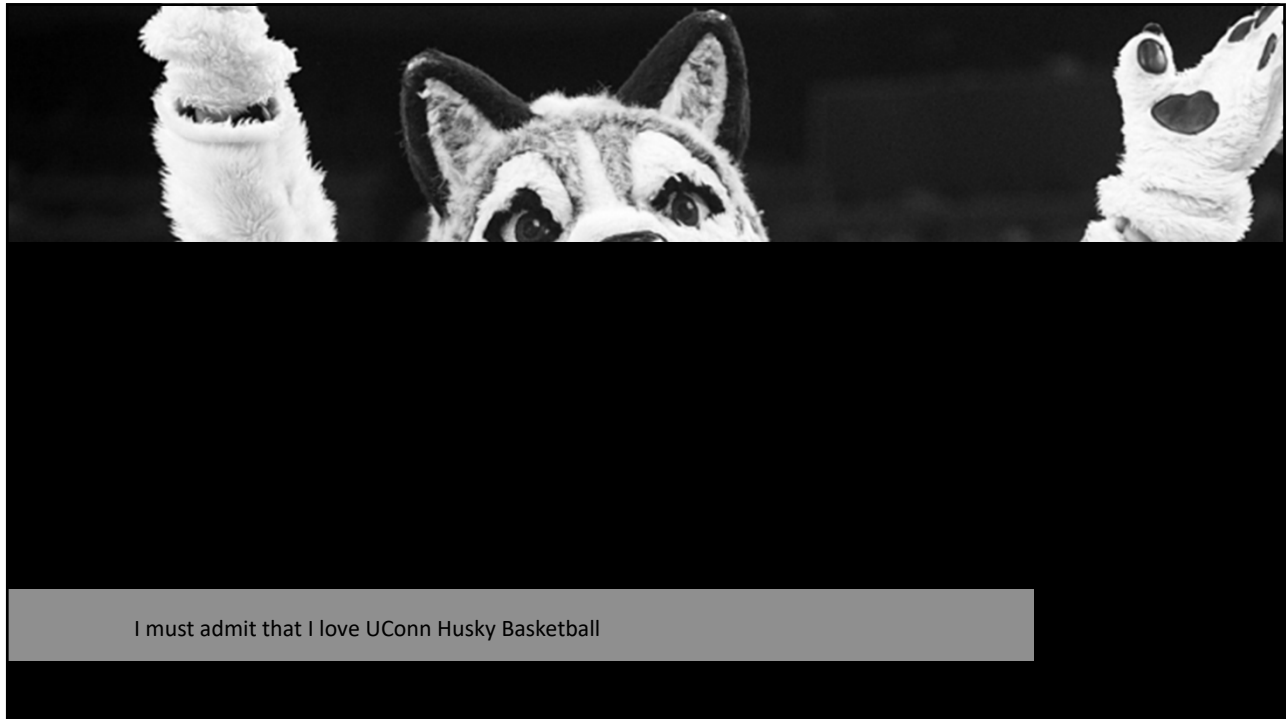


1



2



Learning Objectives


EXAMINE veterinary pharmacy challenges, including species specific pharmacokinetics, patient adherence, drug availability, and contraindications

DISCUSS key compounding principles, including the benefits and risks of different routes of administration, excipients, and flavoring agents


LIST labeling requirements for veterinary compounding

3


Pet Categories




Household/
Companion pets:
dogs, cats




Pocket pets:
gerbil, guinea
pigs




Recreational/
work: oxen,
horses



Food: cattle,
pigs, poultry



Exotics/zoo
animals



Birds

4



Pets are family

- 65.1 Million households with dogs
- 46.5 Million households with cats
- 11.1 Million with freshwater fish
- 6.7 Million with small animals
- 6.1 Million with birds
- 6 Million reptiles
- 2.2 Million horses

66% of households own pets: Increase due to Covid 19, with everyone home and pet insurance more readily available

[Forbes.com/advisor/pet-insurance/pet-ownership-statistics](https://forbes.com/advisor/pet-insurance/pet-ownership-statistics)

5



6

Average Cost of Owning a Pet

Dog: \$1557.00/ year

Veterinary costs: \$479.00
 Pet insurance: \$550.00
 Food: \$350.00
 Grooming: \$99.00
 Toys: \$79.00

Cat: \$970.00/ year

Veterinary costs: \$250.00
 Food: \$310.00
 Pet insurance: \$ 360.00
 Toys: \$50.00
 Dog walking, dog daycare

ADDITIONAL COSTS

Boarding 1 week: \$253.00
 Birthday cakes, presents,
 Clothing, costumes,
 Behavioral training,



[Forbes.com/advisor/pet-insurance/pet-ownership-statistics](https://forbes.com/advisor/pet-insurance/pet-ownership-statistics)

7

Multi Billion-dollar Industry (2022)

- \$136.8 billion spent on pets, up from \$123.6 billion in 2021
- \$31.5 billion spent on supplies, live animals, and over the counter medications
- Pet prescription medications: \$13.99 billion in 2022
- 42% of owners can't cover an unexpected veterinary bill of \$999 or less without going into debt

