERGY DERMATITIS

- Caused by a hypersensitivity to a flea bite
- A single bite can cause system-wide skin inflammation
- Steroids are usually prescribed for inflammation
- Fleas killed with topical or oral insecticide
- Secondary pyoderma is common
- Environment must also be treated

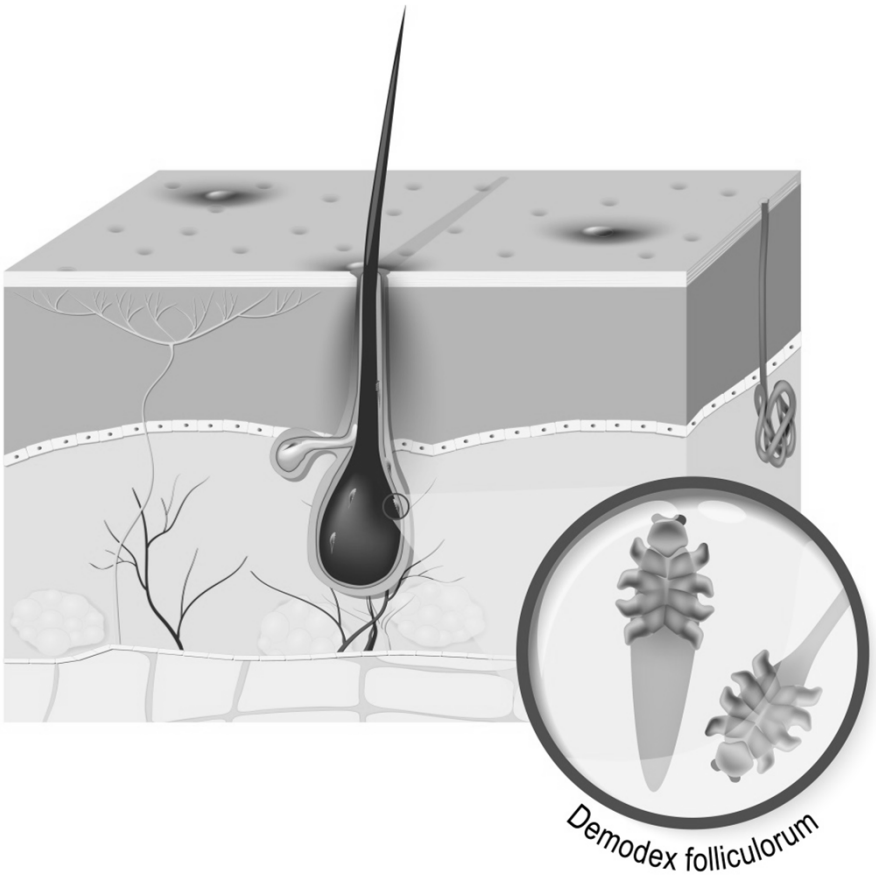


# PYODERMA

- Often secondary to dermatitis
- Superficial and deep forms
- Often seen on abdomen of puppies
- Diagnosed by skin swab
- Staph infections are most common
- Treated with topical or oral antibiotics
- Controlled with bathing in antibacterial shampoo

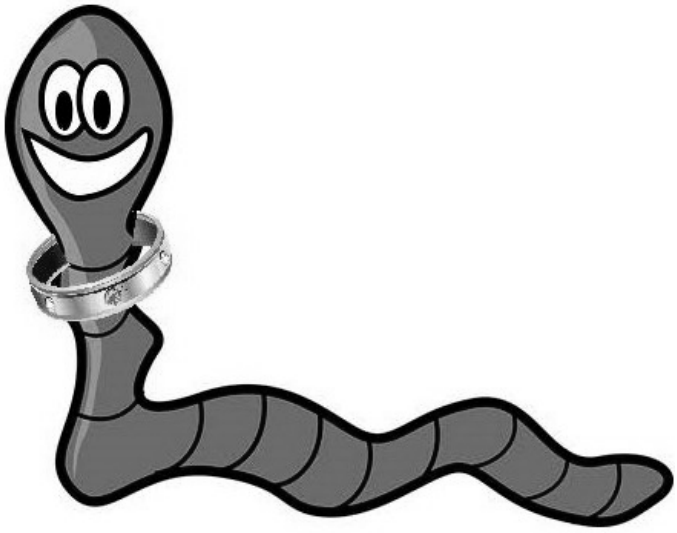
# DEMODICOSIS

- Caused by the Demodex mite
- Problem in immunocompromised animals
- Defective skin barrier lets mite cause inflammation
- Fur loss and thick, crusty skin are hallmark signs
- Secondary pyoderma is common
- Diagnosed by skin scrape and microscopy

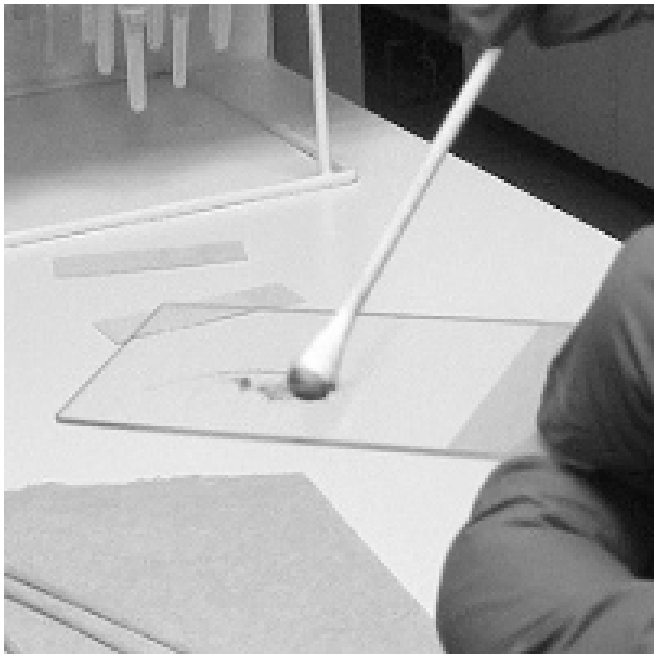


# DERMATOPHYTOSIS

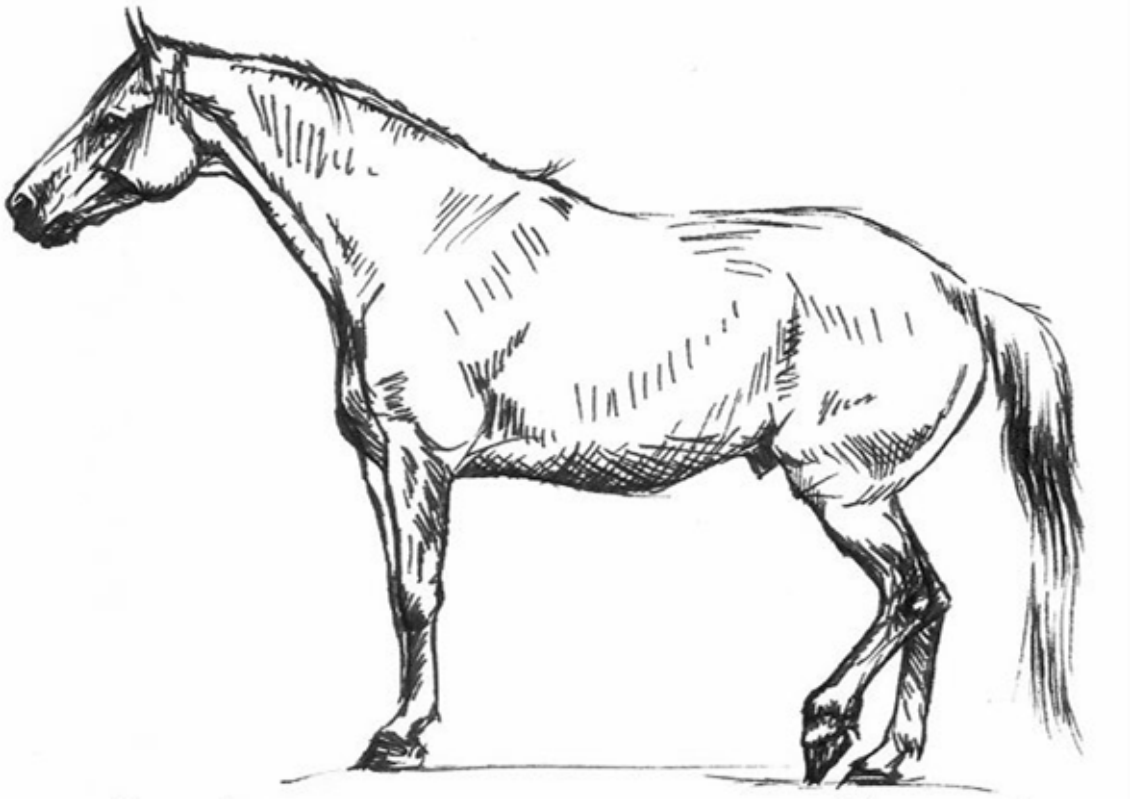
- Also called ringworm, but is caused by a fungus
- Common in cats, but any animal can be infected
- Itchy, contagious and zoonotic!
- Lesion is round and red +/- dark edge
- Fur usually falls our around region
- Diagnosed by ultraviolet light or fungal culture
- Treat with oral or topical antifungal
- Remove spores from environment