[Forbes.com/advisor/pet-insurance/pet-ownership-statistics](https://forbes.com/advisor/pet-insurance/pet-ownership-statistics)

8

1991 American Veterinary Medical Association (AVMA): “A veterinarian shall honor a clients request for a prescription or veterinary feed directive in lieu of dispensing”

It is unethical and unlawful for Veterinarians to write a prescription outside of the veterinary/client relationship



[Use of prescription drugs in veterinary medicine | American Veterinary Medical Association \(avma.org\)](#)

9

2251 Veterinary Pharmacies in the US

Veterinary Pharmacy PG1 Residencies:

- Purdue- 1 spot
- NC State- 2 spots
- Texas A&M – 1 spot
- University of Wisconsin- 1 spot
- University of Illinois- 1 spot
- UIC Chicago- 1 spot at UI

Post graduation opportunities: working at Veterinary teaching hospitals, in academia, in independent compounding centers and specialty clinics, USDA or the FDA

American College of Veterinary Pharmacists, <https://vetmeds.org>



10

Challenges of Filling Prescriptions

- Veterinarians **DO NOT** have **NPI** numbers.
 - NPI numbers are for human healthcare providers, for billing Medicare/Medicaid
- **Not all** Veterinarians have a **DEA** number.
 - They cost money to obtain
- Veterinarians **DO** have a state license number
 - May create problems with retail computer systems since it is a different number of digits
- Most veterinarians **DO NOT** have access to electronic prescription technology.

<https://www.drugtopics.com/view/veterinary-prescriptions-made-easy>

11

Pharmacists speak a different language

Human Medicine

QD= Once daily

QOD= every other day

Veterinary Medicine

SID= Once daily

EOD= every other day

SID often transcribed as BID or QID

TIW (3x /week) often transcribed as TID



<https://www.fda.gov/animal-veterinary/resources-you/microgram-prevention-worth-milligram-cure-preventing-medication-errors-animals>

12

Pharmacists may be unaware of areas where they are legally prohibited from engaging:

Pharmacists

- may have inadequate veterinary pharmacotherapy training
- cannot legally recommend OTC products for veterinary patients without a veterinarian's recommendation or prescription

Pharmacists

- are legally required to offer counseling before dispensing a new prescription
- know human medicine but may lack knowledge or lack the resources to find veterinary information

May lead to inappropriate counseling

<https://www.drugtopics.com/view/veterinary-prescriptions-made-easy>

13

Create a working relationship with your local veterinarian

- To discuss appropriate treatment regimens for pet patients according to its species, age and size
- To choose the appropriate vehicle, dosage form, flavoring agents, and preservatives



14



15

Pet Medications to Know (for dogs and cats)

Antibiotics: Doxycycline, trimethoprim-sulfa, amoxicillin-clavulanic acid, metronidazole, cephalixin, enrofloxacin, penicillin, clindamycin

Non-steroidals/anti-Inflammatories: Carprofen, meloxicam, firocoxib, robenacoxib

Opioids/Pain: Oxycodone, butorphanol, meperidine, fentanyl, gabapentin

Steroids: Prednisone, prednisolone, dexamethasone

Behavior Modifiers: Diazepam, fluoxetine, trazodone, alprazolam, clomipramine

Others: Insulin, levothyroxine, methimazole, atenolol, digoxin, sildenafil

pbahealth.com

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Crossover Medications

• This category of drugs serves both human and animal patients at different doses.

- Doxycycline
- Enalapril
- Fluoxetine
- Furosemide
- Gabapentin
- Omeprazole
- Ondansetron
- Phenobarbital
- Tramadol
- Zonisamide



pbahealth.com

17

Compounding Considerations

Patient Size

Patient anatomy

Patient physiology

Patient safety

Individual patient sensitivity or idiosyncrasy

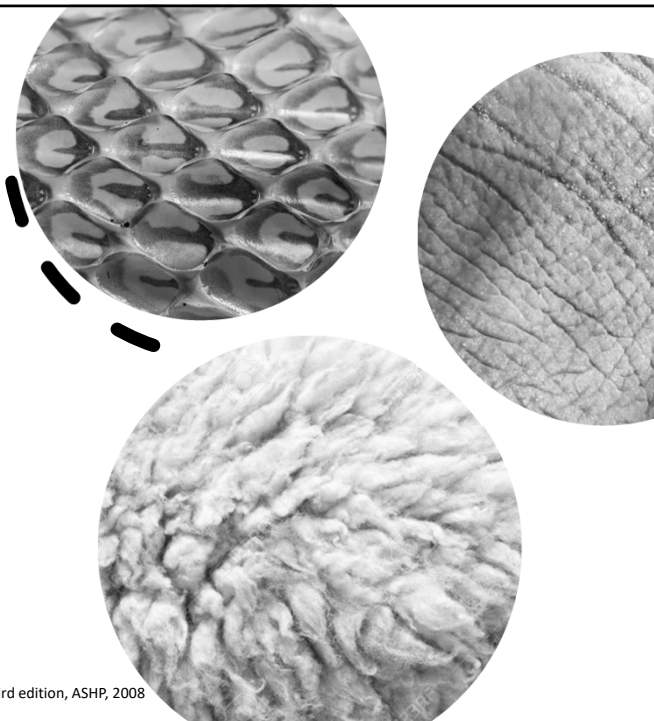
Patient stress

Danger to personnel or owner (s) if restraint is needed to administer

Lloyd V. Allen Jr., "The Art, Science, and Technology of Pharmaceutical Compounding" Third edition, ASHP, 2008

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- Variations among animal species can cause differences in absorption
- Consider systemic drug availability and elimination rates



Lloyd V. Allen Jr., "The Art, Science, and Technology of Pharmaceutical Compounding" Third edition, ASHP, 2008

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Active learning!