# EAR SWAB CYTOLOGY



# HORSE



# HORSE EXAM

## Vital Signs

- Heart Rate 30 to 40 beats per minute
- Breathing Rate 8 to 15 breaths per minute
- Body Temperature 99-100.5°F

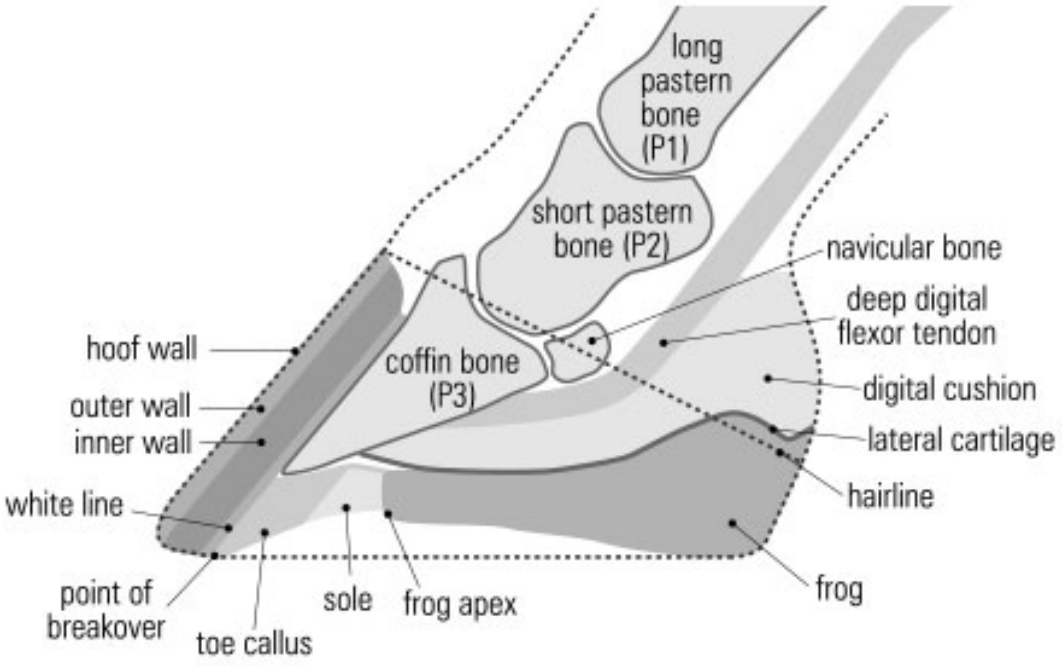
## Examination

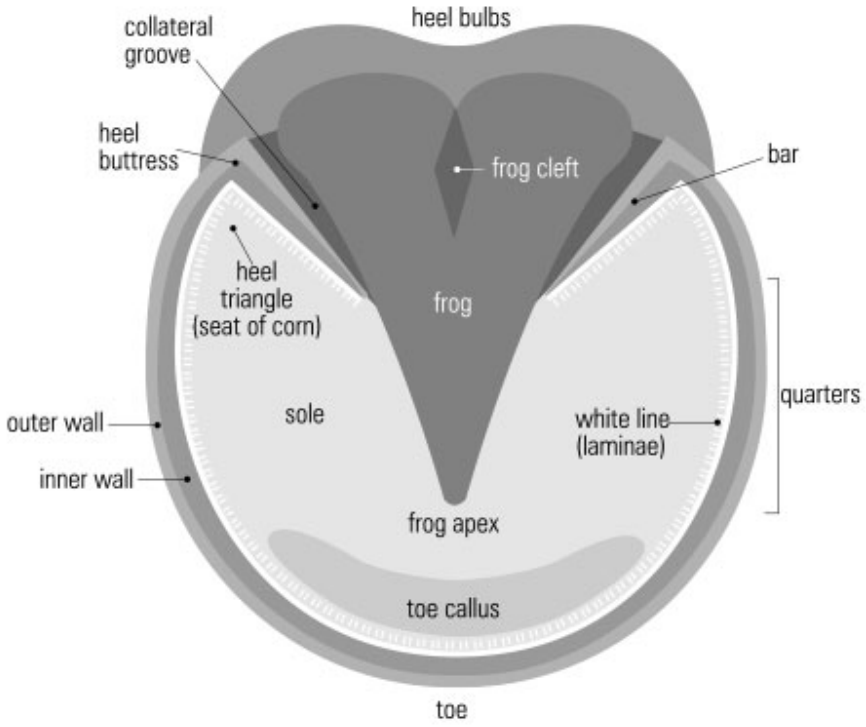
- Body condition and lameness score
- Eyes, mouth (teeth and gums), skin and hooves
- Reproductive organs
- Listen to gut sounds
- Record vital signs
- Vaccinate and/or treat

## Common Problems

- Teeth (lots of wear and tear)
- Eyes
- Hooves
- Gastrointestinal system

# HORSE HOOF


long pastern bone (P1)
short pastern bone (P2)
navicular bone
deep digital flexor tendon
coffin bone (P3)
digital cushion
lateral cartilage
hairline
hoof wall
outer wall
inner wall
white line
point of breakover
toe callus
sole
frog apex
frog

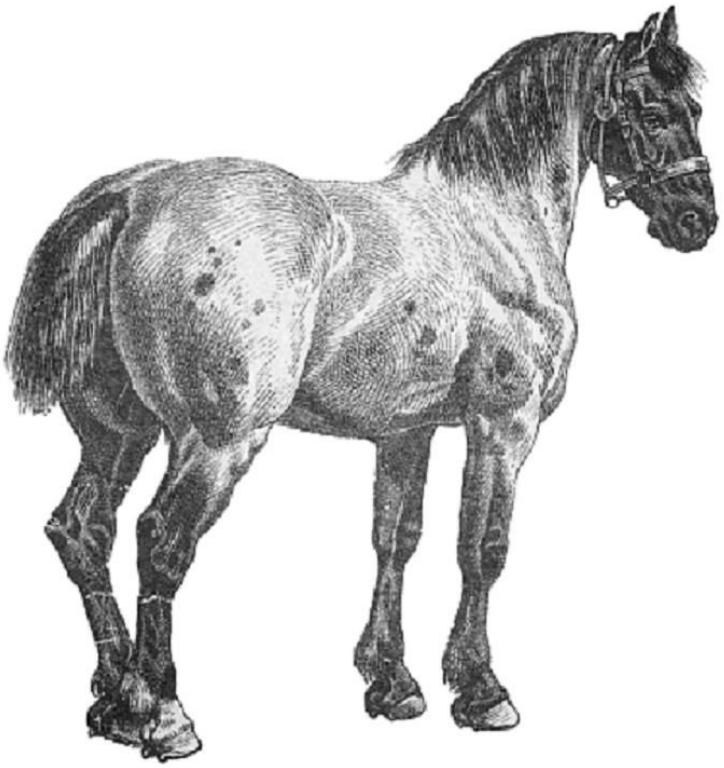

heel bulbs
collateral groove
heel buttress
frog cleft
bar
heel triangle (seat of corn)
frog
quarters
outer wall
sole
white line (laminae)
inner wall
frog apex
toe callus
toe

# LAMINITIS

- Also called Founder
- Inflammation of the laminae inside the hoof
- Results from the disruption of blood flow to laminae
- If severe, bone and hoof wall can separate
- Can affect all or one foot
- Front feet are affected more often
- Inflammation often starts somewhere else in the body
    - Digestive upsets from diet
    - Sudden access to excessive amounts of lush forage
    - Toxins released within the horse's system
    - High fever or illness
    - Severe colic
    - Retained placenta in the mare after foaling
    - Excessive concussion to the feet
    - Excessive weight-bearing on one leg due to injury
    - Various primary foot diseases
    - Bedding that contains black walnut shavings
    - Prolonged use of corticosteroids

# LAMINITIS RISK FACTORS

- Heavy breeds, such as draft horses
- Overweight body
- Feeding large amounts of carb-rich meals
- Ponies, Morgans, miniature horses and donkeys
- Unrestricted grain binges
- Horses who have had previous episodes of laminitis
- Older horses with Cushing's disease