Farmer Brown's large Maine Coon cat needs fluoxetine. Considering size, anatomy, and skin absorption, which animal would require a similar dose of fluoxetine transdermal gel?

- A. A small terrier dog
- B. A medium sized Sphynx (hairless) cat
- C. A large barn owl



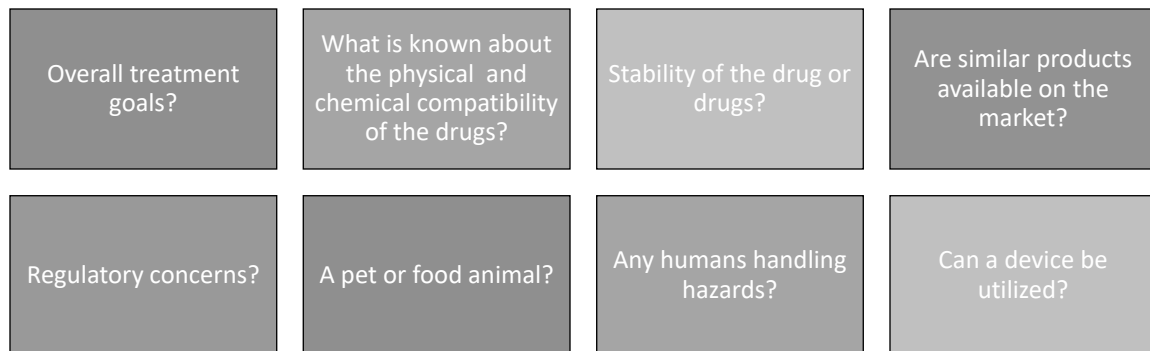
20

Mr. Whiskers is a domestic American cat. He weighs 6.3 pounds, although he needs to gain at least 3 pounds. He needs medication for his heart condition, and the veterinarian wants to prescribe lisinopril 0.25 mg/kg once daily. YIKES! You calculate that Mr. Whiskers weighs 2.9 kg and needs a dose of 0.725 mg of lisinopril. Can you compound this dose?

- A. No, the veterinarian needs to find a different medication
- B. Yes, but it would be easier to give 1.5 mg every other day
- C. Yes, because a commercial product is unavailable in this strength

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When to compound?



Lloyd V. Allen Jr., "The Art, Science, and Technology of Pharmaceutical Compounding" Third edition, ASHP, 2008

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When to Compound?

- **When a commercial product is unavailable**
 - drug recalls, shortages, or yet to be developed
- **When an approved drug needs to be modified**
 - lack of appropriate size, formulation, or route
- **When the likelihood of nonadherence is high**
 - combining drugs, stronger dosage, or taste factor



Compounding: FAQs for veterinarians | American Veterinary Medical Association (avma.org)