# SIGNS OF LAMINITIS

- Lameness, especially when a horse is turning in circles
- Shifting lameness when standing
- Heat in the feet
- Increased digital pulse in the feet
- Pain in the toe region when pressure is applied
- Reluctant or hesitant gait ("walking on eggshells")
- Sawhorse stance with front feet stretched out in front

# LAMINITIS TREATMENT

- Have vet diagnose and treat the primary problem
- Feed only grass hay until advised by your veterinarian
- Purge horse's digestive tract if horse has overeaten
- Administering fluids if the horse is ill or dehydrated
- Antibiotics, anticoagulants and vasodilators to reduce blood pressure while improving blood flow to the feet
- Stabling the horse on soft ground such as sand
- Manage hoof (corrective trimming +/- shoes)
- New therapies such as ice boots or laser therapy

# LAMINITIS MANAGEMENT

A modified diet that provides adequate nutrition based on high-quality forage, digestible fiber (beet pulp) and oil. Avoid excess carbohydrates, especially from grain.

Routine hoof care, including regular trimming and, in some cases, therapeutic shoeing (additional radiographs may be needed to monitor progress).

A good health-maintenance schedule, including parasite control and vaccinations, to reduce the horse's susceptibility to illness or disease

A nutritional supplement formulated to promote hoof health.

Avoid grazing lush pastures, especially between late morning and late afternoon hours, since plant sugars are the highest during these times. Restrict pasture intake during spring or anytime the pasture suddenly greens up

# CAMELIDS

# CAMELID 101

- Camelids are large, strictly herbivorous animals
- Includes camels, llamas and alpacas
- Camelids differ from ruminants
    - They have true canine teeth and tusk-like premolars
    - Different hindlimb musculature
    - They have a 3 chambered stomach (no reticulum)
    - They have a prehensile upper lip
    - Their red blood cells are elliptical
    - They have unique heavy chain antibodies

# LLAMAS

- Scientific name is *Lama glama*
- Average height is 5.6 to 5.9 ft
- Average weight is 290 and 440 lb
- A baby llama is called a cria
- Llamas typically live for 15 to 25 years
- Females are induced ovulators
- The gestation period of a llama is 11.5 months
- Male llamas are excellent livestock guard animals

# LLAMA VITAL SIGNS

- Normal rectal temperature 99.0° to 101.5°F
- Average heart rate is 48 to 60 beats per minute
- Average breathing rate is 12 to 30 breaths per minute

# ALPACA

- Scientific name is *Vicugna pacos*
- Average height is 2.7 to 3.2 ft
- Average weight is 110 to190 lb
- A baby alpaca is also called a cria
- Alpacas typically live for 15 to 20 years
- Females are also induced ovulators
- The gestation period of an alpaca is 11.5 months
- Alpacas are social animals that live in groups

# ALPACA VITAL SIGNS

- Normal rectal temperature 99.5° to 102.5°F
- Average heart rate is 70 to120 beats per minute
- Average breathing rate is 6 to 20 breaths per minute

# DIFFERENCES BETWEEN CAMELIDS

**Their ears:** Alpaca ears have short spear-shaped ears while llamas have much longer, banana-shaped ears.

**Their size:** Alpacas generally weigh in at around 150 pounds while llamas can get as heavy as 400 pounds. At the shoulder, an average alpaca stands between 34 and 36 inches, while a llama generally ranges between 42 and 46 inches.

**Their faces:** Llamas have a longer face; an alpaca's face is a bit blunter, giving them a "smooshed in" look.

**Their purpose:** For more than 5,000 years alpacas have been bred for fiber (and in Peru for meat as well), while llamas have been bred for the same amount of time as pack animals and for meat.

**Their hair:** The alpaca produces a much finer fiber than the llama. The alpaca also produces more fleece than its larger cousin and in a much greater variety of colors. Llamas also generally do not have as much hair on their head and face as alpacas do.

**Their dispositions:** Alpacas are very much herd animals, while llamas are more independent minded. Alpacas also tend to be a bit more skittish than llamas, which are often used as guard animals for alpacas, sheep, and other small livestock.

DIVISION OF AGRICULTURE

RESEARCH & EXTENSION

*University of Arkansas System*

# 4-H VETERINARY SCIENCE