Josh Jackson / The Tim

23

Devices for administering medications

• Oral syringes

Balling guns

Droppers



24

Pill pouches
Pill pockets
Oral pastes

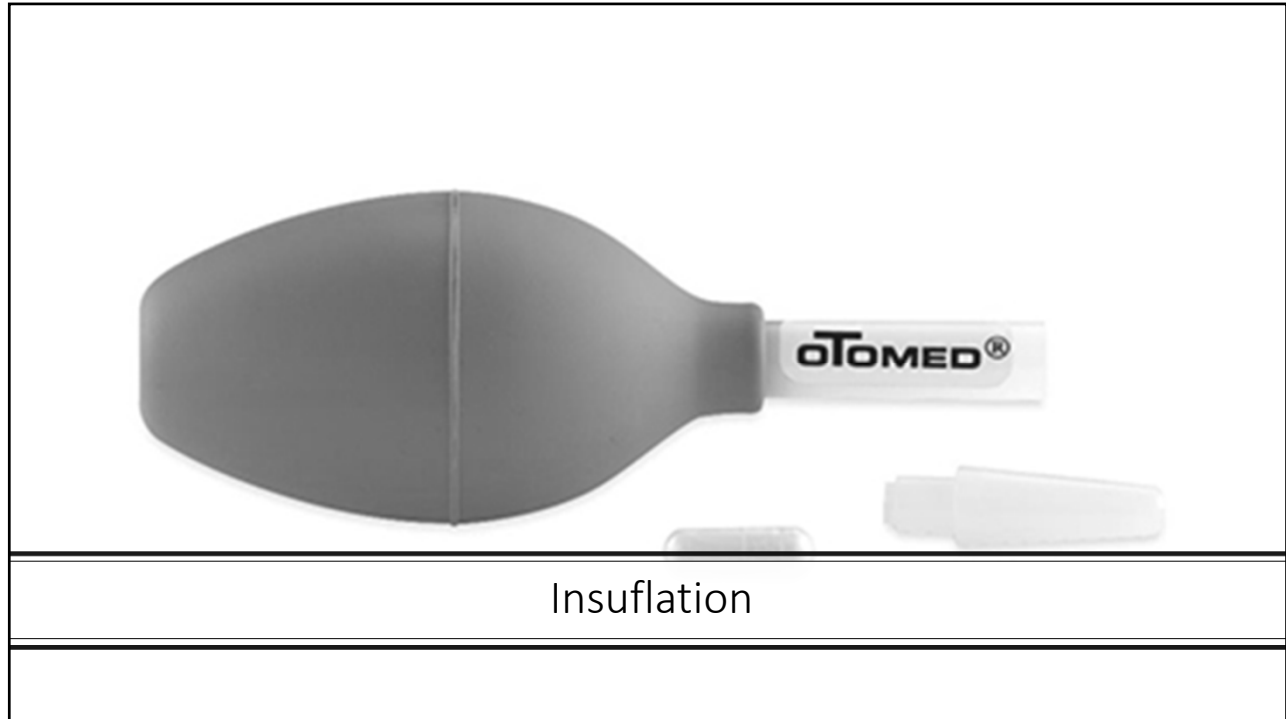


25

Transdermal Administration Pens, Patches, or Topical Use



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27

Other

- Dust bags
- Pour on
- Spray on
- Percutaneous devices
- Implants
- Pole mounted syringes
- Syringe guns and darts

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ACTIVE LEARNING!

Your 30-pound hound, Bosco, is begging to eat the food you left on your plate after dinner. In keeping with your house rule never to feed the dog from the table, you take your plate to the sink and get Bosco's bowl. Which of the following things should you throw in the trash rather than feed to Bosco?

- A. The piece of grilled, boned ribeye steak
- B. The grapes and raisins on the salad
- C. The plain baked potato with yogurt



29

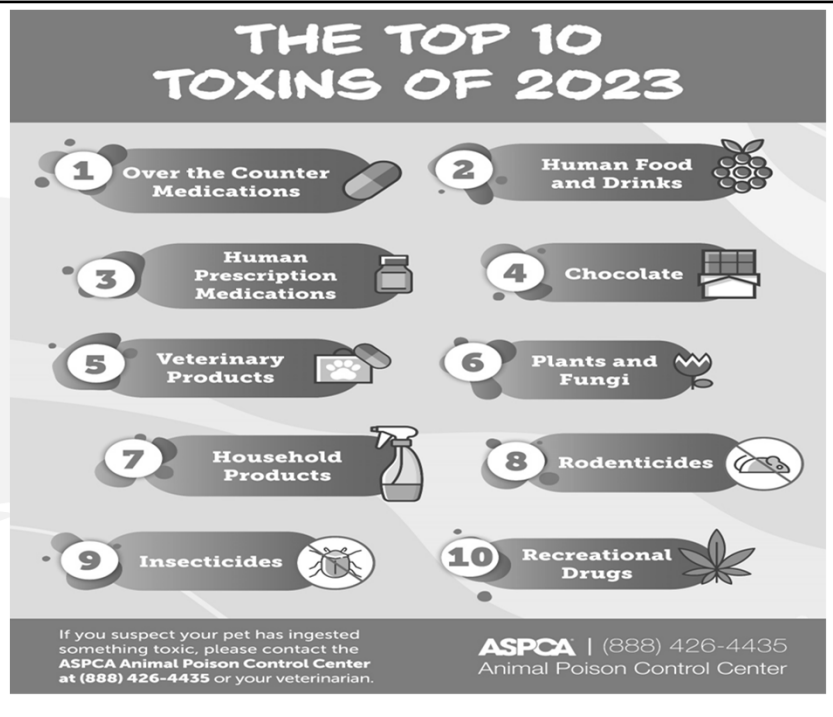
Human foods that should not be given to pets

Food item	Type of pet	Toxicity/ reasoning
Avocado	Dogs, cats, chickens, horses, cows, pet birds	Persin-oil fungicide
Onions, chives, garlic (allium family)	Dogs, cats, chickens, rabbits	Sulfites. disulfides
Chocolate	Dogs, cats, horses, rabbits	Theobromine & caffeine
Citrus fruits	Cats, chickens	Citric acid, essential oils-irritate CNS, tremors/seizures
Cinnamon	Dogs, Cats	Throat irritant
Grapes, raisins	Dogs, cats, rabbits	Kidney failure
Macadamia nuts	Dogs, cats	Toxicity unknown

People Foods Pets Should Never Eat, ASPCA pro, <https://www.aspcapro.org/resource/people-foods-pets-should-never-eat#>

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The Official Top 10 Pet Toxins of 2023 | ASPCA



31

Factors that Influence Toxicity

- Absorption, metabolism, elimination
- Dose of toxin per body weight
- Animals age, size, nutritional status
- Stress level, overall health
- Young animals- not fully developed
- Evolution:
 - Dogs—Opportunistic gorgers
 - Cats – Picky eaters



The Official Top 10 Pet Toxins of 2023 | ASPCA

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ACTIVE LEARNING!

Your client, Venice Marriot, needs to have a medication compounded for her teacup chihuahua Tokyo. Venice indicates that she and Tokyo prefer medications that are pink. After discussing the pros and cons of compounding with color, which food coloring should you use to make a pink oral solution?

- A. Natural beet extract
- B. FD&C Red No. 3
- C. Neither



33

YWO

Sweeteners

Xylitol: contains 2/3 calories of sucrose,
mild increased saliva effect

Extremely toxic to Dogs

- Quickly released into blood stream
- Causes immediate & potent release of insulin
- Leads to severe hypoglycemia, liver failure, seizures, coma, death
- 1 piece of sugar free gum or 1 breath mint can be fatal to a 10 lb. dog

*Xylitol is in everything: BBQ sauce, candy, gum, jam, ketchup, **peanut butter**, cough syrup, deodorant, shampoo, laxatives, skin care products, toothpaste, ODT tablets, prescription medications, gabapentin oral solution*

What Artificial Sweeteners Are Bad for Dogs?: Artificial Sweetener Safety (akc.org)



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JYWO Needs a reference

Jeannette, 2024-04-02T15:29:47.403

Sugar substitutes

- Aspartame (Equal) - blue packet
- Erythritol – non caloric
- Saccharin (Sweet & Low) - pink packet
- Stevia (Truvia) -green packet
- Sucralose (Splenda) - yellow packet
- Monk fruit- newer, similar to stevia



[What Artificial Sweeteners Are Bad for Dogs?: Artificial Sweetener Safety \(akc.org\),https://www.akc.org/expertadvice/nutrition/artificial-sweetener-safety-for-dogs](https://www.akc.org/expertadvice/nutrition/artificial-sweetener-safety-for-dogs)

35

Corn Syrup?

Cheap, humectant, sweetener and flavoring agent
all in one

found in many dog cookies , but...

- Can be addictive!
- Can increase blood sugar significantly
- Better: vegetable-based glycerin (e.g., coconut glycerin) or molasses, stevia, or honey



[Karo Syrup for Dogs - Uses, Advantages, & Disadvantages - The Dogs Journal, https://thedogsjournal.com](https://thedogsjournal.com)

36

JYW0

Food Dyes or Colorants?

Use sparingly!

Use natural products, when possible, for example
beetroot powder

Blue dye #2, red #40, yellow #5 & 6 can cause
hypersensitivity or allergic reactions in pets

Caramel color (4-ME) is under investigation by the FDA
as a possible carcinogen in dogs and cats.

In most cases coloring is more important
to the pet owner than to the pet!



[Is Food Coloring Safe For Dogs? | Nature's Advantage \(naturesadv.com\)](https://naturesadv.com)

37

JYW0

Preservatives and Additives

AVOID:

- Butylated hydroxy anisole (BHA) added to fats & oils, carcinogens
- Butylated hydroxytoluene (BHT) can cause liver/kidney damage
- Ethoxyquin, a preservative/hardening agent. Also used in pesticides & rubber. Illegal to use on humans
- Propylene glycol, a humectant. Extremely toxic to cats
- Polysorbate 80 (Tween 80), surfactant used in soaps or excipient to stabilize aqueous formulations.
 - Causes allergic reactions, tachycardia, can lean to anaphylactic reaction
- Essential Oils (tea tree oil, peppermint oil, eucalyptus) can be toxic, especially to cats (continual groomers) lethargy, depression, ataxia, tremors, seizures, or death

Stick to natural products:

Ascorbic acid
Citric acid
Lemon, Honey
Vitamin E



*Most fragrances are added to
please the owner, not the pet*

<https://www.dogfoodinsider.com/need-know-preservatives>

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Slide 37

JYWO Needs a reference

Jeannette, 2024-04-02T15:30:12.708

Slide 38

JYWO Needs a reference

Jeannette, 2024-04-02T15:30:18.231

Chewable Treat Base (100g)

Powdered Animal Food	65 g
Gelatin base, melted	qs 100 g
Active Drug	qs

Melt the gelatin base
 Incorporate powdered food
 Add active drug and mix well
 Pour into molds and allow to set

Lloyd V. Allen Jr., "The Art, Science, and Technology of Pharmaceutical Compounding" Third edition, ASHP, 2008

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YWO

Basic Oral Paste Formula (100 g)

	Formula 1	Formula 2	Formula 3
Polyethylene glycol 300	65 g	25 g	
Polyethylene glycol 3350 (powder)	35 g	25 g	25 g
Propylene glycol		50 g	25 g
Molasses (for horses)			50 g

Polyethylene glycol formulas are prepared by heating to a temperature of about 70 degrees C followed by cooling and stirring
 Propylene glycol in formula 2 should be added while the preparation is hot
 Add API when cooled

Lloyd V. Allen Jr., "The Art, Science, and Technology of Pharmaceutical Compounding" Third edition, ASHP, 2008

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Slide 40

JYWO Check format. You're better off to use an actual table for this slide

Jeannette, 2024-04-01T20:38:25.740

Active learning!

Which of these basic oral paste formulas would be best to use for Farmer Brown's cat?

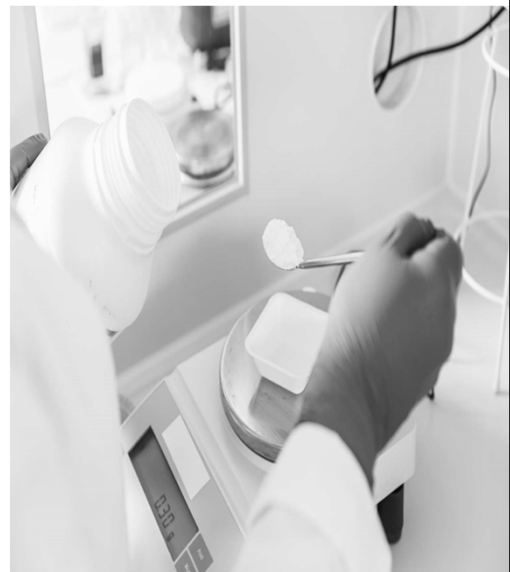
- A. Formula 1
- B. Formula 2
- C. Formula 3



41

USP<795>

- In effect November 1, 2023
- Designated Person
- More Focus on cleanliness
- Manufacturing & compounding records
- Training



(795) Pharmaceutical compounding- nonsterile preparations [USP General Chapter 795 | USP](https://www.usp.org/compounding/general-chapter-795)
<https://www.usp.org/compounding/general-chapter-795>

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YWO

Flavoring

Cats: not too sweet, but not bitter: fish, cod liver oil, tuna, sardines, salmon, beef, chicken, cheese, bacon, peanut butter, butterscotch

Dogs: Meats & sweets: bacon, beef, liver, chicken, turkey, cheese, peanut butter, molasses, caramel, anise, marshmallow, raspberry, strawberry, honey



Lloyd V. Allen Jr., "The Art, Science, and Technology of Pharmaceutical Compounding" Third edition, ASHP, 2008

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YWO

Flavors

Birds: Fruity Flavors: Banana, grape, orange, raspberry, tangerine, tutti-frutti, pina colada

Gerbil: Sweet and fruity. Banana cream, orange, peach, tangerine, tutti-frutti

Goats: Molasses, honey, apple, caramel, cherry

Horses: apple, apple/Caramel, cherry, butterscotch, molasses, maple, eggnog, honey, anise/licorice

Iguana: Must smell good. Poor sense of taste. Banana, cantaloupe, kiwi, orange, tangerine, watermelon, other melons

Poultry: Cantaloupe, corn, meal, milk, vanilla, butternut, watermelon

Rabbits: Find their favorite fruit or veggie and use it. Banana cream, carrot, celery, lettuce, parsley, pineapple, vanilla, butternut



Lloyd V. Allen Jr., "The Art, Science, and Technology of Pharmaceutical Compounding" Third edition, ASHP, 2008

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Slide 43

JYWO Needs a reference

Jeannette, 2024-04-02T15:30:33.798

Slide 44

JYWO Needs a reference

Jeannette, 2024-04-02T15:30:40.193

Board of Pharmacy Positions Towards Flavoring on November 1, 2023

While USP has always provided guidance that they consider medicine flavoring to be a form of compounding, it is State Boards of Pharmacy that regulate and enforce nonsterile compounding standards. 49 of 52 Boards of Pharmacy have determined that USP 795 nonsterile compounding standards do not apply to the simple practice of medicine flavoring, with most Boards saying they do not consider flavoring to be compounding at all.

Click on a state to read its policy toward flavoring, or use the drop down below.

Map Legend

- Flavoring will not be considered compounding per statute, BOP rule or published FAQ
- Flavoring will not be considered compounding per BOP guidance and/or use of enforcement discretion OR only record-keeping will be required.
- Flavoring will be regulated as compounding with full adherence to USP 795 standards
- Uncertain at this time


* States that require documentation for flavoring

Of note, Illinois says flavoring is not compounding in statute. Both NC BOP & MA BOP guidance says flavoring is compounding but only requires documentation, not full

[State Boards of Pharmacy Positions on Flavoring \(flavorx.com\)](http://flavorx.com)

45

Active Learning!



Which flavoring would be best suited for a picky Emperor penguin at Mystic Aquarium?

A. Orange or mango flavoring

B. Sardine or tuna flavors

C. Beef or liver flavoring

46

YWO

FDA (FD&C act)

- Allows animal drug compounding when the source of active ingredient is a finished FDA approved drug and not a bulk drug substance (BDS)
- BDS: Used to make a drug that becomes an active ingredient in the drugs finished dosage form (aka API)
- FDA BDS list for use in veterinary products: effective April 2023 Separate lists for food producing animals, wild-life, and pets
- Exceptions: a BDS can be used when a commercial product is unavailable or is inappropriate for animal use.
 - An FDA approved drug may have excipients or preservatives which an animal cannot tolerate (Xylitol)
 - Dose may be too large or flavoring unacceptable



Animal Drug Compounding | FDA <https://www.fda.gov/animal-veterinary/unapproved-animal-drugs/animal-drug-compounding>

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Guidance for Industry

(GFI)#256
in effect as of
4/1/2023

- Compounding Animal Drugs from Bulk Drug Substances
- Allows pharmacies to purchase and use bulk drug substances from FDA registered suppliers if a certificate of analysis (**COA**) is included
- **Requires compounders** to report adverse effects to FDA within 15 days
- **Veterinarians** must provide patient specific detailed clinical information explaining why a pet cannot use an FDA approved manufactured product

Animal Drug Compounding | FDA <https://www.fda.gov/animal-veterinary/unapproved-animal-drugs/animal-drug-compounding>

48

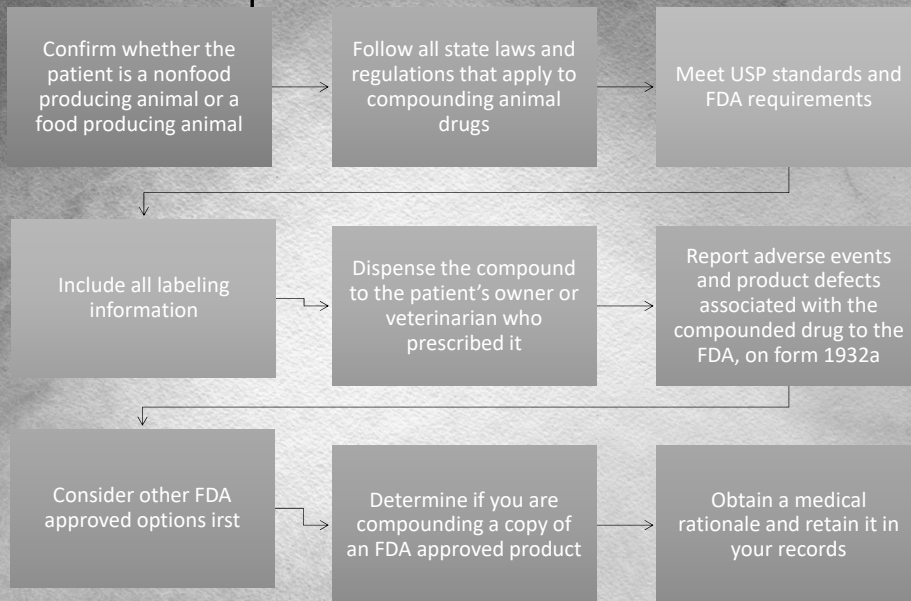
Slide 47

JYWO Needs a reference

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YWO

FDA Checklist for pharmacists



For Pharmacists: Compounding Animal Drugs (fda.gov)

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YWO

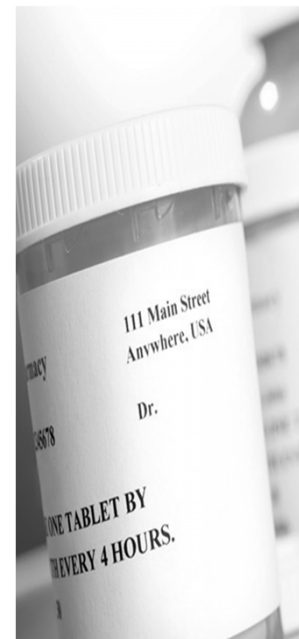
Labeling (extra label) must include:

Report suspected adverse reactions to the pharmacist who compounded the drug and to FDA Using online Form FDA 1932a

This is a compounded drug, Not an FDA approved or indexed drug

Caution federal law restricts this drug to use by or on the order of a licensed veterinarian

For Pharmacists: Compounding Animal Drugs (fda.gov)



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Slide 49

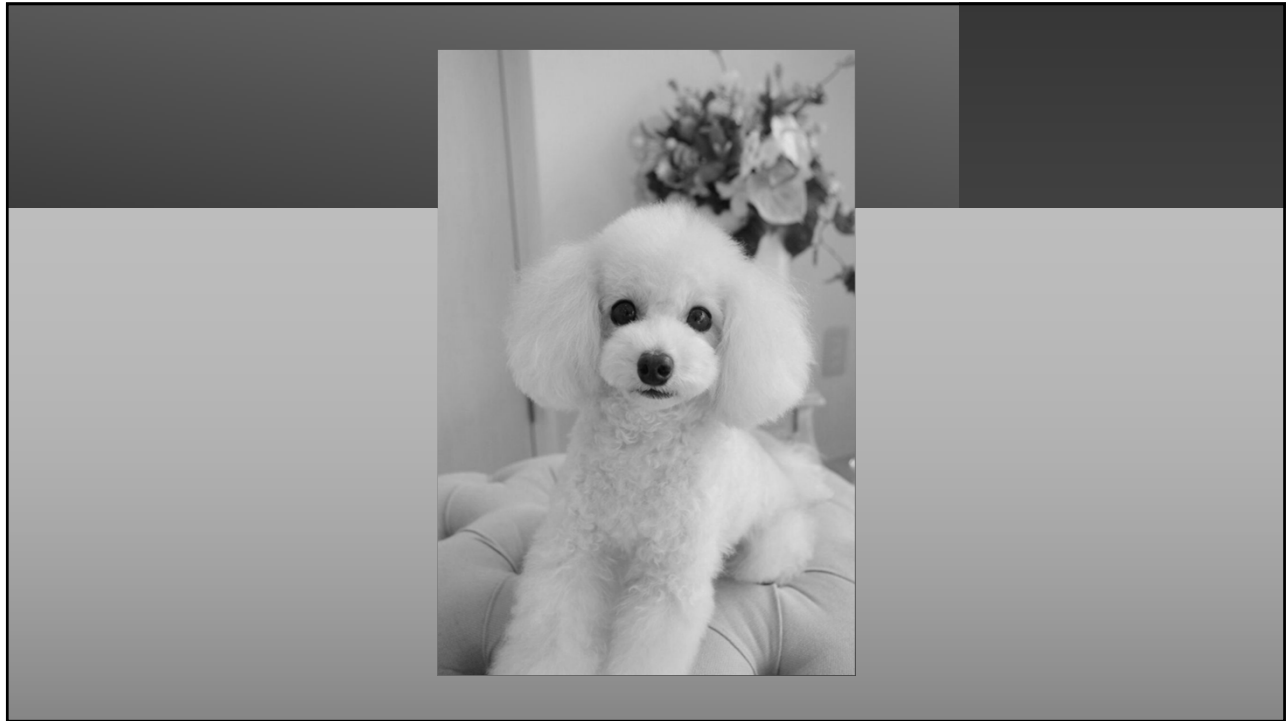
JYWO Needs a reference

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Slide 50

JYWO Needs a reference

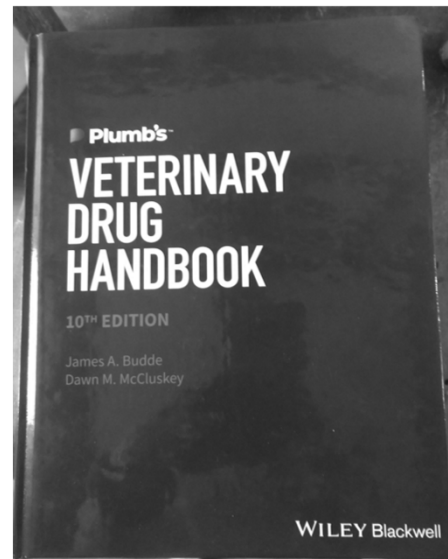
Jeannette, 2024-04-02T15:31:16.609



51

How could this happen?

- The pharmacist did not know
 - the solution contained xylitol
 - xylitol was harmful to dogs
- The computer system had no drug utilization review process in place for veterinary drugs
- The pharmacy did not have a veterinary drug reference book or a veterinary formulary
- Most state boards of pharmacy do not require pharmacies to carry a veterinary drug reference book



52

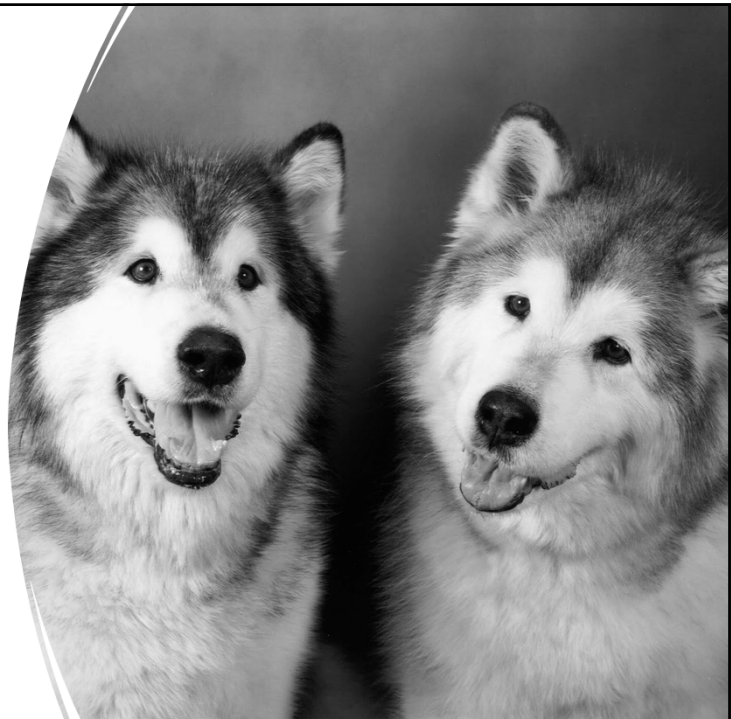
Active learning!

What can be done to improve pharmacy personnel's knowledge of veterinary medications?

- A. Have a veterinary drug handbook in the pharmacy and make sure the computer system flags veterinary precautions
- B. Take a continuing education activity on veterinary pharmacy and require all other staff members to take it also
- C. Take out extra liability insurance and pray

53

Husky Paws for Alaskan Malamutes



54



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